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Maternal delay for institutional delivery and associated factors among postnatal mothers at Southeastern Ethiopia: a cross-sectional study

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Abstract

Background: Maternal delay in timely seeking health care, inadequate health care and the inability to access health facilities are the main causes of maternal mortality in low- and middle-income countries. The three-delay approach was used to pinpoint responsible factors for maternal death. There was little data on the delay in decision making to seek institutional delivery service in the study area. Therefore, the aim of this study was to assess the extent of the first maternal delay for institutional delivery and its associated factors among postpartum mothers in the Bale and east Bale zones.
Methods: An institutional-based cross-sectional study was conducted among 407 postpartum mothers from April 6 to May 6, 2022. A systematic sampling technique was used to select study participants. The data were collected electronically using an Open Data Kit and exported to SPSS window version 25 for cleaning and analysis. Both bivariate and multivariable analysis was done by using binary logistic regression model to identify factors associated with maternal delay for institutional delivery services. Statistical significance was declared at P-value < 0.05.
Results: In this study, the magnitude of the first maternal delay in making the decision to seek institutional delivery service was 29.2% (95% CI: 24.9, 33.9). Previous pregnancy problems (AOR = 1.8; 95% CI: 1.06, 3.08), knowing the danger signs of labor and childbirth (AOR = 1.78; 95% CI: 1.11, 2.85) and decision-making (AOR = 0.42; 95% CI: 0.20, 0.85) were significantly associated with the first maternal delay.
Conclusion: This study identified a significant number of postnatal mothers experienced delay in making decisions to seek institutional delivery service in the study area. Promoting women's empowerment and building on key danger signs should be emphasized.

Keywords: Maternal delay**,** Institutional delivery**,** Postnatal**,** Bale**,** Ethiopia

Discover Food
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Determinants of urban household vulnerability to food insecurity in southern Ethiopia

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Abstract

Food insecurity is a global problem in both urban and rural areas. However, urban food security in Ethiopia has received little attention. Therefore, this study aims to identify the determinants of urban household vulnerability to food insecurity in selected towns in Southern Ethiopia. The study employed a mixed research design, incorporating a household survey, key informant interviews, and focus-group discussions. A multi-stage sampling technique was used to select 310 survey households. Data were collected using a pretested structured questionnaire. The household vulnerability to food insecurity indicator was used to assess the level of vulnerability to food insecurity. An ordered logit model was used to identify the determinants of vulnerability to food insecurity in the urban setup. The results showed 41.3% of households in the study to be highly vulnerable to food insecurity, 48.3% moderately vulnerable, and 10.6% not vulnerable. Among the 16 variables, household ownership of houses, health status, urban agriculture, socio-cultural practices, asset ownership, age, and average monthly income were found to be significant in determining the vulnerability to food insecurity. The study recommended that food security interventions demand due attention, particularly for low-income urban households benefit from the urban productive safety net program. Policymakers and development professionals should implement a multiple approach to address urban food insecurity in Ethiopia. This should include targeted interventions beyond urban productive safety net program for highly vulnerable households.

Keywords: Food insecurity**,** ordered logit model**,** Vulnerability**,** Urban household**,** Wolaita Zone

Scientific Reports
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Knowledge, attitudes, and associated factors towards HIV pre-exposure prophylaxis among health care providers

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Abstract

The knowledge and attitudes of health care providers were limited as reviewed in many studies. Attitudes and knowledge about pre-exposure prophylaxis among healthcare providers have not been investigated in Ethiopia even though pre-exposure prophylaxis is a novel healthcare topic. The aim was to assess knowledge, attitudes, and associated factors towards pre-exposure prophylaxis among healthcare providers in Gojjam health facilities, North West Ethiopia, 2022. An institutional-based cross-sectional study was conducted from June 1–30 among 410 healthcare providers in public health facilities in the East Gojjam zone. A simple random sampling technique was used to recruit the required study participants. The statistical program EPI Data version 4.6 was used to enter the data, and statistical packages for Social science version 25 was used for analysis. Variables with a p-value less than 0.25 in the bivariable analysis were included in the multivariable logistic regression analysis. Statistical significance was determined with a p-value less than 0.05. The good knowledge and the favorable attitude of healthcare providers toward HIV pre-exposure prophylaxis were 55.7% (50.6–60.2%) and 60.2% (55.0–65.0%) respectively. male participant (AOR 1.67; 95% CI (1.01–2.55), service year ≥ 10 years (AOR 2.52; 95% CI (1.23–5.17), favorable attitudes (AOR 1.92; 95%CI (1.25–2.95), and providers good sexual behavior (AOR 1.85; 95%CI (1.21–2.82) were significantly associated with the good knowledge, and training (AOR 2.15; 95% CI (1.23–3.76), reading the guideline (AOR 1.66; 95% CI (1.02–2.70), and good knowledge (AOR 1.78; 95% CI (1.16–2.75) was significantly associated with the favorable attitudes. In general, the finding of this study shows that the knowledge and attitudes of healthcare providers were low. Since this is a new initiative their knowledge is lower than their attitudes. Male, service year 10 years, and good provider sexual behavior were factors significantly associated with good knowledge. Training, reading the guidelines, and good knowledge were factors significantly associated with a favorable attitudes. As a result, healthcare facilities intervention programs and strategies better target these factors to improve the knowledge and attitudes of healthcare providers. Preparing training programs to enhance knowledge and attitudes towards PrEP is recommended.

Keywords: Knowledge**,** Attitudes**,** Healthcare provider**,** And Pre-exposure prophylaxis

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Correction to: Candidate serum protein biomarkers for active pulmonary tuberculosis diagnosis in tuberculosis endemic settings

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Abstract

Background: Identification of non-sputum diagnostic markers for tuberculosis (TB) is urgently needed. This exploratory study aimed to discover potential serum protein biomarkers for the diagnosis of active pulmonary TB (PTB).
Method: We employed Proximity Extension Assay (PEA) to measure levels of 92 protein biomarkers related to inflammation in serum samples from three patient groups: 30 patients with active PTB, 29 patients with other respiratory diseases with latent TB (ORD with LTBI+), and 29 patients with other respiratory diseases without latent TB (ORD with LTBI-). To understand the functional mechanisms associated with differentially expressed proteins, we performed Gene Ontology (GO) and Kyoto Encyclopedia of Genes and Genomes (KEGG) pathway analyses. Least absolute shrinkage and selection operator (LASSO) regression was employed to identify potential TB diagnostic protein biomarkers. Network interactions among the identified candidate diagnostic markers were then analyzed, and their diagnostic performance was evaluated using logistic regression and receiver operating characteristic (ROC) analysis.
Result: The analysis revealed 37 differentially expressed proteins (DEPs) in the active PTB group compared to both ORD with LTBI + and ORD with LTBI- groups. Gene Ontology analysis indicated that these DEPs were primarily involved in the inflammatory response, while KEGG enrichment analysis highlighted the cytokine-cytokine receptor interaction pathway as the top significant hit. LASSO regression identified eight promising candidate protein biomarkers: IFN-gamma, LIF, uPA, CSF-1, SCF, SIRT2, 4E-BP1, and GDNF. The combined set of these eight proteins yielded an AUC of 0.943 for differentiating active PTB from ORD with LTBI+, and an AUC of 0.927 for distinguishing PTB from ORD with LTBI-
Conclusion: We have identified eight protein markers that reliably differentiate active PTB from ORD irrespective of LTBI presence. Further large-scale validation and translation of these protein markers into a user-friendly and affordable point-of-care test hold the potential to significantly enhance TB control in high-burden regions.

Keywords: Proximity extension assay**,** Serum protein markers**,** Tuberculosis diagnosis

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Determinants of survival time for HIV/AIDS patients in the pastoralist region of Borena: a study at Yabelo General Hospital, South East Ethiopia

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Abstract

Introduction: HIV/AIDS is one of the most dangerous diseases globally, impacting public health, economics, society, political issues, and communities. As of 2023, the World Health Organization estimates that 40.4 million people are living with HIV/AIDS. This study aimed to identify the determinants of survival time for HIV/AIDS patients in the pastoralist region of Borena at Yabelo General Hospital.

Method: The study design was a retrospective cohort study, with a sample size of 293 individuals living with HIV/AIDS, based on recorded data. This research utilized survival model analysis, employing Kaplan-Meier plots, the log-rank test, and Cox proportional hazard model analysis. **Result:** Out of the total sample size, 179 (61.1%) were female and 114 (38.1%) were male. Among these males, 36 (31.6%) were deceased. The analysis using the Cox proportional hazard model revealed that the following variables were significantly associated with the survival time of HIV/AIDS patients: gender, educational status, area of residence, tuberculosis (TB), and opportunistic infections.

Conclusions: We concluded that individuals living with HIV/AIDS in urban areas have a lower risk of death compared to those in rural areas, indicating that rural residents have a reduced survival probability. Therefore, the Borena zone administration should focus on adult patients to enhance life expectancy.

Keywords: Borena**,** Cox PH**,** HIV/AIDS**,** Survival time**,** Yabelo General Hospital

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Tuberculosis patients' satisfaction with directly observed treatment short course strategy and associated factors in Southern Ethiopia: a mixed method study

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Abstract

Background: Tuberculosis (TB) is a second major global public health problem and the leading infectious cause of death in Ethiopia. Patients under directly observed treatment short-courses (DOTs) have a higher treatment success rate and reduced drug resistance. A successful treatment outcome and adherence to the treatment are related to patient satisfaction with the DOT strategy. Client satisfaction is one of the indicators of the quality of care. In this perspective, there were limited studies in Ethiopia related to patient satisfaction with the DOTs strategy in the prevention and control of TB to achieve the ''END TB Strategy.'' Therefore, this study was aimed at identifying the TB patients' satisfaction with the DOTs strategy and associated factors in Gamo Zone, Southern Ethiopia.
Methods: An institutional-based cross-sectional study design for quantitative data and a phenomenological approach were employed for qualitative data. The calculated sample size was 374. A systematic random sampling method was used to select study participants. A pre-tested structured interviewer-administered questionnaire for quantitative data and focus group discussions (FGDs) for qualitative data were used for data collection. Bivariable and multivariable analyses were used. The determinants with a p-value < 0.05 were declared to have a significant association with the outcome variable, and an adjusted odd ratio with a 95% confidence interval (CI) was used.
Results: A total of 358 patients participated in the study, with a response rate of 95.72%. The majority of study participants' ages ranged between 25 and 34 years. The tuberculosis DOT satisfaction rate was 61.17% [56.10-66.25%, 95%CI]. The TB patients who took treatment for 20 weeks or more were 3.97 times [AOR = 3.97; 95% CI (1.55–10.16)] more likely to be satisfied with the DOTs service provided. However, the participants who perceived transport costs as high were 79% [AOR = 0.21; 95% CI (0.06–0.71)] less likely to be satisfied with DOTs. Qualitatively, the participants reported that there was a major problem with laboratory services, which resulted in delays and long appointments to get the results in addition to lack of clean toilets and safe water to swallow medications.
Conclusion: The satisfaction rate for tuberculosis DOTs observed in this study appears to be relatively lower in comparison to other studies. Availing DOTs service nearby patients to enhance the accessibility of the service is crucial to improving patients' satisfaction with DOTs service. Reducing laboratory result delays by improving laboratory service is essential to enhancing patients' satisfaction with DOTs. Moreover, improving toilet services, and availing safe water to swallow medications is recommended to enhancing patients' satisfaction with DOTs service.

Keywords: Directly observed treatment short-course/DOTs**,** Ethiopia**,** Patient satisfaction**,** Tuberculosis

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An analytical characterization study on biofuel obtained from pyrolysis of Madhuca longifolia residues

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Abstract

The current study focuses on examining the characteristics of biofuel obtained from the pyrolysis of Madhuca longifolia residues, since the selected forest residue was primarily motivated by its greater volatile matter content. The study used several analytical techniques to describe pyrolysis oil, char, and gas obtained from slow pyrolysis process conducted between 350 and 600 °C in a fixed-bed reactor. Initially, the effect of process temperature on product distribution was assessed to motivate maximum pyrolysis oil yield and found to be 44.2 wt% at pyrolysis temperature of 475 °C, while the yields of char and gas were 22.1 wt% and 33.7 wt%, respectively. In order to determine the suitability of the feedstock, the Madhuca longifolia residues were analyzed by TGA and FT-IR, which revealed that the feedstock could be a feasible option as an energy source. The characterization of pyrolysis oil, char, and gas has been done through various analytical methods like FT-IR, GC-MS, and gas chromatography. The physicochemical characteristics of the pyrolysis oil sample were examined, and the results showed that the oil is a viscous liquid with a lower heating value than conventional diesel. The FT-IR and GC-MS analysis of pyrolysis oil revealed the presence of increased levels of oxygenated chemicals, acids, and phenol derivatives. The findings of the FT-IR analysis of char indicated the existence of aromatic and aliphatic hydrocarbons. The increased carbon content in the char indicated the possibility of using solid fuel. Gas chromatography was used to examine the chemical structure of the pyrolysis gas, and the results showed the existence of combustible elements.

Keywords:- Forest residues Pyrolysis, Fixed bed, FT-IR, GC–MS

BMC Neurology
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Quality of care and associated factors among patients with epilepsy at public hospitals in Arba Minch Town: a facility-based cross-sectional study

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Abstract

Background: Epilepsy is one of the most common neurologic disorders affecting approximately 51 million people globally and is associated with significant cases of age-standardized DALYs (182.6 per 100 000 people). The quality of health care services offered to people suffering from epilepsy often fails to meet standards in Ethiopia or internationally. This study was designed to assess the quality of care and associated factors among patients with epilepsy at public hospitals in Arba Minch Town, 2024.
Method: A facility-based cross-sectional study was conducted among 392 adult epileptic patients attending public hospitals in Arba Minch Town. Data entry was performed via Epi-data 3.1 software, and the data were analyzed via SPSS version 24 software. Binary logistic regression analysis was used to evaluate the associations between quality of care and sociodemographic, disease-related, and treatment-related factors. Multivariate logistic regression analysis was applied to identify factors independently associated with quality of care.
Results: Three hundred ninety-two adults with epilepsy participated in this study, for a response rate of 92.7%. More than one-half of the 237 (60.5%) patients were males, with a median age of 31 ± 12 years (interquartile range). Fewer than one-half (44.1%) of the patients adhered to antiepileptic medicines. The overall proportion of patients receiving quality care was 213 (54.3%). The seizure control rate was also low, at 130 (33.2%). Patients aged 18–29 years [AOR = 30.8 (95% CI, 8.22–35.616, p < 0.000)] and aged 30–39 years [AOR = 18.4 (95% CI, 5.016–67.613, p < 0.000)], and a seizure frequency of less than three [AOR = 2.318 (95% CI, 1.028–5.225, p < 0.043)] were positively associated with quality of care. Whereas, having poor knowledge about epilepsy [AOR = 0.107 (95% CI, 0.0.057–0.202, p < 0.000)] was negatively associated with quality care.
Conclusion: The quality of care provided to adult epilepsy patients at Arba Minch was low. In addition, patient knowledge, medication adherence, and the seizure control rate were also suboptimal. Therefore, addressing identified factors by involving all relevant stakeholders (health professionals, hospitals, zonal health departments, regional health bureaus, and patients) is critical for improving the quality of care. In addition, researchers willing to study this topic should use strong designs that can determine causal determinants of quality care. © The Author(s) 2024.

Keywords: - Epilepsy, Epilepsy treatment, Quality of care, Epilepsy management, Arc Minch Town

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Experimentation on Sargassum wightii as a flash powder igniter for attaining eco-friendly combustion on pyrotechnics

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Abstract

Firecrackers are a vital element of cultural festivities that happen worldwide. However, the hazardous by-products they emit have a significant impact on environmental pollution, leading to the greenhouse effect and climate change. Aluminium powder serves as the fuel in the traditional flash powder mixture, nitrate of potassium serves as an oxidizing agent, and sulphur acts as the igniter at exact concentrations. The presence of sulfur in the flash powder mixture is critical as it acts as an igniter, contributing to the formation of sulfur dioxide, which can cause environmental harm. We carried out an experiment employing Sargassum wightii brown seaweed powder as a replacement for sulphur at specific amounts to lessen the effects of sulphur in flash powder. We discovered that Sargassum wightii brown seaweed powder may replace up to 50% of the sulphur significance in the flash powder mixture without impairing the flash powder's traditional performance. Our experiments included impact and friction sensitivity, SEM, and FTIR analyses to evaluate the improved flash powder composition. The results revealed that the modified flash powder mixture SP5 and SP10 emits less emission by 12% and 21%, and produces similar noise performance of 108 and 107 dB(A) to the normal flash powder composition (SP), affirming that the SP10 flash powder is a viable alternative. Moreover, in our relentless pursuit to mitigate the detrimental effects on our environment, we have ingeniously introduced a novel product—the Chinese cracker made from vegetable waste paper. Not only does this innovative solution address concerns regarding land pollution, but it also presents a sustainable approach to consumer goods.

Keywords: -Sargassum wightii, Flash powder mixture, Thermal characteristics, Noise level, Bio-based green crackers, Sensitivity

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Testcross performance of Striga-resistant maize inbred lines and testers with varying levels of Striga reaction

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Abstract

Background: Using a desirable tester is considered one method used to maximise genetic differences among test crosses derived from new inbred lines and improves the overall performance of maize. Thus, this study aimed to evaluate the potency of the tester with varying levels of resistance to Striga hermonthica in determining the testcross performance of the hybrids for Striga resistance and yield-related traits. Method: The experiment was conducted with these test crosses and two standard checks (susceptible and tolerant) for different Striga resistance and agronomic traits during the 2018 cropping season in Abuja and Mokwa, Nigeria. The experiment was laid out in a 23 × 4 alpha-lattice design with two replications in each location. Field evaluation data was collected from Striga resistance and yield-related traits to estimate the performance of test crosses. Analysis of variance was conducted to determine the variance of the testcross performance. Results: There were significant differences among test crosses for days to silking, days to pollen shedding, ear at harvest, ear aspect, ear per plant, grain yield, Striga damage rating at 8 and 10 weeks after planting (WAP), and Striga count at 8 and 10 WAP. Variations among test crosses were always higher than the corresponding variations due to the interaction between test crosses and the environment for all traits. Conclusion: The inbred lines with low yield reduction crossed with different testers under Striga infested were recorded. These inbreds should be used to develop high-yielding hybrids and synthetics with elevated levels of Striga resistance to improve the maize breeding program.

Keywords: Line × tester, inbred lines, Striga hermonthica, Resistance, Testcross

Parasitology Research
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The expansion of an invasive malaria vector: Anopheles stephensi emergence in Arba Minch town in the southern Rift Valley of Ethiopia

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Abstract

Urban areas in malaria-endemic countries in East Africa are experiencing a significant increase in malaria cases, with the establishment of an "exotic" urban malaria vector, Anopheles stephensi, increasing the risk of urban malaria. To this end, the present study aimed to investigate the emergence of this species in Arba Minch, Ethiopia. Following the detection of An. stephensi in other parts of Ethiopia, 76 artificial containers (55 discarded tyres, 18 concrete water storage, and three plastic containers) were sampled in 21 locations in Arba Minch town, for immature Anopheles mosquito stages, using the standard dipping technique. Larvae were reared into adults which were morphologically identified at the species level 2–3 days after emergence. Morphological identification results were confirmed by species-specific polymerase chain reaction. Of the examined containers, 67 (88%) had at least one Anopheles larva. Thirty-two of the adults emerged were morphologically identified as An. stephensi, with 26 (81%) confirmed by molecular analysis. This is the first study to report An. stephensi from Arba Minch, one of South Ethiopia's largest towns, highlighting the need for increased vigilance. The planned and ongoing study in and around Arba Minch will contribute to understanding the bionomics and role of An. stephensi in malaria parasite transmission, helping develop a strategy to address the impending risk of urban malaria in Ethiopia.

Keywords: Anopheles stephensi, Arba Minch, Entomological surveillance

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Effectiveness of nutritional education intervention during pregnancy on birth outcomes in sub-Saharan Africa: a protocol for a systematic review and meta-analysis

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Abstract

Introduction Nutritional education intervention during pregnancy is the process of teaching pregnant women about the importance of a healthy diet and how to make healthy food choices. It is an important part of public health and vital to preventing adverse birth outcomes. Therefore, synthesising available evidence on the effect of nutritional education intervention on birth outcomes is essential for decision-making by policymakers and for identifying needed gaps for future research. Objective to systematically collect, review and summarise available evidence on the pooled effect of the nutrition education to pregnant women on birth outcomes in sub-Saharan Africa. Primary and secondary outcome measures the primary outcome measures will be birth outcomes, while maternal outcomes will be treated as secondary. Methods and analysis This systematic review will systematically search and collect data from a variety of databases, including the MEDLINE, CINAHL, EMBASE, Joanna Briggs Institute Database, Cochrane Database, PEDro, POPLINE, ProQuest, OpenGrey (SIGLE), Google Scholar, Google, APA PsycINFO, Web of Science, Scopus and HINARI. In addition, the systematic review will also search for unpublished studies and grey literature from a variety of sources. The review will only include experimental and quasi-experimental studies published in English from 1 January 2013 to 31 December 2023. Two independent reviewers will critically appraise all eligible studies for methodological quality using the standard Joanna Briggs Institute (JBI) Critical Appraisal Checklist for randomised controlled trials. Any disagreements between the reviewers will resolve through discussion. Either a random effects or fixed effects model will be used to pool the data, depending on the appropriateness of the model. The heterogeneity will be assessed statistically using the standard $\chi 2$ and I2 tests. Publication bias will be examined graphically using funnel plots and statistically using Egger's regression test. In the case when funnel plot is asymmetric and/or Egger's test is statistically significant, the trim and fill (Duval and Tweedie's) analysis will be performed. Statistical association between independent and dependent variables will be declared at $p<0.05$. The meta-analysis will be conducted using the statistical software STATA V.17. Ethics and dissemination by synthesising existing research without ethical concerns, this impactful review will be published and presented across academic and relevant institutions

BMC Medical Imaging
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A methodical exploration of imaging modalities from dataset to detection through machine learning paradigms in prominent lung disease diagnosis: a review

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Abstract

Background: Lung diseases, both infectious and non-infectious, are the most prevalent cause of mortality overall in the world. Medical research has identified pneumonia, lung cancer, and Corona Virus Disease 2019 (COVID-19) as prominent lung diseases prioritized over others. Imaging modalities, including X-rays, computer tomography (CT) scans, magnetic resonance imaging (MRIs), positron emission tomography (PET) scans, and others, are primarily employed in medical assessments because they provide computed data that can be utilized as input datasets for computer-assisted diagnostic systems. Imaging datasets are used to develop and evaluate machine learning (ML) methods to analyze and predict prominent lung diseases.
Objective: This review analyzes ML paradigms, imaging modalities' utilization, and recent developments for prominent lung diseases. Furthermore, the research also explores various datasets available publically that are being used for prominent lung diseases.
Methods: The well-known databases of academic studies that have been subjected to peer review, namely Science Direct, arXiv, IEEE Xplore, MDPI, and many more, were used for the search of relevant articles. Applied keywords and combinations used to search procedures with primary considerations for review, such as pneumonia, lung cancer, COVID-19, various imaging modalities, ML, convolutional neural networks (CNNs), transfer learning, and ensemble learning.
Results: This research finding indicates that X-ray datasets are preferred for detecting pneumonia, while CT scan datasets are predominantly favored for detecting lung cancer. Furthermore, in COVID-19 detection, X-ray datasets are prioritized over CT scan datasets. The analysis reveals that X-rays and CT scans have surpassed all other imaging techniques. It has been observed that using CNNs yields a high degree of accuracy and practicability in identifying prominent lung diseases. Transfer learning and ensemble learning are complementary techniques to CNNs to facilitate analysis. Furthermore, accuracy is the most favored metric for assessment.

Keywords: CNN, CT scan, deep learning, Ensemble learning, Transfer learning, X-ray

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In vitro and in vivo antitrypanosomal activity of the fresh leaves of Ranunculus Multifidus Forsk and its major compound anemonin against Trypanosoma congolense field isolate.

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Abstract

Background: Animal trypanosomiasis is a major livestock problem due to its socioeconomic impacts in tropical countries. Currently used trypanocides are toxic, expensive, and the parasites have developed resistance to the existing drugs, which calls for an urgent need of new effective and safe chemotherapeutic agents from alternative sources such as medicinal plants. In Ethiopian traditional medicine fresh leaves of Ranunculus multifidus Forsk, are used for the treatment of animal trypanosomiasis. The present study aimed to evaluate the antitrypanosomal activity of the fresh leaves of R. multifidus and its major compound anemonin against Trypanosoma congolense field isolate. Methods: Fresh leaves of R. multifidus were extracted by maceration with 80% methanol and hydro-distillation to obtain the corresponding extracts. Anemonin was isolated from the hydro-distilled extract by preparative TLC. For the in vitro assay, 0.1, 0.4, 2 and 4 mg/ml of the test substances were incubated with parasites and cessation or drop in motility of the parasites was monitored for a total duration of 1 h. In the in vivo assay, the test substances were administered intraperitoneally daily for 7 days to mice infected with Trypanosoma congolense. Diminazene aceturate and 1% dimethylsulfoxide (DMSO) were used as positive and negative controls, respectively. Results: Both extracts showed antitrypanosomal activity although the hydro-distilled extract demonstrated superior activity compared to the hydroalcoholic extract. At a concentration of 4 mg/ml, the hydro-distilled extract drastically reduced motility of trypanosomes within 20 min. Similarly, anemonin at the same concentration completely immobilized trypanosomes within 5 min of incubation, while diminazene aceturate (28.00 mg/kg/day) immobilized the parasites within 10 min. In the in vivo antitrypanosomal assay, anemonin eliminates parasites at all the tested doses (8.75, 17.00 and 35.00 mg/kg/day) and prevented relapse, while in diminazene aceturate-treated mice the parasites reappeared on days 12 to 14. Conclusions: The current study demonstrated that the fresh leaves of R. multifidus possess genuine antitrypanosomal activity supporting the use of the plant for the treatment of animal trypanosomiasis in traditional medicine. Furthermore, anemonin appears to be responsible for the activity suggesting its potential as a scaffold for the development of safe and cost effective antitrypanosomal agent.

Keywords: Ranunculus multifidus, Fresh leaves, Antitrypanosomal activity, Trypanosoma congolense, Anemonin

Scientific Reports
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Integrated smart dust monitoring and prediction system for surface mine sites using IoT and machine learning techniques

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Abstract

The mining industry confronts significant challenges in mitigating airborne particulate matter (PM) pollution, necessitating innovative approaches for effective monitoring and prediction. This research focuses on the design and development of an Internet of Things (IoT)-based real-time monitoring system tailored for PM pollutants in surface mines, specifically PM 1.0, PM 2.5, PM 4.0, and PM 10.0. The novelty of this work lies in the integration of IoT technology for real-time measurement and the application of machine learning (ML) techniques for accurate prediction based on recorded dust pollutants data. The study's findings indicate that PM 1.0 pollutants exhibited the highest concentration in the atmosphere of the ball clay surface mine sites, with the stockyard site registering the maximum levels of PM pollutants (28.45 µg/m3, 27.89 µg/m3, 26.17 µg/m3, and 27.24 µg/m3, respectively) due to the dry nature of clay materials. Additionally, the research establishes four ML models—Decision Tree (DT), Gradient Boosting Regression (GBR), Random Forest (RF), and Linear Regression (LR)—for predicting PM pollutant concentrations. Notably, Random Forest demonstrates superior performance with the lowest Mean Abssolute Error (MAE) and Root Mean Squared Error (RMSE) at 1.079 and 1.497, respectively. This comprehensive solution, combining IoT-based monitoring and ML-based prediction, contributes to sustainable mining practices, safeguarding worker well-being, and preserving the environment.

Keywords: Mining industry, Miner's safety, IoT technology, Machine learning models, Dust pollutants

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Household food insecurity and associated factors among postpartum women in southern Ethiopia: a community based cross sectional study

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Abstract

Approximately two billion individuals, or 26.4% of the global population, live in moderate- to severely food-insecure circumstances. It was discovered that not receiving all recommended antenatal care throughout one's pregnancy is one of the effects of household insecurity. The majority of women in Ethiopia, one of the most food-insecure countries in the world, with 10% of the population facing food poverty, devote more of their time to household duties, making food insecurity in the home the primary effect of poor prenatal care utilization. The main objective this study was to assess the status of household food insecurity among postpartum women at Arba Minch town, southern Ethiopia. A community-based cross-sectional study was conducted among 381 mothers who were enrolled from December 1, 2022, to January 30, 2023. The total sample size was allocated proportionately to the number of postpartum women living in each kebeles taking from the town registry of health extension workers for immunization. Thus, systematic sampling was applied. Kobo Toolbox was used for data collection and cleaning, which was then analyzed using the statistical package of Social Science Version 26 (SPSS). In this study, the prevalence of food insecurity was 30.2% (95% CI 25.5–34.5). The associated factors with household food-insecurity were maternal occupation (AOR = 0.5, 95% CI 0.27, 0.90), late antenatal care initiation (AOR = 3.5, 95% CI 2.13, 5.91), and low monthly income (AOR = 3.1, 95% CI 1.38, 6.93). Food insecurity among postpartum mothers in the study area is high. Families who are severely food insecure require quick assistance to lower poor maternal and neonate's outcomes. Furthermore, enhancing the occupation of mothers is crucial in reducing the morbidities and mortality of food insecure mothers, such as delayed prenatal care services, anemia, low birth weight, and stillbirth.

Keywords: Antenatal care, Arba Minch town, Food insecurity, Postpartum, Southern Ethiopia

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Analyzing women's knowledge of pregnancy complications in Ethiopia through a multilevel approach

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Abstract

Pregnancy complications can't always be predicted. However, pregnant women must be aware of these pregnancy complications to avoid serious complications and begin treatment as soon as possible. Maternal mortality can be decreased by offering high-quality maternity services and educating women about the early warning signs of pregnancy. Therefore, the current study aimed to assess individual and community-level factors associated with women's knowledge about pregnancy complications in Ethiopia based on the 2019 Ethiopian mini-demographic health survey data (EMDHS). The study analyzed data from the 2019 EMDHS, including a weighted sample of 1,655 reproductive-age women. Multilevel binary logistic regression analysis was used to fit the associated variables. Using the interclass correlation (ICC), deviance, proportional change variance (PVC), and median odds ratio (MOR), the comparison and fit of the models were evaluated. The significant variables associated with knowledge about complications during pregnancy were identified using an adjusted odds ratio (AOR) and a 95% confidence interval (CI). The proportion of mothers with good knowledge of pregnancy complications was 44.8% (CI 42.4%–47.2%). The multi-level analysis revealed that secondary education (AOR = 1.54, 95% CI = 1.04–2.29), a higher education level (AOR = 1.74, 95% CI = 1.11–2.72), four and above ANC Visits (AOR = 0.74, 95% CI = 0.49–0.98), women who lived in Amhara (AOR = 2.10, 95% CI = 1.24–3.55), and SNNPR (AOR = 3.92, 95% CI = 2.10–7.31) were positively associated with knowledge about pregnancy complications while, women residing in Harari (AOR = 0.20, 95% CI = 0.98–0.44) and Dire-Dawa (AOR = 0.48, 95% CI = 0.24–0.95) were negatively associated with knowledge about pregnancy complications. This study found that nearly half (44.8%) of the study participants demonstrated knowledge about pregnancy complications. This suggests a significant gap in awareness that could potentially impact access to obstetric care for women experiencing complications during pregnancy. Therefore, prioritizing enhancements in antenatal counseling services and community health education regarding pregnancy complications is crucial.

Subjects: Medical research, Risk factors, Signs and symptoms

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Improved energy efficiency using adaptive ant colony distributed intelligent based clustering in wireless sensor networks

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Abstract

Optimization algorithms have come a long way in the last several decades, with the goal of reducing energy consumption and minimizing interference with primary users during data transmission over shorter distances. The adaptive ant colony distributed intelligent based clustering algorithm (AACDIC) is a key component of the cognitive radio (CR) system because of its superior performance in spectrum sensing among a group of multi-users in terms of reduced sensing errors, power conservation, and faster convergence times. This study presents the AACDIC method, which improves energy efficiency by determining the ideal cluster count using connectedness and distributed cluster-based sensing. In this study, we take into account the reality of a system with an unpredictable number of both primary users and secondary users. As a result, the proposed AACDIC method outperforms pre-existing optimization algorithms by increasing the rate at which solutions converge via the utilisation of multi-user clustered communication. Experiments show that compared to other algorithms, the AACDIC method significantly reduces node power usage by 9.646 percent. The average power of Secondary Users nodes is reduced by 24.23 percent compared to earlier versions. The AACDIC algorithm is particularly strong at reducing the Signal-to-Noise Ratio to levels as low as 2 dB, which significantly increases the likelihood of detection. When comparing AACDIC to other primary detection optimization strategies, it is clear that it has the lowest false positive rate. The proposed AACDIC algorithm optimizes network capacity performance, as shown by the results of simulations, due to its ability to solve multimodal optimization challenges. Our analysis reveals that variations in SNR significantly affect the probability of successful detection, shedding light on the intricate interplay between signal strength, noise levels, and the overall reliability of sensor data. This insight contributes to a more comprehensive understanding of the proposed scheme's performance in realistic deployment scenarios, where environmental conditions may vary dynamically. The experimental results demonstrate the effectiveness of the proposed algorithm in mitigating the identified drawback and highlight the importance of SNR considerations in optimizing detection reliability in energy-constrained WSNs. © The Author(s) 2024.

Keywords: Energy efficiency, Adaptive ant colony distributed intelligent based clustering algorithm (AACDIC), Spectrum sensing, Convergence time, Node power, Network capacity performance

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Assessing the Status of Soil Seed Bank in Parthenium Hysterophorus - Invaded Land Use Types and Its Social Aspects in Lower Hare Watershed, Southern Ethiopia

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Abstract

In Ethiopia, Parthenium hysterophorus (P. hysterophorus) is an invasive alien plant affecting various ecosystems. P. hysterophorus displaces native plant species and causes a serious threat to biodiversity. With this background, we aimed to assess the soil seed bank of P. hysterophorus under major land use types and assess the perception of the community toward the effects of P. hysterophorus on social aspects in the lower Hare watershed. For this study, 210 soil samples were collected from 15 transect lines in grassland, cropland, and forest land use types. Statistical analysis using three-way factorial analysis of variance (ANOVA) was used to analyze the difference in density of P. hysterophorus among various land uses soil depths and sites ($P < 0.05$). For assessing the perception of local communities regarding the effects of P. hysterophorus, a total of 117 respondents were enrolled and semi-structured and close-ended questionnaires were used for data collection. It was found that all factors, that is, land use, site, and soil depth, significantly affected the soil seed bank density in the lower Hare watershed ($P < 0.05$). Results indicated that the mean density of seeds was the highest in croplands among the land use types. Meanwhile, the highest mean density of seeds was identified in 0-10 cm soil depth, but the lowest mean density of seeds was identified in 10-15 cm soil depth. The highest seeds were identified at Chano Cheliba, but the density of seeds the lowest in Kola Shera. Moreover, 38.5% of households in Kola Shera and 21.4% of households in Kola Cheliba, but 8.5% of households in Kola Doriga said that it had effects on ecosystem services such as crop yield and livestock production. There should be a need for increased awareness about the density of P. hysterophorus in various land uses and its impacts on native plant species. Seeking for possible solutions such as mechanical control methods in terms of abortion of its seed set and weeding in early vegetative period are among the local people, researchers, and extension workers can use for the management of its invasion, and appropriate control measures can be designed to combat its further invasion and impacts on different land uses of the region.

Key words: density, invasive alien plants, Parthenium hysterophorus, social aspect, soil seed bank

BMC Pregnancy and Childbirth
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24 (2024)

Determinants of preterm delivery among mothers who gave birth in hospitals of Wolaita zone, southern Ethiopia, 2023: unmatched case-control study

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Abstract

Background: Preterm delivery refers to childbirth that occurs before 37 full weeks' gestation. Globally, around 13.4 million babies are born preterm annually, a million died due to its complications. Identifying its determinants is mandatory to decrease preterm birth and thereby neonatal deaths. Therefore, this study aimed to identify the determinants of preterm delivery among mothers who gave birth in hospitals in the Wolaita zone, southern Ethiopia.
Methods: A hospital-based unmatched case-control study design was conducted from March 29 to May 20, 2023, in the Wolaita zone, southern Ethiopia. Cases were women who gave birth after 28 weeks and before 37 completed weeks, and controls were women who gave birth at and after 37 and before 42 weeks of gestation from the first day of the last normal menstrual period. A consecutive sampling method was used. Data were collected by a structured interviewer-administered questionnaire. Data were coded and entered into Epi data 3.1 and analyzed by using SPSS version 25. Variables that had a P-value < 0.25 in the bivariate logistic regression analysis were entered into a multivariable logistic regression model. Finally, p-value < 0.05 was used to claim statistical significance.
Result: From a total of 405 eligible participants, 399 respondents (133 cases and 266 controls) participated in this study with a response rate of 98.52%. The result of the multivariable analysis shows that mothers who resided in rural areas [AOR = 2.78:95% CI (1.51–5.12)], not receiving support from their partner [AOR = 2.37:95% CI (1.24–4.51)], less than four antenatal care visits [AOR = 4.52:95%CI (2.38–8.57)], developed pregnancy-induced hypertension [AOR = 5.25:95%CI (2.27–12.14)] and exposed for intimate partner violence [AOR = 2.95:95%CI (1.105–7.85)], had statistically significant association with experiencing preterm delivery. **Conclusion and recommendation:** Most of the determinants for preterm delivery have been proven modifiable. Thus, designing new strategies, providing comprehensive mobile clinic services to address hard-to-reach areas and Health care providers should give due attention to mothers with pregnancy-induced hypertension and exposure to intimate partner violence and increase the awareness of antenatal care follow-up and benefit of support during pregnancy to reduce preterm delivery.

Keywords: Preterm delivery, Determinant, Gestational age, Pregnancy

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Prevalence and associated factors of visual impairment among adults aged 40 and above in Southern Ethiopia, 2022

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Abstract

Visual impairment is a functional limitation of the eye caused by a disorder or disease that can reduce one's ability to perform daily activities. Many studies in Ethiopia have focused on childhood visual impairments. We assessed the prevalence and factors associated with visual impairment among adults aged 40 and above. Community-based cross-sectional study was done and a systematic sampling technique was used to select 655 participants. Data were collected by interviewer administered questionnaire, E-Snell chart, pinhole, torch light, and magnifying loupe. SPSS version 25 was used for analysis. Bivariate and multivariate analyses were performed to identify factors associated with outcome variable. The overall prevalence of visual impairment was found to be 36.95% (95% CI 33.2–40.8%). Factors associated with a higher odd of visual impairment included aged 51–60 years (AOR 2.37, 95% CI 1.29–4.44), aged 61 and above (AOR 8.9, 95% CI 4.86–16.3), low wealth index (AOR 1.91, 95% CI 1.14–3.2), divorced and widowed (AOR 4.67, 95% CI 2.77–7.86), no formal education (AOR 14.28, 95% CI 2.82–71.46), not utilizing eyeglass (AOR 3.94, 95% CI 1.65–9.40). The prevalence of visual impairment was relatively high compared to other studies. Age, marital status, occupation, educational status, wealth index, and not using eyeglasses were significantly associated with visual impairment. Refractory error is the leading cause of visual impairment. Early eye care service interventions are needed in this area.

Iranian Journal of Numerical Analysis and Optimization
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A novel mid-point upwind scheme for fractional-order singularly perturbed convection-diffusion delays differential equation

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Abstract

This study presents a numerical approach for solving temporal fractional order singularly perturbed parabolic convection-diffusion differential equations with a delay using a uniformly convergent scheme. We use the asymptotic analysis of the problem to offer a priori bounds on the exact solution and its derivatives. To discretize the problem, we use the implicit Euler technique on a uniform mesh in time and the midpoint upwind finite difference approach on a piece-wise uniform mesh in space. The proposed technique has a nearly first-order uniform convergence order in both spatial and temporal dimensions. To validate the theoretical analysis of the scheme, two numerical test situations for various values of ε are explored.

Keywords: Caputo–Fabrizio derivative operator, midpoint upwind scheme, fractional-order differential equation, delay differential equation, singularly perturbed problem.

Quaternary Science Advances
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16 (2024)

Combined GIS, FR and AHP approaches to landslide susceptibility and risk zonation in the Baso Liben district, Northwestern Ethiopia

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Abstract

In mountainous places, landslides pose severe environmental threats, weakening infrastructure, resulting in death and costing the economy. This article assesses landslide susceptibility and risk in the Baso Liben district of Northwestern Ethiopia using an analytical hierarchy process (AHP) and Geographic Information System (GIS)-based Frequency Ratio (FR). Eleven key environmental and geological components— height, slope, lithology, soil type, and land use—were studied. After field research and Google Earth photos, 342 landslide incidents were collated and separated into validation (30%) and training (70%) datasets. ROC curves provide a technique for analyzing the efficacy of the FR and AHP models. With an Area Under the Curve (AUC) value of 83.4%, the AHP model exhibited superior accuracy than the FR model, with an AUC value of 74.4%. Very low, low, moderate, high, and very high vulnerability are five categories defined as landslide hazard zones. The AHP model assessed 10.5% of the area as very high risk, 19.8% as high danger, 25.6% as moderate risk, 28% as medium risk, and 16.1% as very low risk. The FR model meanwhile assessed 10.16% of the area as very high risk, 21.3% as high risk, 28.9% as moderate risk, 22.5% as low risk, and 17.04% as very low risk. The results reveal that slope angle, lithology, and elevation are key factors impacting landslide vulnerability. These findings equip a practical framework for land-use planning and disaster risk reduction, providing decision-makers with appropriate instruments to help lessen landslide hazards. The research underscores the significance of combining objective data analysis with expert knowledge to enhance the accuracy and reliability of landslide susceptibility models.

Keywords: Landslide, susceptibility GIS, Frequency ratio, AHP, Hazard zonation, Baso Liben, Ethiopia

Scientific Reports
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14 (2024)

Maize leaf disease recognition using PRF-SVM integration: a breakthrough technique

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Abstract

The difficulty of collecting maize leaf lesion characteristics in an environment that undergoes frequent changes, suffers varying illumination from lighting sources, and is influenced by a variety of other factors makes detecting diseases in maize leaves difficult. It is critical to monitor and identify plant leaf diseases during the initial growing period to take suitable preventative measures. In this work, we propose an automated maize leaf disease recognition system constructed using the PRF-SVM model. The PRFSVM model was constructed by combining three powerful components: PSPNet, ResNet50, and Fuzzy Support Vector Machine (Fuzzy SVM). The combination of PSPNet and ResNet50 not only assures that the model can capture delicate visual features but also allows for end-to-end training for smooth integration. Fuzzy SVM is included as a final classification layer to accommodate the inherent fuzziness and uncertainty in real-world image data. Five different maize crop diseases (common rust, southern rust, grey leaf spot, maydis leaf blight, and turcicum leaf blight along with healthy leaves) are selected from the Plant Village dataset for the algorithm's evaluation. The average accuracy achieved using the proposed method is approximately 96.67%. The PRFSVM model achieves an average accuracy rating of 96.67% and a mAP value of 0.81, demonstrating the efficacy of our approach for detecting and classifying various forms of maize leaf diseases.

Keywords: Maize leaf diseases, Segmentation, Convolutional neural network, Classification, Fuzzy SVM

BMC Medical Education
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24 (2024)

Implementation status of the nationally harmonized competency-based, integrated, modular medical curriculum in Ethiopia: opportunities and challenges

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Abstract

Background: Well-designed curriculums are crucial for quality education. This study aimed to assess the implementation status of a harmonized competency-based medical curriculum (CBMC) in Ethiopia, as well as identify the associated challenges and benefits. Methods: A mixed-method approach was used. Data collection took place from September 1, 2023, to October 15, 2023. Eleven medical schools were randomly selected from a list of 28 public medical schools in Ethiopia. Participants were purposively chosen from selected medical schools using a controlled sampling method. A total of 121 participants took part in the survey. Interviews and focus group discussions were conducted with key informants to complement the quantitative findings. Descriptive statistics, such as frequencies and percentages, were used to summarize the quantitative survey responses. Thematic content analysis was used to analyze the qualitative data. Results: The implementation of a CBMC in Ethiopian public universities faces various challenges and provides opportunities. Around 22% of respondents mentioned that the whole group session (WGS) had never been implemented in their school. Regarding community-based learning (CBL), 64.6% of respondents noted that it was intermittently implemented in their institution. Only 32% of respondents considered students' clinical exposure during preclerkship years to be reasonable. Interestingly, approximately 73% of respondents stated that problem-based learning (PBL) activities were regularly conducted in their school. Around 68% of respondents believed that competency-based assessment methods were moderately utilized. While many participants perceive the curriculum as having positive content alignment and structure with intended learning outcomes, challenges related to practical sessions, resource limitations, and uneven access to training opportunities persist. Resource constraints are a prominent challenge. The opportunities identified include early clinical exposure and enhanced communication skills. Conclusions: This survey highlights the need for ongoing curriculum evaluation and fine-tuning to ensure its success.

Keywords: Competency-based medical curriculum, Challenges, Ethiopia, Implementation, Opportunities

PLoS Neglected Tropical Diseases
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18 (2024)

Rapid assessment of noma: Reporting on forgotten and neglected disease in Ethiopia

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Abstract

Background: Noma is a rapidly progressing, invasive, and debilitating orofacial disease that primarily affects the most vulnerable and marginalised populations worldwide. The highest-risk group includes pre-school children, exposed to other risk factors, such as malnutrition and poverty-related diseases. Since 2010, Ethiopia has reported an increasing number of noma cases, primarily identified through medical missions. Data on the disease burden and epidemiology are essential for planning service delivery and developing effective disease prevention strategies. In this endeavour to document noma. s presence in Ethiopia, and assess the health system capacity for noma care, we have performed a rapid assessment.

Methodology: We performed a rapid assessment including a desk and literature review, health sector capacity assessment and a retrospective analysis of hospital records to identify all confirmed cases of noma cases from 2015–2022, based on data from NGOs and health facility records.

Result: The desk review revealed that Ethiopia lacks a national policy on noma. However, the national health policy emphasizes the prevention and control of poverty-related diseases. There is no formal oral health program within the primary healthcare, aside from the limited dental care availability in regional/referral hospitals and private sector. The retrospective assessment has extracted 69 noma cases record reported from January 2015 to December 2020, with 97% of case record came from two NGO's supporting surgical mission. Cases were reported from nearly every region of the country with a notable concentration in Amhara region. The trend of cases being cared has decreased from 2015 to 2020 and no record is found for acute cases of noma.

Conclusion: The rapid assessment highlights a critical lack of research and surveillance programmes for noma. Efforts to increase public awareness and educate community workers and primary health care professionals on identification of noma and referring patients for care are essential. As a first step toward eliminating noma, the disease should be added to the national list of neglected tropical diseases, followed by integrated control programmes through the existing health extension system to expand oral health service.

Materials
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Green Synthesis of Titanium Dioxide Nanoparticles Using Maerua oblongifolia Root Bark Extract: Photocatalytic Degradation and Antibacterial Activities

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Abstract

The root bark extract of the Maerua oblongifolia plant in the green synthesis of titanium dioxide nanoparticles (TiO2 NPs) for photocatalytic degradation of toxic pollutants and antibacterial activities was implemented in this study. The root bark extract served as a novel capping and reducing agent for the first time. Characterization of the TiO2 NPs was conducted by using visual observation, ultraviolet visible spectrometry (UV-Vis), Fourier transform infrared spectroscopy (FTIR), X-ray diffraction (XRD), and scanning electron microscopy (SEM) techniques, confirming their successful synthesis. The TiO2 NPs exhibited maximum absorbance at 323 nm and an average particle size of 19.58 nm; the conjugations and existences of Ti-O and OH vibrational bands were revealed by the FTIR spectrum. The photocatalytic activities of the TiO2 NPs were investigated by using solar irradiation as an energy source for aqueous solutions of methyl orange (MO) and methylene blue (MB) dyes. The TiO2 NPs showed strong photocatalytic activities by degrading 97.23% MB and 91.8% MO under optimized conditions. Degradation behavior was investigated by isotherms and kinetics models, with the Langmuir isotherms (R2: 0.996, 0.979) and Langmuir–Hinshelwood (R2: 0.998, 0.997) highest correlation coefficients for MB and MO, respectively. Moreover, the antibacterial efficacy of the green-synthesized TiO2 NPs and the results indicated higher antibacterial activities on Gram-negative bacteria (27 ± 0.52).

Quaternary
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7 (2024)

The Evolution of Long-Range Hunting with Stone-Tipped Weapons during the Afrotropic Middle Stone Age: A Testable Framework Based on Tip Cross-Sectional Area

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Abstract

In the Afrotropic biogeographic realm, with its diverse and high-density mammal population, early humans may have been hunting with stone-tipped weapons since ~500,000 years ago. Being able to hunt effectively from a distance has several important adaptive advantages. Yet, until now, African long-range javelin hunting remained unexplored as intermediate between short/medium-range, hand-delivered and long-range, mechanically projected weapons. Insights gained from a new Afrotropic comparative dataset with 950 weapon tips of known use—including several javelin types—provide a contextually appropriate middle-range tool for assessing the probable effective hunting ranges of Middle Stone Age points. We use a novel application of the ballistically relevant tip cross-sectional area (TCSA) statistic to define contact, short-, medium-, long- and maximum-range hunting and discuss the adaptive advantages for each. The approach is applied to suggest developments and variations in the best-fit hunting ranges of 5597 stone points from 62 Middle Stone Age Afrotropic assemblages. By aligning our results with the Marine Isotope Stage (MIS) record we hypothesize that effective long-range (~20–30 m) hunting with stone-tipped weapons was probably not practiced by ≥MIS 8, and that experimentation with long-range javelins—similar to those used by contemporary Ethiopian hunters—over these distances may have started during MIS 6, becoming part of the everyday Afrotropic hunting arsenal by the end of MIS 5.

BMC Cardiovascular Disorders
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24 (2024)

Predictors of complications and mortality among patients undergoing pacemaker implantation in resource-limited settings: a 10-year retrospective follow-up study

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Abstract

Introduction: Pacemakers (PMs) are used to treat patients with severe bradycardia symptoms. They do, however, pose several complications. Even with these risks, there are only a few studies assessing PM implantation outcomes in resource-limited settings like Ethiopia and other sub-Saharan countries in general. Therefore, this study aims to assess the mid-term outcome of PM implantation in patients who have undergone PM implantation in the Cardiac Center of Ethiopia by identifying the rate and predictors of complications and death. Methodology: This retrospective study was conducted at the Cardiac Center of Ethiopia from October 2023 to January 2024 on patients who had PM implantation from September 2012 to August 2023 to assess the midterm outcome of the patients. Complication rate and all-cause mortality rate were the outcomes of our study. Multivariable logistic regression was used to identify factors associated with complications and death. To analyze survival times, a Kaplan–Meier analysis was performed. Results: This retrospective follow-up study included 182 patients who underwent PM implantation between September 2012 and August 2023 and were at least 18 years old. The patients' median follow-up duration was 72 months (Interquartile range (IQR): 36–96 months). At the end of the study, 26.4% of patients experienced complications. The three most frequent complications were lead dislodgement, which affected 6.6% of patients, PM-induced tachycardia, which affected 5.5% of patients, and early battery depletion, which affected 5.5% of patients. Older age (Adjusted Odds Ratio (AOR) 1.1, 95% CI 1.04–1.1, p value < 0.001), being female (AOR 4.5, 95%CI 2–9.9, p value < 0.001), having dual chamber PM (AOR 2.95, 95%CI 1.14–7.6, p value = 0.006) were predictors of complications. Thirty-one (17%) patients died during the follow-up period. The survival rates of our patients at 3, 5, and 10 years were 94.4%, 92.1%, and 65.5% respectively with a median survival time of 11 years. Patients with a higher Charlson comorbidity index before PM implantation (AOR 1.2, 95% CI 1.1–1.8, p = 0.04), presence of complications (AOR 3.5, 95% CI 1.2–10.6, p < 0.03), and New York Heart Association (NYHA) class III or IV (AOR 3.3, 95% CI 1.05–10.1, p = 0.04) were associated with mortality. Conclusion: Many complications were experienced by patients who had PMs implanted, and several factors affected their prognosis. Thus, it is essential to identify predictors of both complications and mortality to prioritize and address the manageable factors associated with both mortality and complications.

Keywords: Pacemaker, Complication, Mortality, Predictors, Sub-Saharan, Resource-Limited

BMC Infectious Diseases
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24 (2024)

Peripheral neuropathy and associated factors among children living with HIV on antiretroviral therapy in Gamo zone, Southern Ethiopia: an institution-based cross-sectional study

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Abstract

Background: Peripheral neuropathy (PN) is a common neurological complication of HIV (Human Immunodeficiency Virus) that can significantly affect patients' quality of life. In Ethiopia, children living with HIV are at an increased risk of developing peripheral neuropathy due to comorbidities such as anemia, tuberculosis, malnutrition, and poor socio-economic status. Our study aims to evaluate the prevalence of peripheral neuropathy among children living with HIV in Ethiopia using a simple clinical screening tool.

Methods: A health institution-based cross-sectional study was conducted among 148 children aged 5 to 18 years living with HIV who are receiving treatment at the antiretroviral therapy (ART) clinic of the randomly selected public health institutions in the Gamo zone. An interview and neurologic examination were conducted. A binary logistic regression model was used to identify factors associated with the outcome variable. Variables with p-value < 0.25 in the bi-variable logistic regression analysis were entered and checked for association in a multivariable logistic regression model. The level of statistical significance was declared at the p-value < 0.05.

Result: In this study, 148 children participated, making a response rate of 97.5%. The mean ± standard deviation (SD) age of the respondents was 15.03 ± 2.99 years, and 81(54.7%) were male. The magnitude of PN was 20.9% (31/148). Children in the age category of 15–18 (adjusted odds ratio (AOR) = 1.88, 95%CI; 1.24–4.60), low BMI for age (AOR = 1.66, 95%CI; 1.12–4.15), last exposure to isoniazid within 1 year (AOR = 2.31, 95%CI; 1.12–8.53). Longer duration of HIV illness (AOR = 2.17, 95%CI; 1.54–4.64), and past tuberculosis (TB) treatment (AOR = 2.11, 95%CI; 1.08–7.48) were significantly associated factors with peripheral neuropathy.

Conclusion: Our analysis revealed that being in the age category of 15–18 years, low BMI for age, Isoniazid exposure, longer Duration of HIV illness, and past TB treatment were significantly associated with peripheral neuropathy in children living with HIV. These disease-related factors may contribute to the development and progression of peripheral neuropathy in this population. Clinical trial number: Not applicable.

Keywords: Peripheral neuropathy, HIV/AIDS, Ped m TNS

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Administration of ivermectin to cattle induced mortality, reduced fecundity and survivorship of Anopheles arabiensis in Ethiopia: an implication for expansion of vector control toolbox

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Abstract

Background: Although many countries have shown interest in eliminating malaria, approaches that complement existing vector control interventions are needed because existing methods have been scaled up but malaria still persists. Therefore, the effect of ivermectin administration to cattle was evaluated for its effect on mortality, survivorship and mortality of laboratory reared Anopheles arabiensis. Methods: Three calves were randomly selected and injected with ivermectin at a therapeutic dose of 0.2 mg/kg, while the other two calves received no treatment and served as controls. Five tents were constructed for the trial. Calves were housed in tents (one per tent) and then 30 starved female An. arabiensis were introduced into each tent. Only fully engorged females were collected from each tent and placed in different mosquito cages to monitor their mortality, survival and fecundity. Data analysis was done using SPSS version 16. Results: During the follow-up period (until day 21), ivermectin induced significantly higher mortality when compared to controls. It resulted in an average 24-h mortality rate of 81.6% against An. arabiensis on the first day following treatment. 100% An. arabiensis that fed on ivermectin-treated calves on the first day after treatment died within four days. Egg production rate of An. arabiensis that fed on ivermectin-treated calves was significantly lower compared to controls ($F = 768.7$, $P < 0.001$). Conclusion: In conclusion, ivermectin induced mortality, reduced fecundity and survivorship of laboratory maintained An. arabiensis. Further study is recommended using a wild mosquito population. Moreover, mass ivermectin administration to domestic animals could be recommended to supplement the existing indoor based interventions.

Keywords: Anopheles arabiensis, Fecundity, Ivermectin, Mortality, Survival rate

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24 (2024)

Determining behavioral intention and its predictors toward preconception care use among reproductive age women in Arba Minch town, Southern Ethiopia, 2022: a cross-sectional study based on the theory of planned behavior

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Abstract

Background: Preconception care is a highly effective, evidence-based intervention aimed at promoting the health of reproductive-age women and reducing adverse pregnancy-related outcomes. The Ethiopian Ministry of Health plans to integrate preconception care services into the country's existing healthcare system. However, women's preferences may be influenced by their values and customs. Therefore, this study used the theory of planned behavior to assess women's intention toward preconception care use and its predictors among reproductive-age women in Arba Minch town, southern Ethiopia. Methods: A community-based cross-sectional study was conducted in Arba Minch town from May 1 to 30, 2022. A simple random sampling technique was employed to select 415 study participants for data collection. Data were collected through a face-to-face interview using a pretested, structured questionnaire. Epi Data version 4.6 and SPSS version 26 were used for the entry and analysis of data, respectively. Multiple linear regression was performed to identify independent predictors of intention to use preconception care. The standardized β-coefficient was used as a measure of association. A P value of less than 0.05 was used to declare statistical significance. Results: This study had 415 participants, giving a response rate of 98.3%. The mean age of the participants was 28.4 (SD 5.18). The mean intention to use preconception care was 21.43 (SD 2.47). Direct perceived behavioral control ($\beta = 0.263$, $p < 0.001$), direct attitude ($\beta = 0.201$, $p = 0.001$), direct subjective norm ($\beta = 0.158$, $p = 0.006$), and age ($\beta = -0.115$, $p = 0.023$) were significant predictors of women's behavioral intention to use preconception care. Conclusion: The study identified perceived behavioral control as the strongest predictor, followed by attitude and subjective norms, influencing the intention to use preconception care. These findings underscore the importance of integrating these predictors into health intervention programs aimed at promoting the implementation of preconception care services.

Keywords: Preconception care, Intention, Reproductive age women, Theory of planned behaviors

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404 (2024)

The burden of diseases, injuries, and risk factors by state in the USA, 1990–2021: a systematic analysis for the Global Burden of Disease Study 2021

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Abstract

Background: The Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) 2021 provides a comprehensive assessment of health and risk factor trends at global, regional, national, and subnational levels. This study aims to examine the burden of diseases, injuries, and risk factors in the USA and highlight the disparities in health outcomes across different states.

Methods: GBD 2021 analysed trends in mortality, morbidity, and disability for 371 diseases and injuries and 88 risk factors in the USA between 1990 and 2021. We used several metrics to report sources of health and health loss related to specific diseases, injuries, and risk factors. GBD 2021 methods accounted for differences in data sources and biases. The analysis of levels and trends for causes and risk factors within the same computational framework enabled comparisons across states, years, age groups, and sex. GBD 2021 estimated years lived with disability (YLDs) and disability-adjusted life-years (DALYs; the sum of years of life lost to premature mortality and YLDs) for 371 diseases and injuries, years of life lost (YLLs) and mortality for 288 causes of death, and life expectancy and healthy life expectancy (HALE). We provided estimates for 88 risk factors in relation to 155 health outcomes for 631 risk–outcome pairs and produced risk-specific estimates of summary exposure value, relative health risk, population attributable fraction, and risk-attributable burden measured in DALYs and deaths. Estimates were produced by sex (male and female), age (25 age groups from birth to ≥95 years), and year (annually between 1990 and 2021). 95% uncertainty intervals (UIs) were generated for all final estimates as the 2·5th and 97·5th percentiles values of 500 draws (ie, 500 random samples from the estimate's distribution). Uncertainty was propagated at each step of the estimation process.

Findings: We found disparities in health outcomes and risk factors across US states. Our analysis of GBD 2021 highlighted the relative decline in life expectancy and HALE compared with other countries, as well as the impact of COVID-19 during the first 2 years of the pandemic. We found a decline in the USA's ranking of life expectancy from 1990 to 2021: in 1990, the USA ranked 35th of 204 countries and territories for males and 19th for females, but dropped to 46th for males and 47th for females in 2021. When comparing life expectancy in the best-performing and worst-performing US states against all 203 other countries and territories (excluding the USA as a whole), Hawaii (the best-ranked state in 1990 and 2021) dropped from sixth-highest life expectancy in the world for males and fourth for females in 1990 to 28th for males and 22nd for females in 2021. The worst-ranked state in 2021 ranked 107th for males (Mississippi) and 99th for females (West Virginia). 14 US states lost life expectancy over the study period, with West Virginia experiencing the greatest loss (2·7 years

between 1990 and 2021). HALE ranking declines were even greater; in 1990, the USA was ranked 42nd for males and 32nd for females but dropped to 69th for males and 76th for females in 2021. When comparing HALE in the best-performing and worst-performing US states against all 203 other countries and territories, Hawaii ranked 14th highest HALE for males and fifth for females in 1990, dropping to 39th for males and 34th for females in 2021. In 2021, West Virginia—the lowest-ranked state that year—ranked 141st for males and 137th for females. Nationally, age-standardised mortality rates declined between 1990 and 2021 for many leading causes of death, most notably for ischaemic heart disease (56·1% [95% UI 55·1–57·2] decline), lung cancer (41·9% [39·7–44·6]), and breast cancer (40·9% [38·7–43·7]). Over the same period, age-standardised mortality rates increased for other causes, particularly drug use disorders (878·0% [770·1–1015·5]), chronic kidney disease (158·3% [149·6–167·9]), and falls (89·7% [79·8–95·8]). We found substantial variation in mortality rates between states, with Hawaii having the lowest age-standardised mortality rate (433·2 per 100 000 [380·6–493·4]) in 2021 and Mississippi having the highest (867·5 per 100 000 [772·6–975·7]). Hawaii had the lowest age-standardised mortality rates throughout the study period, whereas Washington, DC, experienced the most improvement (a 40·7% decline [33·2–47·3]). Only six countries had age-standardised rates of YLDs higher than the USA in 2021: Afghanistan, Lesotho, Liberia, Mozambique, South Africa, and the Central African Republic, largely because the impact of musculoskeletal disorders, mental disorders, and substance use disorders on age-standardised disability rates in the USA is so large. At the state level, eight US states had higher age-standardised YLD rates than any country in the world: West Virginia, Kentucky, Oklahoma, Pennsylvania, New Mexico, Ohio, Tennessee, and Arizona. Low back pain was the leading cause of YLDs in the USA in 1990 and 2021, although the age-standardised rate declined by 7·9% (1·8–13·0) from 1990. Depressive disorders (56·0% increase [48·2–64·3]) and drug use disorders (287·6% [247·9–329·8]) were the second-leading and third-leading causes of age-standardised YLDs in 2021. For females, mental health disorders had the highest age-standardised YLD rate, with an increase of 59·8% (50·6–68·5) between 1990 and 2021. Hawaii had the lowest age-standardised rates of YLDs for all sexes combined (12 085·3 per 100 000 [9090·8–15 557·1]), whereas West Virginia had the highest (14 832·9 per 100 000 [11 226·9–18 882·5]). At the national level, the leading GBD Level 2 risk factors for death for all sexes combined in 2021 were high systolic blood pressure, high fasting plasma glucose, and tobacco use. From 1990 to 2021, the age-standardised mortality rates attributable to high systolic blood pressure decreased by 47·8% (43·4–52·5) and for tobacco use by 5·1% (48·3%–54·1%), but rates increased for high fasting plasma glucose by 9·3% (0·4–18·7). The burden attributable to risk factors varied by age and sex. For example, for ages 15–49 years, the leading risk factors for death were drug use, high alcohol use, and dietary risks. By comparison, for ages 50–69 years, tobacco was the leading risk factor for death, followed by dietary risks and high BMI.

Interpretation: GBD 2021 provides valuable information for policy makers, health-care professionals, and researchers in the USA at the national and state levels to prioritise interventions, allocate resources effectively, and assess the effects of health policies and programmes. By addressing socioeconomic determinants, risk behaviours, environmental influences, and health disparities among minority populations, the USA can work towards improving health outcomes so that people can live longer and healthier lives.

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Hidden cost of hospital-based delivery and associated factors among postpartum women attending public hospitals in Gamo zone, southern Ethiopia

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Abstract

Background: Since 2005, the healthcare system in Ethiopia has implemented policies to promote the provision of free maternal healthcare services. The primary goal of these policies is to enhance the accessibility of maternity care for women from various socioeconomic backgrounds. Additionally, the aim is to increase the utilization of maternity services, such as institutional deliveries, by removing financial obstacles that pregnant women may face. Even though maternity services are free of charge. The hidden cost has unquestionably been a key obstacle in seeking and utilizing health care services. Significant payments due to delivery services could create a heavy economic burden on households. Objectives: To determine the hidden cost of hospital-based delivery and associated factors among postpartum women attending public hospitals in Gamo zone, southern Ethiopia 2023. Methods: A facility-based cross-sectional study was conducted on 411 postpartum women in Gamo Zone Public Health Hospitals from December 1, 2022, to January 30, 2023. The systematic sampling technique was applied to reach study units. Data was collected using the Kobo Toolbox Data Collection Tool and exported to SPSS statistical software version 27 for analysis. Simple linear regression and multiple linear regression were done to see the association of variables. The significance level was declared at a P-value < 0.05 in the final model. Result: The median hidden cost of hospital-based delivery was 1142 Ethiopian birr (ETB), with a range (Q) of 2262 (504–2766) ETB. Monthly income of the family (β = 0.019), obstetrics complications (β = 0.033), distance from the health facility (β = 0.003), and mode of delivery (β = 0.072), were positively associated with the hidden cost of hospital-based delivery. While, rural residence (β = −0.041) was negatively associated with the outcome variable. Conclusion: This study showed the hidden cost of hospital-based delivery was relatively high. Residence, monthly income of the family, obstetric complications, mode of delivery, and distance from the health facility were statistically significant. It is important to take these factors into account when designing health intervention programs and hospitals should prioritize the availability of essential drugs and medical supplies within their facilities to address direct medical costs in hospitals. © The Author(s) 2024.

Keywords: Hidden costs, Hospital costs, Hospital -based delivery, Ethiopia

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26 (2024)

Mainstreaming control interventions for neglected tropical diseases into the health system: A scoping review protocol

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Abstract

Introduction: The WHO neglected tropical diseases (NTD) roadmap (2021-2030) proposed a shift in approach to addressing NTDs through accountability for impact, implementing integration across NTDs, mainstreaming in national health systems and ensuring country ownership. However, a major challenge has been the dearth of evidence on how to implement this shift in a resource-limited setting. The objective of this scoping review is to understand the extent and type of evidence on the mainstreaming or integration of programmes and/or interventions against NTDs into the national health system.

Methods: Research articles of any methodology, series, evaluations and reports published from 1995 in the English language on any peer-reviewed platforms, and WHO, universities and government or implementing partners websites that report and discuss mainstreaming or integration implementation practices or experiences of any interventions against NTDs into the health system will be included. The main databases searched on 30 October 2024 were Medical Literature Analysis and Retrieval System Online (Ovid), Embase (Ovid), Global Health (Ovid), Cochrane Database of Systematic Reviews and CENTRAL on the Cochrane Library (Wiley), and WHO Global Index Medicus. Following piloting, screening and data extraction will be undertaken independently by at least two people. Any disagreements that arise between the reviewers at each stage of the screening and selection process will be resolved through discussion, or with an additional reviewer/s. Thematic analysis will be conducted guided by the project INTEGRATE framework and the Primary Health Care Performance Initiative conceptual framework. Key information or evidence relevant to the mainstreaming of interventions against NTDs into the health system such as mainstreamed interventions and the level of health system where the mainstreaming occurred, the effectiveness of the mainstreaming, contextual differences in health system organisation between settings, and challenges and promising practices will be summarised.

Ethics and dissemination: Ethical approval will not be sought as our review will only include published data. The findings will be published in a peer-reviewed journal and will be disseminated at national and international research and programme review platforms.

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Questioning the democracy–growth debate in countries of the East African region: a political economy perspective

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Abstract

In Africa, though the nexus between democracy and economic growth has been studied for decades, the issue remains topical in academic and public policy debates. This has been common, particularly from the vantage point of the continent's drive to meet the 2030 United Nations Sustainable Development Goals. However, existing literature in East African countries has substantial limitations in comprehensively analyzing the conventional democracy–growth hypothesis' intellectual, theoretical, and ideological compatibility. Moreover, most research findings and reports did not employ a mixed research approach and overlooked key econometric variables to address the underlying research question. Hence, this study aims to investigate the impact of democracy on economic growth in countries in the East African region from a political economy perspective. For the quantitative analysis, the study uses secondary panel data with panel autoregressive distributed lag, fully modified OLS, and dynamic OLS regression approaches from 1990 to 2018. For qualitative discussion, the study uses secondary documents and further discusses and interprets the quantitative results. The quantitative results show that all panel mean models provide different and mixed results concerning the impact of democracy on economic growth. As such, it reveals an inconclusive outcome, showing that a direct link between democracy and economic growth in countries in the East African region cannot be established. The study indicates that such a mixed or blurred result of the above econometric tests necessitates the consideration of country-specific, ideological, and policy contexts of the countries and global and exceptionally regional socio-economic as well as ideological–political contexts in the study of the democracy–growth nexus in East Africa.

Keywords: Democracy, Economic growth, Political economy, Conflict hypothesis, Compatibility, hypothesis, Skeptical hypothesis, East Africa

Journal of Social and Economic Development
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Correction to: Questioning the democracy–growth debate in countries of the East African region: a political economy perspective (Journal of Social and Economic Development, (2024), 26, 3, (1059-1081), 10.1007/s40847-023-00270-z)

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Abstract

In Africa, though the nexus between democracy and economic growth has been studied for decades, the issue remains topical in academic and public policy debates. This has been common, particularly from the vantage point of the continent's drive to meet the 2030 United Nations Sustainable Development Goals. However, existing literature in East African countries has substantial limitations in comprehensively analyzing the conventional democracy–growth hypothesis' intellectual, theoretical, and ideological compatibility. Moreover, most research findings and reports did not employ a mixed research approach and overlooked key econometric variables to address the underlying research question. Hence, this study aims to investigate the impact of democracy on economic growth in countries in the East African region from a political economy perspective. For the quantitative analysis, the study uses secondary panel data with panel autoregressive distributed lag, fully modified OLS, and dynamic OLS regression approaches from 1990 to 2018. For qualitative discussion, the study uses secondary documents and further discusses and interprets the quantitative results. The quantitative results show that all panel mean models provide different and mixed results concerning the impact of democracy on economic growth. As such, it reveals an inconclusive outcome, showing that a direct link between democracy and economic growth in countries in the East African region cannot be established. The study indicates that such a mixed or blurred result of the above econometric tests necessitates the consideration of country-specific, ideological, and policy contexts of the countries and global and exceptionally regional socio-economic as well as ideological–political contexts in the study of the democracy–growth nexus in East Africa.

Keywords: Democracy, Economic growth, Political economy, Conflict hypothesis, Compatibility hypothesis, Skeptical hypothesis, East Africa

Reproductive Health
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21 (2024)

Husband responses towards birth preparedness, complications readiness, and associated factors in southern Ethiopia: the case of Kena District

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Abstract

Background: Birth preparedness and complication readiness is a holistic approach that empowers mothers and families with the knowledge, attitude, and resources to alleviate potential challenges during childbirth. Despite its benefits, husbands' participation in maternal care differs significantly between countries and regions. There is a lack of previous studies that look at husbands' responses to birth preparedness and complication readiness in the research area. Thus, the primary goal of this study is to find out how husbands who have wives with infants under 12 months old feel about birth preparation, readiness for problems, and its associated factors.

Methods: A community-based cross-sectional study design was conducted from May 30 to July 29, 2022. Simple random sampling was employed to select 499 husbands. An interviewer-administered, structured, and pretested questionnaire was used to collect the data. Data entry and analysis were performed using Epi Data version 4.6 and SPSS version 25, respectively. We used multivariable logistic regression to find statistically significant factors. P-values less than 0.05, 95% confidence intervals, and adjusted odds ratios are used to declare statistical significance. The findings were shown in figures, tables, and text.

Results: The study found that 55.9% (95% CI: 51.4 to 61.4%) of husbands responded to birth preparedness and complication readiness. This response was significantly associated with being employed (AOR = 3.7, 95% CI: 2.27–5.95), engaging in self-business (AOR = 5.3, 95% CI: 2.34–12.01), having wives who delivered in health facilities (AOR = 7.1, 95% CI: 3.92–12.86), accompanying wives for antenatal care (AOR = 2.2, 95% CI: 1.39–3.56), possessing good knowledge of danger signs during labor (AOR = 2.0, 95% CI: 1.08–3.74) and the postnatal period (AOR = 7.1, 95% CI: 3.14–16.01). Interestingly, residents living near a health facility (AOR = 0.6, 95% CI: 0.39–0.97) were less likely to respond.

Conclusion: The present study found that nearly 6 out of 10 husbands actively responded in terms of birth preparedness and complication readiness. While husbands in this study showed some involvement in birth preparedness and complications, it is good when compared to studies carried out nationally. To improve this, educating husbands by focusing on the danger signs and their role in childbirth is recommended.

Keywords: Birth preparedness, Complications readiness, Husband involvement, Husban, responses, Husband participation, Male involvement, Kena Woreda.

Environmental Systems Research
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Regional climate models and bias correction methods for rainfall-runoff modeling in Katar watershed, Ethiopia

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Abstract

Systematic errors in regional climate models (RCMs) hinder their implementation and lead to uncertainties in regional hydrological climate change studies. As a result, checking the accuracy of climate model simulations and applying bias correction are preliminary methods for achieving consistent findings. Therefore, identifying suitable RCM models for bias correction is important for providing reliable inputs for evaluating climate change impacts. The impacts of bias correction methods on streamflow were assessed on the Katar catchment within the Lake Ziway subbasin using coordinated regional climate downscaling experiments with a spatial resolution of 50 km (CORDEX-44) RCMs through the Integrated Hydrological Modelling System (IHMS) version 6.3. This study evaluated fourteen RCM models under five precipitation and three temperature bias correction methods for the Katar catchment. Statistical approaches, such as bias (PBIAS), the root mean square error (RMSE), the mean absolute error (MAE), the coefficient of variation (CV), the coefficient of determination (R2), and the relative volume error (RVE), are used for performance analysis. GERICS-MPI, RAC4-NOAA-2G, and CCLM4-NCCR-AFR-22 have better performances for both rainfall and temprature. The empirical cumulative distribution function (ECDF) method performed best in removing bias from the frequency-based statistics of rainfall and streamflow, followed by the power transformation (PT), distribution mapping (DM), local intensity scaling (LOCI), and linear scaling (LS) methods. Specifically, for temperature, the VARI and DM methods perform better in frequency-based statistics than the LS method. The performance of hydrological modeling is strongly affected by the selection of rainfall bias correction methods. In addition, the effect of the temperature bias correction method was not significant. The adequacy of the BCM depends on the RCM models and regional context. Therefore, the BCM implementation procedure can be adapted from region to region. This study revealed that the performance of the RCM models differed and that the errors in the RCM model outputs were reduced by the use of bias correction methods. © The Author(s) 2024.

Keywords: Bias correction, IHMS, Katar watershed

BMC Health Services Research
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24 (24)

Availability and readiness of health facilities providing services for other infectious diseases to treat neglected tropical diseases in Ethiopia: implications for service integration in high burden areas

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Abstract

Background: The burden of neglected tropical diseases (NTDs), HIV/AIDS, tuberculosis, and malaria pose significant public health challenges in Ethiopia. This study aimed to the explore service availability and readiness for NTD care among Ethiopian health facilities treating tuberculosis (TB), HIV/AIDS, and/or malaria.
Methods: This study utilized secondary data from the Ethiopian Service Provision Assessment 2021–22 survey. The availability of services was calculated as the percentage of HIV/AIDS, tuberculosis, or malaria facilities providing NTD services. Facilities were considered highly prepared to manage any type of NTD if they scored at least half (> 50%) of the tracer items listed in each of the three domains (staff training and guidelines, equipment, and essential medicines). Descriptive statistics and logistic regression models were employed to present the study findings and analyze factors influencing facility readiness, respectively.
Results: Out of 403 health facilities providing NTD care nationally, 179, 183, and 197 also offer TB, HIV/AIDS, and malaria services, respectively. The majority of TB (90.1%), HIV/AIDS (89.6%), and malaria (90.9%) facilities offer soil-transmitted helminth services, followed by trachoma (range 87–90%). The percentages of the aforementioned facilities with at least one trained staff member for any type of NTD were 87.2%, 88.4%, and 82.1%, respectively. The percentage of facilities with guidelines for any type of NTD was relatively low (range 3.7–4.1%). Mebendazole was the most widely available essential medicine, ranging from 69 to 70%. The overall readiness analysis indicated that none of the included facilities (TB = 11.9%; HIV/AIDS = 11.6%; and malaria = 10.6%) were ready to offer NTD care. Specifically, a higher level of readiness was observed only in the domain of medicines across these facilities. Hospitals had better readiness to offer NTD care than did health centers and clinics. Furthermore, significant associations were observed between facility readiness and factors such as facility type, region, and presence of routine management meetings, types of NTD services provided, and fixed costs for services.
Conclusions: Ethiopian health facilities treating TB, HIV/AIDS, and malaria had an unsatisfactory overall service availability and a lack of readiness to provide NTD care. Given the existing epidemiological risks and high burden of TB, HIV/AIDS, malaria, and NTDs in Ethiopia, there is an urgent need to consider preparing and implementing a collaborative infectious disease care plan to integrate NTD services in these facilities.

Keywords: Availability, Service, Access to treatment, Infectious diseases, Neglected tropical diseases, Health facilities, Service integration, High-burden areas, Ethiopia

The Lancet
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Burden of disease scenarios by state in the USA, 2022–50: a forecasting analysis for the Global Burden of Disease Study 2021

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Abstract

Background: The capacity to anticipate future health issues is important for both policy makers and practitioners in the USA, as such insights can facilitate effective planning, investment, and implementation strategies. Forecasting trends in disease and injury burden is not only crucial for policy makers but also garners substantial interest from the general populace and leads to a better-informed public. Through the integration of new data sources, the refinement of methodologies, and the inclusion of additional causes, we have improved our previous forecasting efforts within the scope of the Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) to produce forecasts at the state and national levels for the USA under various possible scenarios.

Methods: We developed a comprehensive framework for forecasting life expectancy, healthy life expectancy (HALE), cause-specific mortality, and disability-adjusted life-years (DALYs) due to 359 causes of disease and injury burden from 2022 to 2050 for the USA and all 50 states and Washington, DC. Using the GBD 2021 Future Health Scenarios modelling framework, we forecasted drivers of disease, demographic drivers, risk factors, temperature and particulate matter, mortality and years of life lost (YLL), population, and non-fatal burden. In addition to a reference scenario (representing the most probable future trajectory), we explored various future scenarios and their potential impacts over the next several decades on human health. These alternative scenarios comprised four risk elimination scenarios (including safer environment, improved behavioural and metabolic risks, improved childhood nutrition and vaccination, and a combined scenario) and three USA-specific scenarios based on risk exposure or attributable burden in the best-performing US states (improved high adult BMI and high fasting plasma glucose [FPG], improved smoking, and improved drug use [encompassing opioids, cocaine, amphetamine, and others]).

Findings: Life expectancy in the USA is projected to increase from 78·3 years (95% uncertainty interval 78·1-78·5) in 2022 to 79·9 years (79·5-80·2) in 2035, and to 80·4 years (79·8-81·0) in 2050 for all sexes combined. This increase is forecasted to be modest compared with that in other countries around the world, resulting in the USA declining in global rank over the 2022-50 forecasted period among the 204 countries and territories in GBD, from 49th to 66th. There is projected to be a decline in female life expectancy in West Virginia between 1990 and 2050, and little change in Arkansas and Oklahoma. Additionally, after 2023, we projected almost no change in female life expectancy in many states, notably in Oklahoma, South Dakota, Utah, Iowa, Maine, and Wisconsin. Female HALE is projected to decline between 1990 and 2050 in 20 states and to remain unchanged in three others. Drug use disorders and low back pain are projected to be the leading Level 3 causes of age-standardised DALYs in 2050. The age-standardised DALY rate due to drug use disorders is projected to increase considerably between 2022 and 2050 (19·5% [6·9-34·1]). Our combined risk elimination scenario shows that the USA could gain 3·8 additional years (3·6-4·0) of life

expectancy and 4·1 additional years (3·9-4·3) of HALE in 2050 versus the reference scenario. Using our USA-specific scenarios, we forecasted that the USA could gain 0·4 additional years (0·3-0·6) of life expectancy and 0·6 additional years (0·5-0·8) of HALE in 2050 under the improved drug use scenario relative to the reference scenario. Life expectancy and HALE are likewise projected to be 0·4-0·5 years higher in 2050 under the improved adult BMI and FPG and improved smoking scenarios compared with the reference scenario. However, the increases in these scenarios would not substantially improve the USA's global ranking in 2050 (from 66th of 204 in life expectancy in the reference scenario to 63rd-64th in each of the three USA-specific scenarios), indicating that the USA's best-performing states are still lagging behind other countries in their rank throughout the forecasted period. Regardless, an estimated 12·4 million (11·3-13·5) deaths could be averted between 2022 and 2050 if the USA were to follow the combined scenario trajectory rather than the reference scenario. There would also be 1·4 million (0·7-2·2) fewer deaths over the 28-year forecasted period with improved adult BMI and FPG, 2·1 million (1·3-2·9) fewer deaths with improved exposure to smoking, and 1·2 million (0·9-1·5) fewer deaths with lower rates of drug use deaths.

Interpretation: Our findings highlight the alarming trajectory of health challenges in the USA, which, if left unaddressed, could lead to a reversal of the health progress made over the past three decades for some US states and a decline in global health standing for all states. The evidence from our alternative scenarios along with other published studies suggests that through collaborative, evidence-based strategies, there are opportunities to change the trajectory of health outcomes in the USA, such as by investing in scientific innovation, health-care access, preventive health care, risk exposure reduction, and education. Our forecasts clearly show that the time to act is now, as the future of the country's health and wellbeing-as well as its prosperity and leadership position in science and innovation-are at stake.

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13 (24)

Quantifying the climate change impacts on the magnitude and timing of hydrological extremes in the Baro River Basin, Ethiopia

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Abstract

Extreme hydrological events, like floods and droughts, exert considerable effects on both human and natural systems. The frequency, intensity, and duration of these events are expected to change due to climate change, posing challenges for water resource management and adaptation. In this study, the Soil and Water Assessment Tool plus (SWAT +) model was calibrated and validated to simulate flow under future shared socioeconomic pathway (SSP2-4.5 and SSP5-8.5) scenarios in the Baro River Basin with R2 values of 0.88 and 0.83, NSE of 0.83 and 0.74, and PBIAS of 0.39 and 8.87 during calibration and validation. Six bias-corrected CMIP6 Global Climate Models (GCM) were selected and utilized to investigate the effects of climate change on the magnitude and timing of hydrological extremes. All climate model simulation results suggest a general increase in streamflow magnitude for both emission scenarios (SSP2-4.5 and SSP5-8.5). The multi-model ensemble projections show yearly flow increases of 4.8% and 12.4% during the mid-term (MT) (2041–2070) and long-term (LT) (2071–2100) periods under SSP2-4.5, and 15.7% and 35.6% under SSP5-8.5, respectively. Additionally, the analysis revealed significant shifts in the projected annual 1 day, 3 day, 7 day, and 30 day maximum flows, whereas the annual 3 day and 7 day minimum flow fluctuations do not present a distinct trend in the future scenario compared to the baseline (1985–2014). The study also evaluated the timing of hydrological extremes, focusing on low and peak flow events, utilizing the annual 7 day maximum and minimum flow for this analysis. An earlier occurrence was noted for both peak and low flow in the SSP2-4.5 scenario, while a later occurrence was observed in the SSP5-8.5 scenario compared to the baseline. In conclusion, this study showed the significant effect of climate change on river hydrology and extreme flow events, highlighting their importance for informed water management and sustainable planning.

Keywords: Timing of high flow and low flow, Climate change, CMIP6, SWAT +, Baro River Basin

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17 (24)

Breast Tumor Classification with Enhanced Transfer Learning Features and Selection Using Chaotic Map-Based Optimization

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Abstract

Among women, breast cancer remains one of the most dominant cancer types. In the year 2022, around 2,87,800 new cases were diagnosed, and 43,200 women faced mortality due to this disease. Analysis and processing of mammogram images is vital for its earlier identification and thus helps in reducing mortality rates and facilitating effective treatment for women. Accordingly, several deep-learning techniques have emerged for mammogram classification. However, it is still challenging and requires promising solutions. This study proposed a newer automated computer-aided implementation for breast cancer classification. The work starts with enhancing the mammogram contrast using a haze-reduced adaptive technique followed by augmentation. Afterward, EfficientNet-B4 pre-trained architecture is trained for both original and enhanced sets of mammograms individually using static hyperparameters' initialization. This provides an output of 1792 feature vectors for each set and then fused using a serial mid-value-based approach. The final feature vectors are then optimized using a chaotic-crow-search optimization algorithm. Finally, the obtained significant feature vectors were classified with the aid of machine learning algorithms. The evaluation is made using INbreast and CBIS-DDSM databases. The proposed framework attained a balanced computation time with a maximum classification performance of 98.459 and 96.175% accuracies on INbreast and CBIS-DDSM databases, respectively.

Keywords: Mammography, Mammograms, Breast cancer, Optimization, Deep-learning, Crow search algorithm

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13 (2024)

Revisiting writing feedback: Using teacher-student writing conferences to enhance learners' L2 writing skills

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Abstract

Previous studies have largely overlooked teacher feedback, which plays a significant role in the social construction of knowledge within educational ecosystems worldwide. While written corrective feedback has been the focus of writing feedback research, oral feedback in teacher-student L2 writing conferences has not received as much attention, especially from an ecological lens. To address this research gap, this study investigated how writing training, including teacher-student conferences, can improve learners' L2 writing skills, with a specific focus on Ethiopia. The study explores how these conferences can help students enhance their L2 writing skills through constructive criticism and encouragement. To achieve this, 63 students (aged 15 to 23; 38 male and 25 female) were divided into experimental and control groups using a quasi-experimental design. The students underwent pre- and post-tests during an eight-week intervention. MANOVA was used to evaluate the pre-test data, while ANCOVA was used for the post-test analysis. The post-test results show that teacher-student conferences can effectively improve three writing skills: organization, vocabulary, and mechanics. The greatest impact on students' understanding of the writing process was seen in mechanics (43.4%), vocabulary (36.9%), and organization (11.5%). However, the intervention did not have a statistically significant impact on two other writing skills: content and language usage or grammar. Recommendations for future research and strategies for integrating teacher-student conferences into writing instruction are provided.

Keywords: L2 writing skills, Teacher-student feedback, writing conferences, writing feedback, writing instruction,

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Performance evaluation of varies climate models using observed and regional climate models for the Katar Watershed, Ethiopia

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Abstract

Climate models are fundamental tools to estimates the reliable future climate change and its effects on the water resources and agriculture in basins. However, all climate models are not equally performed for all areas. Therefore, determining the most appropriate climate models for a specific study area is essential. The focus of this study was to evaluate the performance of the regional climate models with regard to simulating precipitation, and temperatures at Katar watershed. This study examines the performance of fourteen CORDEX-AFRICA-220 Regional Climate Models (RCMs) for the period of 1984–2005 using statistical metrics such as Pearson correlation coefficient (R), mean absolute error (MAE), root mean squared error (RMSE), and bias. The findings indicated that GERICS-MPI was better performed in representing Areta, and Bokoji station, GERICS-IPSL was better representing in Assela, Ketergenet, and Sagure station, CCCma-CanESM2-AFR22, and RCA4-ICHEC performed relatively better in representing the mean annual observed rainfall at the Kulumsa, and Ogolcho station respectively. However, RCA4-CSIRO performed weakly in estimation of annual rainfall at all stations. RCM model such as GERICS-MPI was relatively better than the others in replicating the annual pattern of the maximum temperature at Areta, Bokoji, and Ketergenet stations. Similarly, GERICS-IPSL were relatively better in replicating the annual maximum temperature at Assela, and Sagure stations, CCCma-CanESM2-AFR22 at Kulumsa station, and RCA4-ICHEC at Ogolcho station performed well in capturing the observed and simulated annual maximum temperature. Better performance was observed on minimum temperature at CCCma-CanESM2-AFR22 at Areta, Assela, and Ketergenet stations, GERICS-MOHE-AFR-22 at Bokoji station, GERICS-MPI at Kulumsa, and Ogolcho stations, RAC4-NOAA-2G at Sagure stations. However, weak performance was observed RCA4-CSIRO at all stations. RCM models of GERICS-MPI, and CCLM4-NCC-AFR-22 performed better than the other RCM models for correction of annual rainfall in Katar watershed. However, poor performance was observed at RCA4-ICHEC model on Katar watershed. The GERICS-MPI model performed well. However, poor performance was observed at RCA4-ICHEC on maximum temperature, and GERICS-NOAA-2M on minimum temperature in Katar watershed.

Keywords: CORDEX-Africa, Climate models Performance, RCM

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Prevalence and risk factors of cutaneous leishmaniasis in a newly identified endemic site in South-Ethiopia

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Abstract

Background: Although there are several areas in southern Ethiopia environmentally favourable for cutaneous leishmaniasis (CL), studies on the existence and risk factors of CL are lacking beyond a few well-known hotspots. This study aimed to assess the prevalence and risk factors of CL in Bilala Shaye, a village in the southern Ethiopian highlands at an altitude of 2,250 meters.

Methods: A cross-sectional house-to-house survey was done between July-August 2021. Those with skin lesions were clinically assessed and data on individual risk behaviour and environmental and household features were collected using questionnaires. Univariate and multivariable logistic regression models were used to identify independent risk factors of CL at a 5% significance level with two-sided P-values <0.05 considered statistically significant.

Result: A total of 1012 individuals were interviewed; the median age was 23 years (interquartile range 12–50), with 7% below the age of five; 51% were female. All households had domestic animals, and for 143 (57%) households goats/sheep lived inside or around the house. Animal dung was found in the compounds of 194 (77%) households. The overall prevalence of active CL was 2.5% (95% confidence interval (CI) 1.6–3.6), reaching 6.7% (95% CI 3.6–11.2) in children between 5–12 years old. The prevalence of CL scars was 38.5% (95% CI 35.5–41.6). In multivariate analysis, the presence of animal dung in the compound (adjusted odds ratio (OR) 2.1; 95% CI: 1.3–3.5, P = 0.003) and time spent outside in the late evening in areas where hyraxes live (adjusted OR 2.4; 95% CI: 1.7–3.3, P <0.001) were identified as independent risk factors.

Conclusion: This is the first report on the existence of CL in this village, with the high prevalence of CL scars indicating long-term endemicity. Further studies are needed to understand the role of animals and their dung in (peri)-domestic CL transmission. © 2024 Merdekios et al. This is an open access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

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Fodder trees: Identification, leaf biomass yield, nutritional quality and socioeconomic importance in Essera district, Dawuro zone, southwest Ethiopia

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Abstract

The scarcity of feed in terms of quantity and quality tremendously impacts livestock productivity in Ethiopia. Using fodder trees (FTs) as livestock feed could partially overcome this gap. Thus, the present study aimed to identify species, estimate leaf biomass yield (LBY), evaluate nutritional quality and assess the socioeconomic importance of FTs in the Essera district. The study sites and households (HHs) were selected using a multistage sampling procedure. Data on the socioeconomic importance of FTs were collected from 134 randomly selected HHs. Ten FT species were evaluated for LBY determination, and 15 FTs (including nine FT species) were evaluated for nutritional quality across three agroecologies (AEs). In total, 34 FTs were identified at the species level. The overall mean of LBY of the FTs ranged from 14.32 to 370.94 kg/tree, with the lowest and highest values of 10.85 and 430.27 kg/tree at mid- and low-altitudes, respectively. A significant difference ($p < 0.05$) in the chemical composition of the selected FTs was observed between AEs. The overall mean of dry matter (DM), ash, crude protein (CP), neutral detergent fibre (NDF), acid detergent fibre (ADF), and acid detergent lignin (ADL) contents of the FTs ranged from 90.03 to 93.55 %, 6.26–16.52 %, 13.05–25.50 %, 33.06–50.42 %, 25.58–34.52 %, and 4.19–8.38 %, respectively. Moreover, the in vitro dry matter digestibility (IVDMD) of the FTs ranged from 37.80 to 67.89 %. The results indicated that the overall mean tannin, phytate, and oxalate contents were 2.84 ± 0.12 %, 0.60 ± 0.05 %, and 1.66 ± 0.21 %, respectively. Antinutritional factors (ANFs) were significantly ($p < 0.05$) influenced by FT species. In addition to feed sources, FTs were used for air pollution reduction (52.2 %), income generation (44.0 %), and soil erosion prevention (34.3 %) in the studied areas. In conclusion, due to the high CP content, high digestibility potential, low to moderate fibre and lignin contents, and tolerable levels of ANFs in FTs, the use of FTs as supplementary feed to livestock in the study area is recommended. Further experimental studies should be conducted on the impact of FTs on livestock performance.

Keywords: Essera district, Fodder trees, Nutritional quality

Scientific Reports
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Fused deposition modeling process parameter optimization on the development of graphene enhanced polyethylene terephthalate glycol

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Abstract

This study investigates the production of graphene-enhanced polyethylene terephthalate glycol (G-PETG) components using fused deposition modeling (FDM) and evaluates their mechanical properties, contributing to the advancement of additive manufacturing. Trials demonstrated notable improvements in mechanical performance, with optimal printing parameters identified using the Spice Logic Analytical Hierarchy Process (AHP). The effectiveness of this methodology is further compared with the Fuzzy Analytic Hierarchy Process (FAHP) combined with the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS). The study revealed significant enhancements, with the ultimate tensile strength (UTS) reaching 69.1 MPa, an average Young's modulus of 735.6 MPa, and an ultimate compressive strength (UCS) of 85.3 MPa. These findings provide valuable insights into optimizing techniques for improving the mechanical performance of G-PETG components, advancing material applications in various industries.

Keywords: Additive manufacturing, Mechanical properties, Polymer matrix composites, Graphene reinforcement, 3D printing optimization, Industrial applications, Materials science

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Time to initiation of antenatal care and its predictors among pregnant women who delivered in Arba Minch town public health facilities, Gamo Zone, southern Ethiopia, 2023: a retrospective follow-up study

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Abstract

Background: Early antenatal care visit is important for optimal care and health outcomes for women and children. In the study area, there is a lack of information about the time to initiation of antenatal care. So, this study aimed to determine the time to initiation of antenatal care visits and its predictors among pregnant women who delivered in Arba Minch town public health facilities.

Methods: An institution-based retrospective follow-up study was performed among 432 women. A systematic random sampling technique was employed to select the study participants. The Kaplan-Meier survival curve was used to estimate the survival time. A Multivariable Cox proportional hazard regression model was fitted to identify predictors of the time to initiation of antenatal care. An adjusted hazard ratio with a 95% confidence interval was used to assess statistical significance.

Results: The median survival time to antenatal care initiation was 18 weeks (95% CI = (17, 19)). Urban residence (AHR = 2.67; 95% CI = 1.52, 4.71), Tertiary and above level of education of the women (AHR = 1.90; 95% CI = 1.28, 2.81), having pregnancy-related complications in a previous pregnancy (AHR = 1.53; 95% CI = 1.08, 2.16), not having antenatal care for previous pregnancy (AHR = 0.39; 95% CI = 0.21, 0.71) and unplanned pregnancy (AHR = 0.66; 95% CI = 0.48, 0.91) were statistically significant predictors.

Conclusion: Half of the women initiate their antenatal care visit after 18 weeks of their pregnancy which is not in line with the recommendation of the World Health Organization. Urban residence, tertiary and above level of education of the women, having pregnancy-related complications in a previous pregnancy, not having previous antenatal care visits and unplanned pregnancy were predictors of the time to initiation of antenatal care. Therefore, targeted community outreach programs including educational campaigns regarding antenatal care for women who live in rural areas, who are less educated, and who have no previous antenatal care experience should be provided, and comprehensive family planning services to prevent unplanned pregnancy are needed.

Keywords: Antenatal care, Time to initiation, public health facilities, Southern Ethiopia

Scientific Reports
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Intelligence model on sequence-based prediction of PPI using AISSO deep concept with hyperparameter tuning process

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Abstract

Protein–protein interaction (PPI) prediction is vital for interpreting biological activities. Even though many diverse sorts of data and machine learning approaches have been employed in PPI prediction, performance still has to be enhanced. As a result, we adopted an Aquilla Influenced Shark Smell (AISSO)-based hybrid prediction technique to construct a sequence-dependent PPI prediction model. This model has two stages of operation: feature extraction and prediction. Along with sequence-based and Gene Ontology features, unique features were produced in the feature extraction stage utilizing the improved semantic similarity technique, which may deliver reliable findings. These collected characteristics were then sent to the prediction step, and hybrid neural networks, such as the Improved Recurrent Neural Network and Deep Belief Networks, were used to predict the PPI using modified score level fusion. These neural networks' weight variables were adjusted utilizing a unique optimal methodology called Aquila Influenced Shark Smell (AISSO), and the outcomes showed that the developed model had attained an accuracy of around 88%, which is much better than the traditional methods; this model AISSO-based PPI prediction can provide precise and effective predictions.

Keywords: PPI prediction, Sequence-dependent features, Gene ontology (GO), Improved recurrent neural network, Deep belief network, Aquilla influenced shark smell optimization (AISSO)

Scientific Reports
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14 (2024)

Thermogravimetric analysis of rice husk and low-density polyethylene co-pyrolysis: kinetic and thermodynamic parameters

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Abstract

The purpose of this study is to examine how co-pyrolysis of low-density polyethylene (LDPE) and rice husk is impacted by LDPE. It also looks into the physicochemical characteristics, thermal behavior, and kinetic parameters of these materials. To understand the thermal behavior through TGA, rice husk and LDPE blends in the ratios of LDPE: RH (50:50), LDPE: RH (25:75), and LDPE: RH (75:25) were prepared and tested. These tests were carried out in the presence of a nitrogen environment at a flow rate of 20 ml/min with a different heating rate of 10 to 40 °C/min from 30 to 600 °C.In this paper, activation energy (Ea) was measured using the integral method (coats and Redfern) and two distinct iso-conversional approaches are Flynn wall Ozawa (FWO) and Kissinger Akahira Sunose (KAS). According to this study, the Ea values during co-pyrolysis varied with the conversion points, demonstrating the complex nature of the materials that resulted from the process. Moreover, it can be said that the assessment of low-density polyethylene in conjunction with rice husk led to noteworthy changes in thermos kinetic behaviors. In the meantime, the calculated average activation energy is, in turn, 110–117, 101–102, and 102–107 kJ/mol. In this study, we analyze the thermodynamic parameters, including enthalpy, Gibbs free energy, and entropy, and also pyrolysis performance index was thoroughly explored to understand the co-pyrolysis process of rice husk and plastic waste. To develop efficient reactors for continuous operation regardless of feedstock composition, it was necessary to establish the significance of blending biomass with plastics in terms of augmented carbon conversion, volatiles, and reaction rate.

Keywords: Co pyrolysis, Rice husk, Low-density polyethylene, TGA, Iso-conversional method, Thermodynamic parameter

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17 (2024)

Efficient Heart Disease Classification through Stacked Ensemble with Optimized Firefly Feature Selection

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Abstract

In the current century, heart-related sickness is one of the important causes of death for all humans. An estimated 17.5 million deaths occur due to heart disease worldwide. It is observed that more than 75% of peoples with average income level mostly suffer from heart diseases and its complications. So, there is need for predicting heart infection and its related complications. Data mining is the method of converting raw data into useful information. These tools allow given data to predict future trends. Data mining concepts were mainly adapted in heart disease data sets to interpret the intricate inferences out of it. In the modern world, many research are carried in health care engineering with the use of mining and prediction techniques. This investigation aims to identify significant features in heart disease dataset and to apply ensembling techniques for improving exactness of prediction. Prediction models are developed using different ensembling techniques like stacking and voting. For the experimental purpose, the Z-Alizadeh Sani dataset is used, which is available in the UCI machine learning data repository. Stacking and voting techniques are applied to the dataset. Stacking with substantial characteristics has the maximum accuracy of 86.79% in the Z-Alizadeh dataset. Test outcome proves that the prediction model implemented with the features selected using firefly algorithm and stacking-based classification model has the highest accuracy prediction than other technique. Furthermore, this study delineates a comparative analysis with prior works, showcasing the superior capabilities of the firefly algorithm in optimizing feature selection processes, which is crucial for advancing the accuracy of heart disease predictions.

Keywords: Heart disease, Ensembling techniques, Feature selection, Firefly algorithm, Stacking, Voting

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5 (2024)

Nexus between natural resource endowments and economic growth in selected African countries

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Abstract

Africa began implementing the Sustainable Development Goals (SDGs) in 2015 emphasizing on sustainable management and effective use of natural capital to spur economic growth (Goals 12, 14, and 15). This study using World Bank data sets from 46 African countries selected for the years 2000 to 2022, examined the nexus between natural resource endowments and economic growth in Africa. We used the system generalized method of moments (sys-GMM) and dynamic panel threshold regression (DPTR) to analyze the data. The findings of the two-step sys-GMM estimation using 'xtabond2' revealed that when the institutional quality variable is added and excluded from the model, natural resource dependence negatively impacts economic growth, but the impact is greater when the institution is excluded. In the estimation of the interaction variable of natural resource dependence and institutional variable included in the model, natural resource dependence positively impacts economic growth. The results of the DPTR using "xthenreg" showed that when the threshold value of natural resource dependence is ≤ 1.73% of gross domestic product, natural resource dependence has a positive impact on economic growth and a negative impact when the threshold value is above 1.73%. Similarly, when the institutional quality threshold is ≤ 0.277, natural resources dependence impacts economic growth negatively; above the threshold (0.277), the impact is positive. In conclusion, natural resource endowment is a curse with no or low-quality institutions and a blessing with high-quality institutions. Thus, building strong institutions and proper utilization of natural resources helps to minimize the adverse impact of resource endowments on economic growth.

Keywords: Natural resource, Economic growth, Institutional quality, Dynamic panel, Africa

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Population travel increases the risk of Plasmodium falciparum infection in the highland population of Gardula Zone, South Ethiopia: A longitudinal study

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Abstract

Population movement influences malaria epidemiology and can be a threat to malaria control and elimination. In Ethiopia, highland dwellers often travel to lowland areas where malaria is endemic. The current study aimed to assess the incidence of malaria and risk factors among dwellers in two highland villages of the former Dirashe District (now Gardula Zone), South Ethiopia. A longitudinal study was conducted from 10/05/2018 to 30/11/2018. A total of 1672 individuals from 329 households were recruited via a systematic random sampling technique. Blood samples were collected from all consented family members. The study participants were interviewed via a pretested questionnaire. Bivariate and multivariate analyses were conducted to determine risk factors associated with malaria infection. A total of 4,884 blood samples were screened for malaria parasites in three rounds of surveys. Among those, 82 slides were positive for malaria parasites, 70 (85%) of which were collected during active case detection, and the remaining 12 (15%) were captured by passive case detection. Plasmodium falciparum accounted for 69.5% (57), and the remaining 30.5% (25) were Plasmodium vivax. The incidence of malaria in the highlands of Dirashe District was 0.2 infections per person-year at risk. Inhabitants who traveled to lowlands in the past 30 days (AOR = 2.60, 95% CI: 1.27–5.33) had a significantly greater risk of contracting Plasmodium falciparum infection. Those people traveling in May and November, those participants who had no formal education and agricultural workers, had a greater risk of developing malaria infection. Low bed net ownership (63.2%) and use (52.9%) have been documented among highland populations. This study revealed that people who travel from highlands to malaria-endemic lowland areas for agriculture are at increased risk of developing malaria. Hence, malaria interventions targeting travelers should be implemented to reduce the imported malaria burden in highlands. © 2024 Assefa et al. This is an open access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

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Multiple indicators-based assessment of rural food security status in landslide-prone areas of Southern Ethiopia

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Abstract

Landslide hazards significantly threaten rural communities, impacting various aspects of livelihoods, including food security. The Gamo Highlands in southern Ethiopia is vulnerable to landslide hazards. Therefore, this research aims to investigate the effect of landslide hazards on rural households' food security status in the Gacho Baba district, Gamo Highlands, southern Ethiopia. The study employed a mixed approach, to collect and analyze data collected from 289 households, community leaders, and early warning and food security experts. Purposive and multistage sampling techniques were deployed. Both descriptive and inferential statistics were used to analyze the data. Household Food Insecurity Access Scale (HFIAS), Food Consumption Score (FCS), and Reducing Coping Strategies Index (RCSI) were food in/security indicators used. The HFIAS reveals significant worries regarding stable access and availability of food, with 62% of sample households categorized as mildly, moderately, and severely food-insecure. FCS indicates prevalent challenges in achieving adequate food consumption levels among the surveyed households, with a significant portion falling into the poor consumption category (51.3%). while the investigation of coping strategies using RCSI categorized (53.3%) of study samples into high coping strategies. The study also reveals varying levels of awareness and preparedness among households, with a significant proportion expressing uncertainty about landslide occurrence and prevention mechanisms. The findings underscore the need for targeted educational and awareness initiatives, as well as comprehensive risk reduction strategies, to enhance household resilience and safeguard food security in landslide-prone areas.

Keywords: Coping strategies, Food security, Gamo highlands, Indicator, Landslide hazard

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Assessment of monthly to daily streamflow disaggregation methods: A case study of the Nile River Basin

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Abstract

Study region: The Nile River Basin Study focus: The lack of observed streamflow data at a short time scale poses a critical challenge for calibrating and validating hydrologic models. Therefore, many disaggregation methods were developed, resulting in various relative performances without a clear indication of the optimal choice. This study aims to iteratively assess eight monthly to daily streamflow disaggregation methods at 21 major subbasin outlets in the Nile River Basin (NRB) to identify the best-performing ones. These methods include one proportionality method and seven interpolation methods, i.e., linear, 2nd-order spline, 3rd-order spline, Piecewise Cubic Hermite Interpolating Polynomial (Pchip), Modified Akima (MAkima), mean preserved 2nd-order spline, and mean preserved 3rd-order spline. We assessed these methods using three metrics and visual investigations. New hydrologic insights for the region: The results showed that the interpolation methods performed well, better than the proportionality method. However, their performances decreased at stations with high daily streamflow fluctuations. The interpolation methods' performances were similar in mimicking the daily values but significantly different in preserving the mass balance. The mean preserving 3rd-order interpolation method (Lai 22) was the best in preserving the mass balance and capturing the low, moderate and high flows and, therefore, selected to generate the daily flow data in the NRB. The results of this study can guide a reliable method for obtaining daily streamflow data, which is important for the hydrologic and water management studies in the NRB.

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Aerodynamic performance characteristics of low Re airfoils: A parametric and multi criteria decision study

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Abstract

This research aims at investigating the aerodynamic performance of 51 low Re airfoils and applying a Multi Criteria Decision Making (MCDM) approach for selecting airfoils that align with the specific requirements of small wind turbines (SWTs). The study was carried out by varying the Re from 5 × 104 to 5 × 105; angle of attack (AOA) from −10° to 20°, thickness to chord ratio (0.1–0.9), camber ratio (0.1–0.9), and camber position (10 %–80 %) to evaluate the impact of these parameters on the airfoils' performance. Furthermore, MCDM approach was applied to identify suitable airfoils optimized for their average lift to drag ratio, stall angle, operating range of AOA, strength, manufacturability, and material cost. The findings showed that of the teste parameters, the AOA and airfoil profile have the most pronounced effects on the airfoil performance. Among the tested airfoils, the E63 provided superior performance at 105 Re with LDR of 76.32, a 37.7 % improvement over that of NACA 4412 which is commonly used for wind turbine blade design. Furthermore, the MCDM results revealed that SG6043, FX63-137, E216 and E62 airfoils were the top-ranked airfoils suitable for SWTs application. These findings can help to produce optimized airfoil designs for increased performance and efficiency of SWTs.

Keywords: Aerodynamic performance, Low Reynolds number airfoils, small wind turbine, multi-criteria decision making, XFoil, CFD

The Lancet
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Global, regional, and national progress towards the 2030 global nutrition targets and forecasts to 2050: a systematic analysis for the Global Burden of Disease Study 2021

Global Nutrition Target Collaborators

Abstract

Background: The six global nutrition targets (GNTs) related to low birthweight, exclusive breastfeeding, child growth (ie, wasting, stunting, and overweight), and anaemia among females of reproductive age were chosen by the World Health Assembly in 2012 as key indicators of maternal and child health, but there has yet to be a comprehensive report on progress for the period 2012 to 2021. We aimed to evaluate levels, trends, and observed-to-expected progress in prevalence and attributable burden from 2012 to 2021, with prevalence projections to 2050, in 204 countries and territories.

Methods: The prevalence and attributable burden of each target indicator were estimated by age group, sex, and year in 204 countries and territories from 2012 to 2021 in the Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) 2021, the most comprehensive assessment of causes of death, disability, and risk factors to date. Country-specific relative performance to date was evaluated with a Bayesian meta-regression model that compares prevalence to expected values based on Socio-demographic Index (SDI), a composite indicator of societal development status. Target progress was forecasted from 2021 up to 2050 by modelling past trends with meta-regression using a combination of key quantities and then extrapolating future projections of those quantities.

Findings: In 2021, a few countries had already met some of the GNTs: five for exclusive breastfeeding, four for stunting, 96 for child wasting, and three for child overweight, and none met the target for low birthweight or anaemia in females of reproductive age. Since 2012, the annualised rates of change (ARC) in the prevalence of child overweight increased in 201 countries and territories and ARC in the prevalence of anaemia in females of reproductive age decreased considerably in 26 countries. Between 2012 and 2021, SDI was strongly associated with indicator prevalence, apart from exclusive breastfeeding (|r-|=0·46–0·86). Many countries in sub-Saharan Africa had a decrease in the prevalence of multiple indicators that was more rapid than expected on the basis of SDI (the differences between observed and expected ARCs for child stunting and wasting were –0·5% and –1·3%, respectively). The ARC in the attributable burden of low birthweight, child stunting, and child wasting decreased faster than the ARC of the prevalence for each in most low-income and middle-income countries. In 2030, we project that 94 countries will meet one of the six targets, 21 countries will meet two targets, and 89 countries will not meet any targets. We project that seven countries will meet the target for exclusive breastfeeding, 28 for child stunting, and 101 for child wasting, and no countries will meet the targets for low birthweight, child overweight, and anaemia. In 2050, we project that seven additional countries will meet the target for exclusive breastfeeding, five for low birthweight, 96 for child stunting, nine for child wasting, and one for child overweight, and no countries are projected to meet the anaemia target.

Interpretation: Based on current levels and past trends, few GNTs will be met by 2030. Major reductions in attributable burden for exclusive breastfeeding and anthropometric indicators should be recognised as huge scientific and policy successes, but the comparative lack of progress in reducing the prevalence of each, along with stagnant anaemia in women of reproductive age and widespread increases in child overweight, suggests a tenuous status quo. Continued investment in preventive and treatment efforts for acute childhood illness is crucial to prevent backsliding. Parallel development of effective treatments, along with commitment to multisectoral, long-term policies to address the determinants and causes of suboptimal nutrition, are sorely needed to gain ground.

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Adherence to implementing physical distancing and other COVID-19 preventive measures and its barriers among adults in Arba Minch town, Southwest Ethiopia: A lesson learned from the pandemic

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Abstract

Background: Globally, as of March 2024, the number of confirmed Coronavirus Disease 2019 (COVID-19) cases and deaths were over 774 million and seven million, respectively. Since there are no proven treatment in place against the disease, controlling strategy mainly rely on preventive measures. However, data on the extent of implementing physical distancing and other preventive measures during the pandemic of COVID-19 were inadequate in the study setting. This study is, therefore, documenting these gaps among people in Arba Minch town, South Ethiopia.

Methods: We conducted a community-based cross-sectional survey and qualitative study at Arba Minch in June 2020. Quantitative data were collected using an interviewer-administered questionnaire and check-list from study participants (head of household or any adult ≥18 years old in a household) and analyzed using SPSS version 20. Qualitative data were collected using key informant interviews (KIIs) and analyzed by using a thematic approach.

Results: Of the total surveyed adults (459), only 43.6% achieved above the mean score on adherence to implementing preventive measures of COVID-19. We found that 29.8% of participants kept physical distancing, only 37.7% of study participants had face-mask use practice, 20.5% had hand sanitizer use practice, 42.5% of participants avoided attendance in public gatherings, 44.7% stopped touching their nose, eye, and mouth, 55.6% practiced stay at home, and 60% had frequent hand washing practice. Besides, the main emerged barriers of adherence to implementing COVID-19 preventive measures were poverty, distrust of government, misbelief, lack of ownership, lack of attention and sustained actions, lack of ownership, socio-cultural influence, lack of coordination and leadership.
Conclusions: The finding of this study suggests inadequate adherence to implementing COVID-19 preventive measures in adults in Arba Minch. Although inadequately implemented, a lot of lessons have been learned from COVID-19 pandemic preventive measures that would help in prevention and control of such a pantomimic disease happened.

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Magnitude of neonatal asphyxia and its predictors among newborns at public hospitals of Wolaita Zone in Southern Ethiopia, 2023

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Abstract

Background: Neonatal asphyxia is one of preventable causes of neonatal mortality throughout the world. It could be improved by early detection and control of the underlying causes. However, there was lack of evidence on it in the study setting. Thus, the aim of this study was to assess the magnitude and predictors of neonatal asphyxia among newborns at public hospitals of Wolaita Zone in Southern Ethiopia. Method: A facility-based cross-sectional study was done among 330 mothers with neonates in selected public hospitals. A systematic random sampling technique was used to select the study participants. Data were collected through an interviewer-administered questionnaire and checklist. The collected data were entered into EpiData version 4.6 and exported to SPSS version 26 for analysis. Logistic regression was fitted to examine the association between explanatory variables and outcome variable. In multivariable logistic regression, AOR with 95% CI was reported, and $p < 0.05$ was used to declare statistically significant variables. Results: The magnitude of neonatal asphyxia was 26.4% with 95% CI: (21.8, 30.9). In multivariable logistic regression analysis primiparity (AOR = 2.63 95%CI 1.47, 4.72), low-birth-weight (AOR = 3.45 95%CI 1.33, 8.91), preterm birth (AOR = 3.58 95%CI 1.29, 9.92), and premature rupture of membranes (AOR = 5.19 95%CI 2.03, 13.26) were factors significantly associated with neonatal asphyxia. Conclusions: In this study, the magnitude of neonatal asphyxia was high. From the factors, premature rapture of the membrane, parity, birth weight of the newborn, and gestational age at birth were significantly associated with neonatal asphyxia. Attention should be given to early detection and prevention of neonatal asphyxia from complicated labor and delivery.

Keywords: Neonatal asphyxia, Newborns, Associated factors, Ethiopia

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18 (2024)

Teacher-related factors associated with teacher–child interaction quality in preschool education

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Abstract

Quality teacher–child interaction is considered one of the primary mechanisms through which educational experience fosters the development of children's competencies. Teachers' self-efficacy and beliefs about developmentally appropriate practices influence the quality of classroom interaction. However, the findings are mixed, and more research must be done within the preschool teacher population. The present study investigated teacher-related factors influencing teacher–child interaction quality with preschool children. Two rating scales and one observation measure were used to survey and observe 55 preschool teachers in preschool centres of Arba Minch town, Ethiopia. Statistically significant positive correlations were found between teacher factors (i.e., teacher belief, self-efficacy, teaching experience) and teacher–child interaction quality (emotional support, classroom organization, and instructional support). Teacher belief significantly predicted teachers' emotional support and classroom organization, while teaching experience significantly predicted instructional support. The findings of this study have implications for concerned bodies striving to achieve the 2030 sustainable development goals aimed at increasing the supply of qualified teachers to ensure all girls and boys have access to quality early childhood development and care so that they are ready for primary education, especially in the least developed countries.

Keywords: Teacher-related factors, Teacher–child interaction, Preschool education, Classroom quality, Teacher belief, Self-efficacy

International Journal of Emergency Medicine
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Datura stramonium seed ingestion leading to unintentional poisoning in a 3-year-old Ethiopian toddler: case report

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Abstract

Introduction: Datura stramonium poisoning, resulting from the ingestion of seeds, leaves, or flowers of Datura stramonium, is a severe condition with significant risks, particularly for young children. Most documented cases of Datura stramonium poisoning in the literature involve teenagers who intentionally ingest the plant to induce hallucinogenic and euphoric experiences. This report presents a rare instance of unintentional Datura stramonium poisoning in a 3year-old Ethiopian toddler. Case presentation: He presented with symptoms consistent with anticholinergic toxidrome, including altered mental status, agitation, seizures, dilated pupils, and tachycardia. Laboratory tests, including complete blood count, liver function test, renal function test, electrolyte levels and cerebrospinal fluid analysis were normal. Results of blood toxicology screen were negative. Timely recognition and supportive care lead to a positive outcome. Conclusion: Through this report, we aim to add to the limited body of literature on Datura stramonium poisoning in toddlers and offer insights into its clinical course and management in paediatric patients.

Keywords: Datura stramonium, Poisoning, Anticholinergic toxicity, Case report

Discover Sustainability
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5 (2024)

Production preference barriers and lowland-appropriate strategies of sustaining local food systems in drought-affected southern Ethiopia

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Abstract

A key element of food systems that look for significant inputs to ensure food security is food production. The production process is adversely affected by impermanent climates, particularly in places where droughts occur recurrently. In southern Ethiopia's drought-prone Gamo lowlands, this study explores lowland-friendly strategies and challenges to food production choices. A cross-sectional survey design centered on households was utilized. Primary and secondary sources of data were used in the data collection process. The study's primary data sources were the survey participants. The main methods used for gathering data were field observations, key informant interviews, focus group discussions, and surveys. Both qualitative and quantitative methods were employed in the data analysis. Numerous obstacles stand in the way of food production preference, according to the results of the household-level study. The most often mentioned ones were low professional support, rising production input costs, inadequate professional support, and traditional agriculture methods. The methods that were found included improving access to basic production resources like farmland and oxen as well as managing production costs to a reasonable level in order to alleviate these constraints. Furthermore, it was discovered that reevaluating the trends in production that are transitioning from food crops to cash crops is a major problem in the Gamo lowland environment. With growers paying less attention to valuable food sources—root crops in particular—the move toward cash crops is one that should be closely monitored. As a result, it is advised that local food systems need to be sustainable in view of changing climate and a growing populace.

Keywords: Barriers, Drought-prone, Food in/security, Gamo lowlands, Strategies

Discover Environment
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2 (2024)

Concentration and variation of traffic-related air pollution as measured by carbon monoxide in Hawassa City, Ethiopia

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Abstract

Air pollution is a pressing problem and causes millions of deaths each year related to its effects on respiratory health worldwide. Despite its significant impact, information on air pollution in many cities, including Hawassa city, remains limited. The aim of this study was to determine the concentrations and variations of traffic-related air pollution, as measured by carbon monoxide, and its relationship with temperature, relative humidity, traffic flow, and road routing in Hawassa City. We monitored carbon monoxide (CO) concentrations in Hawassa city, Ethiopia, for 24 days using real-time monitors with carbon monoxide sensor head. A total of 24 different roads (12 high-traffic congested roads and 12 low-traffic congested roads) were included as monitoring sites. We conducted 1 hour monitoring at each monitoring site in the morning and afternoon to characterize the temporal variations. Accordingly, the average carbon monoxide concentrations varied temporally at different times. In addition, the average carbon monoxide concentrations on paved main roads, traffic light roads and low-traffic flow roads were 4.87 ± 0.6 ppm, 5.38 ± 0.8 ppm and 1.62 ± 0.53 ppm, respectively. The study also identified factors that correlated positively with carbon monoxide concentration, including temperature, relative humidity, traffic flow and road routing. The study concludes that long-term monitoring of carbon monoxide concentrations is necessary to fully characterize the health effects. The study also provides valuable insights for urban planners when implementing measures to mitigate the negative effects.

Keywords: Carbon monoxide, ambient air, Traffic-related, Monitoring, Roads, Respiratory effect

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Coagulase-negative staphylococci from bovine milk: Antibiogram profiles and virulent gene detection

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Abstract

Background: Coagulase-negative Staphylococcus species are an emerging cause of intramammary infection, posing a significant economic and public health threat. The aim of this study was to assess the occurrence of coagulase-negative Staphylococcus species in bovine milk and dairy farms in Northwestern Ethiopia and to provide information about their antibiotic susceptibility and virulence gene profiles.

Methods: The cross-sectional study was conducted from February to August 2022. Coagulase-negative Staphylococcus species were isolated from 290 milk samples. Species isolation and identification were performed by plate culturing and biochemical tests and the antimicrobial susceptibility pattern of each isolate was determined by the Kirby-Bauer disc diffusion test. The single-plex PCR was used to detect the presence of virulent genes. The STATA software version 16 was used for data analysis. The prevalence, proportion of antimicrobial resistance and the number of virulent genes detected from coagulase-negative Staphylococcus species were analyzed using descriptive statistics.

Results: Coagulase-negative Staphylococcus species were isolated in 28.6%, (95% CI: 23.5–34.2) of the samples. Of these, the S. epidermidis, S. sciuri, S. warneri, S. haemolyticus, S. simulans, S. chromogens, S. cohnii, and S. captis species were isolated at the rates of 11, 5.2, 3.4, 3.1, 3.1, 1, 1, and 0.7% respectively. All the isolates showed a high percentage (100%) of resistance to Amoxicillin, Ampicillin, and Cefotetan and 37.5% of resistance to Oxacillin. The majority (54.2%) of coagulase-negative isolates also showed multidrug resistance. Coagulase-negative Staphylococcus species carried the icaD, pvl, mecA, hlb, sec, and hla virulent genes at the rates of 26.5%, 22.1%, 21.7%, 9.6%, 9.6% and 8.4% respectively.

Conclusion: The present study revealed that the majority of the isolates (54.2%) were found multidrug-resistant and carriage of one or more virulent and enterotoxin genes responsible for intramammary and food poisoning infections. Thus, urgent disease control and prevention measures are warranted to reduce the deleterious impact of coagulase-negative species. To the best of our knowledge, this is the first study in Ethiopia to detect coagulase-negative Staphylococcus species with their associated virulent and food poisoning genes from bovine milk.

Keywords: Antibiogram profile, Bovine milk, Coagulase-negative Staphylococcus species, virulent gene

Discover Sustainability
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5 (2024)

Landslide susceptibility mapping using combined geospatial, FR and AHP models: a case study from Ethiopia's highlands

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Abstract

This study performed landslide susceptibility mapping in Awabel Woreda, situated in the east Gojjam zone of the Amhara region in Ethiopia. The occurrence of landslides and slope instability is widespread in Awabel Woreda, leading to the devastation of agricultural fields, crops, and residences, the demise of animal life, and the forced relocation of local inhabitants from their dwellings. The present investigation utilized remote sensing and GIS techniques in conjunction with the Frequency Ratio (FR) and Analytical Hierarchy Process (AHP) models to map landslide risk zones. For the landslide susceptibility mapping of this study, nine causative factors, such as "elevation, slope, aspect, drainage density, lineament density, land use and land cover (LULC), soil texture, rainfall, and lithology", were considered. A total of 130 past landslide events were identified via field survey and Google Earth image, of which 70% (91) of them were used as training datasets and 30% (39) were used as validation datasets of the proposed models (i.e., FR and AHP). The nine contributing variables and their classes were evaluated, and factor weights were computed using the IDRISI Selva 17.0 expert programme. The landslide susceptibility indexes (LSI) of the FR and AHP models were calculated and categorized into five relative zones using ArcGIS 10.7. The landslide susceptibility map (LSM) produced by the FR model shows that 93.2 km2 (14.52%) of the study area is classified as very low susceptibility, 167.51 km2 (26.09%) as low susceptibility, 174.10 km2 (27.12%) as moderate susceptibility, 137.03 km2 (21.34%) as high susceptibility, and 70.30 km2 (10.93%) as very high susceptibility to landslides. Based on the AHP model's LSM, different landslide susceptibility zones were identified in the study area. Specifically, 140.46 km2 (21.88%) of the region falls into the very low susceptibility zone, 116.78 km2 (18.59%) falls into the low susceptibility zone, 147.94 km2 (23.04%) falls into the moderate susceptibility zone, 154.04 km2 (23.99%) falls into the high susceptibility zone, and 82.78 km2 (12.89%) falls into the very high susceptibility zone. The validation investigation demonstrated that the FR and AHP models had accuracy rates of 89.73 and 87.18%, respectively. The FR model exhibited marginally more accurate results than AHP, primarily because of the direct correlation between previous and current occurrences of landslides. Nevertheless, the AHP model's effectiveness relies on the individual's expertise and the characteristics of the components that cause the outcome. The landslide susceptibility maps generated through these models provide valuable insights for land management and disaster mitigation efforts, with delineated zones indicating very low to very high susceptibility areas.

Keywords: Landslide susceptibility, Frequency ratio, AHP, Remote sensing, GIS, Ethiopia

Scientific African
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26 (2024)

Post COVID-19 vaccination side effects and associated factors among vaccinated clients in East Africa region: A systematic review and meta-analysis

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Abstract

By the end of December 2023, COVID-19 had infected 701,748,397 people worldwide, killing 6,968,845 of them. A total of 1,734,021 cases and 30,162 deaths were reported in the countries of East Africa, with the highest number of cases (501,117) coming from Ethiopia and the lowest number from Eritrea (10,189). Globally, the epidemic has resulted in an astounding death toll and presents an unmatched danger to public health, the workplace, and food systems. Although most people agree that vaccination has had the biggest positive impact on global health in reduction of COVID 19, safe and effective vaccines were desperately needed to protect vulnerable populations. Research released in English between January 1, 2021, and January 14, 2024 was thoroughly searched through PubMed, Medline, EMBASE, CINAHL, and other pertinent sources. Data extraction and quality assessment were conducted using the Newcastle-Ottawa Scale (NOS) and the Preferred Reporting Items for Systematic Review and Meta-Analyses. STATA 17MP was used for the data analysis. The I2 test statistic and Egger's test of significance were used to evaluate heterogeneity and publication bias. The odds ratio (OR) and 95 % confidence interval (CI) were displayed using forest plots. This review and meta-analysis comprised a total of 23 articles, or a total sample size of 170,853. The pooled prevalence of post-COVID-19 vaccination side effects showed that 55 % (95 %CI 40–69 %) of population in East African nations experienced at least one side effect after receiving vaccination. The pooled odds ratio showed that a significant association was found between post-COVID-19 vaccination and gender (OR = 1.70; 95 %CI: 1.26–2.14), safety concern (OR: 2.79; 95 % CI: 0.51, 5.0), age (OR = 0.97; 95 %CI: 0.95–0.98), comorbidity (OR = 2.72; 95 %CI: 1.08–4.35). This review highlighted a significant number of adverse reactions to COVID-19 vaccinations. It is crucial to begin educating the public about these vaccines to enhance their understanding that the pandemic can be managed and that side effects are rare, temporary, and reversible.

Keywords: COVID-19 vaccine's safety, Reaction to COVID-19 vaccine, Side effect of COVID-19 vaccination, East Africa

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Advancing structural efficacy and resonance performance of battery enclosures through multi-objective optimization

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Abstract

Pursuing electric mobility has led to a growing demand for efficient battery enclosures that can withstand dynamic forces and vibrations. This study focuses on advancing the structural integrity and vibrational resilience of battery enclosures through a holistic optimization approach. This research identifies optimal design parameters that minimize deformation and stress while maximizing resonance frequency by leveraging finite element analysis, modal analysis, and multi-objective optimization techniques. The study unveils three candidate designs that showcase remarkable improvements, including a 49.41% reduction in deformation, a 35.79% reduction in stress, and a 19.92% increase in resonance frequency. These findings underscore the potential of integrated design strategies to drive innovation in sustainable electric vehicle technologies.

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26 (2024)

Evaluation of possible health risks associated with groundwater pollution at Kombolcha, a north-central Ethiopian industrial town in the Awash River basin

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Abstract

Groundwater contamination from intensive agricultural and industrial activity can lead to deteriorated drinking water quality that poses serious health threats for humans. The intention of the study was to appraisal the level of groundwater pollution and the potential risks it could pose to the residents of Kombolcha Town, an area with significant industrial and agricultural activity. Samples were obtained from seventeen groundwater wells in August 2021 and examined with standard methods. The groundwater comprehensive and indices for irrigation were calculated to evaluate the appropriateness of water quality for various purposes. A USEPA model was applied to estimate human health risks from polluted groundwater. Results revealed that all hydrogeochemical characteristics and heavy metals, with the exception of chromium, were within Ethiopian and World Health Organization drinking water guideline. Groundwater quality pollution index results for drinking demonstrated that 5.88% of water samples were evaluated as very good, whereas 94.12% of water samples were rated excellent. Ca-HCO3 facies make up 53% of samples, and Ca–Mg–Cl facies account for the remaining samples. Total non-carcinogenic risks to health for males extended from 0.35 to 2.39, for women from 0.38 to 2.59, and for children from 0.49 to 3.38. Cancer risks ranged from 0 to 1.6 × 10−3 for men, 0 to 1.74 × 10−3 for females, and 0 to 2.24 × 10−3 for children. These results indicate that children in this region suffer more risks for health than adults. The study concluded that to safeguard water quality, reduce threats to health, and more efficiently use the groundwater resource, prompt and efficient actions on agricultural and industrial practices must be taken in the research area.

Keywords: Groundwater contamination, Human health risk, Industrial activity, Kombolcha, Ethiopia

Engineering Reports
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Evaluation, tribological examination, and multi-objective optimization of aluminum-fly ash-egg shell composites for sustainability

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Abstract

This study addresses the technological challenge of enhancing the mechanical and tribological properties of Al 6082 alloy by incorporating fly ash (FA) and eggshell (ES) as reinforcing materials. The objective is to fabricate hybrid metal matrix composites using sand casting, with varying weight percentages of eggshell and fly ash: 4 wt% eggshell with 6 wt% fly ash, 5 wt% eggshell with 5 wt% fly ash, and 6 wt% eggshell with 4 wt% fly ash. The experimental methodology involved designing experiments with response surface methodology (RSM), considering applied load, sliding velocity, and sliding distance as variables. The outcomes showed that the composite with 6 wt% eggshell and 4 wt% fly ash exhibited superior hardness, tensile strength, and impact resistance compared to pure Al 6082 and other composite variations. Additionally, this composite reduced the coefficient of friction (COF) from 0.489 for the base Al 6082 to 0.265. ANOVA based on RSM identified sliding distance as the most influential factor affecting COF. Optimal conditions for minimizing COF were determined to be a 40 N load, 0.215 m/s sliding velocity, and 800 m sliding distance through confirmatory trials. Scanning electron microscopy (SEM) analysis of the worn surfaces provided further insights into the wear mechanisms. The research reveals that integrating the addition of eggshell and fly ash significantly enhances the mechanical properties and reduces the friction of Al 6082, with sliding distance being a critical factor in tribological performance. This investigation is distinctive due to its innovative use of dual reinforcement with fly ash and eggshell, which are abundant, cost-effective, and rarely employed together in this context. The research thoroughly investigates various reinforcement ratios, providing vital insights into how they affect the composite's properties, particularly in terms of improving tribological properties. Using RSM and ANOVA makes the findings more precise and reliable. The investigation highlights sliding distance as the key factor affecting the tribological behavior of the composites.

Keyword: Al 6082, egg shell, fly ash, multi-objective, optimization

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17 (2024)

Spatiotemporal distribution and bionomics of Anopheles stephensi in different eco-epidemiological settings in Ethiopia

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Abstract

Background: Malaria is a major public health concern in Ethiopia, and its incidence could worsen with the spread of the invasive mosquito species Anopheles stephensi in the country. This study aimed to provide updates on the distribution of An. stephensi and likely household exposure in Ethiopia.

Methods: Entomological surveillance was performed in 26 urban settings in Ethiopia from 2021 to 2023. A kilometer-by-kilometer quadrant was established per town, and approximately 20 structures per quadrant were surveyed every 3 months. Additional extensive sampling was conducted in 50 randomly selected structures in four urban centers in 2022 and 2023 to assess households' exposure to An. stephensi. Prokopack aspirators and CDC light traps were used to collect adult mosquitoes, and standard dippers were used to collect immature stages. The collected mosquitoes were identified to species level by morphological keys and molecular methods. PCR assays were used to assess Plasmodium infection and mosquito blood meal source.

Results: Catches of adult An. stephensi were generally low (mean: 0.15 per trap), with eight positive sites among the 26 surveyed. This mosquito species was reported for the first time in Assosa, western Ethiopia. Anopheles stephensi was the predominant species in four of the eight positive sites, accounting for 75–100% relative abundance of the adult Anopheles catches. Household-level exposure, defined as the percentage of households with a peridomestic presence of An. stephensi, ranged from 18% in Metehara to 30% in Danan. Anopheles arabiensis was the predominant species in 20 of the 26 sites, accounting for 42.9–100% of the Anopheles catches. Bovine blood index, ovine blood index and human blood index values were 69.2%, 32.3% and 24.6%, respectively, for An. stephensi, and 65.4%, 46.7% and 35.8%, respectively, for An. arabiensis. None of the 197 An. stephensi mosquitoes assayed tested positive for Plasmodium sporozoite, while of the 1434 An. arabiensis mosquitoes assayed, 62 were positive for Plasmodium (10 for P. falciparum and 52 for P. vivax).

Conclusions: This study shows that the geographical range of An. stephensi has expanded to western Ethiopia. Strongly zoophagic behavior coupled with low adult catches might explain the absence of Plasmodium infection. The level of household exposure to An. stephensi in this study varied across positive sites. Further research is needed to better understand the bionomics and contribution of An. stephensi to malaria transmission.

Keywords: Anopheles stephensi, Spatiotemporal distribution, Blood meal source, Sporozoite rate, Household's exposure, Ethiopia

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Global, regional, and national burden of injuries, and burden attributable to injuries risk factors, 1990 to 2019: results from the Global Burden of Disease study 2019

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Abstract

Objectives: In this study, the trends and current situation of the injury burden as well as attributable burden to injury risk factors at global, regional, and national levels based on the Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) 2019 are presented.
Study design: To assess the attributable burden of injury risk factors, the data of interest on data sources were retrieved from the Global Health Data Exchange (GHDx) and analyzed. Methods: Cause-specific death from injuries was estimated using the Cause of Death Ensemble model in the GBD 2019. The burden attributable to each injury risk factor was incorporated in the population attributable fraction to estimate the total attributable deaths and disability-adjusted life years. The Socio-demographic Index (SDI) was used to evaluate countries' developmental status.
Results: Globally, there were 713.9 million (95% uncertainty interval [UI]: 663.8 to 766.9) injuries incidence and 4.3 million (UI: 3.9 to 4.6) deaths caused by injuries in 2019. There was an inverse relationship between age-standardized disability-adjusted life year rate and SDI quintiles in 2019. Overall, low bone mineral density was the leading risk factor of injury deaths in 2019, with a contribution of 10.5% (UI: 9.0 to 11.6) of total injuries and age-standardized deaths, followed by occupational risks (7.0% [UI: 6.3–7.9]) and alcohol use (6.8% [UI: 5.2 to 8.5]).
Conclusion: Various risks were responsible for the imposed burden of injuries. This study highlighted the small but persistent share of injuries in the global burden of diseases and injuries to provide beneficial data to produce proper policies to reach an effective global injury prevention plan.

Parasites and Vectors
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Plasticity of blood feeding behavior of Anopheles mosquitoes in Ethiopia: a systematic review

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Abstract

Background: The efficacy of vector control tools depends on the behavior of the vector species. Many studies have sought to determine the feeding behavior of Anopheles mosquitoes in different settings of Ethiopia. We have performed a systematic review aimed to generate pooled evidence on the overall and species-specific blood meal sources of Anopheles mosquitoes in Ethiopia.
Methods: A search for relevant articles was performed in two electronic databases (PubMed and Science Direct) and three search engines (Google Scholar, Research Gate and Google) between 11 March and 2 April 2024. Following the initial identification of articles, we used EndNote X8 software and removed duplicate articles and screened the remaining articles by careful reading of their titles and abstracts. The full text of articles that passed this screening phase was retrieved, read and evaluated against predetermined selection criteria. The final decision for inclusion in the systematic review was made after a methodological quality check using the JBI critical appraisal checklist. All relevant data were extracted from tables, figures and texts of the included articles using a premade template in Excel, and the data were analyzed using Stata version 14 software.
Results: Of the 2431 studies identified, 27 met the inclusion criteria; all were published between 1997 and 2024. At 215 data points (frequency of tests of each Anopheles species by location and method of mosquito collections), 18,771 Anopheles mosquitoes belonging to 23 species or species complexes were tested for blood meal sources. The commonest sources of blood meals for Anopheles mosquitoes were bovine (36.0%, n = 6758) and human (29.4%, n = 5520). Among the tested anophelines, Anopheles (An.) arabiensis accounted for 67.9% (n = 12,741), followed by An. pharoensis, An. demeilloni and An. stephensi at 10.0%, 5.6% and 4.4%, respectively. Overall, there was no difference in the mean proportion of An. arabiensis detected with domestic animal blood (33.4%, 95% confidence interval [CI] 32.4–34.4%) and those detected with human blood (31.8%, 95% CI 30.9–32.8%). However, a greater proportion of the outdoor collected An. arabiensis were found to feed on bovines (47.9%, 95% CI 35.3–60.6) compared to humans (12.9%, 95% CI 0.8–24.9, $P < 0.01$). The foraging ratio (FR), which accounts for host availability, was greater for bovines (FR = 0.7) than for humans (FR = 0.2) for An. arabiensis, indicating preferential feeding on bovine hosts. This host preference was supported by the host preference index (human: bovine = 0.4). Anopheles pharoensis was detected with a slightly higher human blood index (53.5%, n = 1005) compared to bovine blood index (45.2%, n = 849). In contrast, An. demeilloni, An. coustani and An. marshalli were detected with a higher bovine blood index. Recently invaded urban malaria vector, An. stephensi was found with a higher ovine blood index.
Conclusions: Bovine and human hosts are common sources of a blood meal for Anopheles mosquitoes. In terms of host availability, An. arabiensis showed preferential feeding on bovines/cattle. Targeting domestic animals, bovines and ovines with endectocides could supplement current vector control interventions. **Study registration:** The protocol of this study was registered on the International Prospective Register of Systematic Reviews, registration no. CRD42024515725.

Keywords: Anopheles mosquitoes, Blood meal source, Host preference, Blood-feeding behavior, Ethiopia

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55 (2024)

Streamflow simulation at different temporal scales under rating curve uncertainty conditions using machine learning models

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Abstract

Reducing uncertainty in streamflow simulation is vital for effective water resource management. The impact of uncertainty in model calibration data (discharge), commonly derived from the rating curve, is often overlooked. This study applies the Monte Carlo simulation technique (MCST) to assess uncertainty in the rating curve. Advanced machine learning (ML) models, bidirectional long short-term memory (BiLSTM), and bidirectional gated recurrent units (BiGRUs) were used comparatively to evaluate the propagation of this uncertainty onto streamflow simulation on both daily and monthly temporal scales. Different sets of streamflow data, derived from the fitted curve and its lower and upper uncertainty bands, were utilized to train ML models independently. The results show the substantial impact of rating curve uncertainty in streamflow simulations, with the BiGRU model surpassing the BiLSTM model on both scales. As a result, the uncertainty in the rating curve results in an uncertainty of the streamflow of up to 30 and 25% on daily and monthly simulations, respectively. These findings underscore the importance of considering rating curve uncertainty in streamflow simulation to ensure accurate and reliable results. Therefore, streamflow should be treated as an uncertain variable and managed by incorporating rating curve uncertainty in decision-making.

Key words: MCST, ML models, rating curve, streamflow simulation, uncertainty

Scientific Reports
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Enhancing heart disease classification with M2MASC and CNN-BiLSTM integration for improved accuracy

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Abstract

Heart disease is a leading cause of death globally; therefore, accurate detection and classification are prominent, and several DL and ML methods have been developed over the last decade. However, the classical approaches may be prone to overfitting and under fitting issues, and the model performance may lag due to the unavailability of annotated datasets. To overcome these issues, the research proposed a model for heart disease detection and classification by integrating blockchain technology with a Modified mixed attention-enabled search optimizer-based CNN-Bidirectional Long Short-Term Memory (M2MASC enabled CNN-BiLSTM) model. The novel model incorporates a pre-trained VGG16 model to enhance feature extraction and improve the overall predictive accuracy. Leveraging the continuous monitoring capabilities of IoT devices, patient data is collected in real-time, providing a dynamic source to the CNN-BiLSTM model. Blockchain integration ensures stored health data's security, transparency, and immutability, addresses privacy concerns, and promotes trust in the predictive system. The classifier parameters are tuned using the modified mixed attention and search optimization. The M2MASC-enabled CNN-BiLSTM model performs better than traditional methods of accuracy 98.25%, precision 99.57%, and recall 97.53% for TP 80 with the MIT-BIH dataset.

Keywords: Heart disease detection, Blockchain, Modified mixed attention mechanism, Modified mixed attention enabled search optimizer-based CNN-BiLSTM, VGG 16

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Therapeutic efficacy of artemether–lumefantrine in the treatment of uncomplicated Plasmodium falciparum malaria in Arba Minch Zuria District, Gamo Zone, Southwest Ethiopia

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Abstract

Background: Artemether–lumefantrine (AL) has been the primary anti-malarial drug used to treat uncomplicated Plasmodium falciparum malaria in Ethiopia since 2004. However, there have been recent reports of AL resistance mutations in different African countries, including Ethiopia. This is concerning and requires periodic monitoring of anti-malarial drug resistance. Therefore, the current study aimed to evaluate the therapeutic efficacy of AL in treating uncomplicated P. falciparum malaria in the Arba Minch Zuria District, Gamo Zone, and Southwest Ethiopia.

Methods: A single-arm prospective study with a 28-day follow-up period was conducted from July to October 2022. Capillary blood samples were collected for RDT and microscopic examination. The study enrolled monoinfected P. falciparum patients aged ≥ 18 years at Ganta Sira Health Post. Sociodemographic and clinical data were recorded, and a dried blood spot (DBS) was prepared for each participant. Nested polymerase chain reaction (nPCR) genotyping of the msp-1 and msp-2 genes was only performed for recurrent cases to distinguish between recurrence and reinfection. Data entry and analysis were performed using the WHO Excel spreadsheet and SPSS version 26.

Results: A total of 89 patients were enrolled, and 67 adequately completed the 28-day follow-up period. AL showed a 100% clearance rate for fever on day 2 and asexual parasites on day 3. Gametocytes were detected in 13.5% (12/89) of the participants. The gametocyte clearance rate was 58.3% (7/12) until day 7 and 100% (12/12) until day 14. Five participants developed recurrent malaria, three of whom experienced relapse and two of whom experienced reinfection. Based on the Kaplan–Meier survival analysis, the PCR-uncorrected and PCR-corrected cumulative incidence of success were 93.7% (95% CI 85.5–97.3) and 96.2% (95% CI 85.5–98.7), respectively.

Conclusion: AL was efficacious in treating uncomplicated P. falciparum malaria in the study area. However, the detection of recurrent patients highlights the need for continuous efficacy studies in this area.

Keywords: Cure rate, Parasite clearance, Recurrence, Malaria

Natural Hazards Research
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Urban stormwater management under various runoff conditions for Arba Minch town of southern Ethiopia

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Abstract

Ineffective urban stormwater management causes increased surface runoff, and impacts on infrastructure and human life. However, urban stormwater condition is not quantified in Arba Minch area, which cause significant damage on the infrastructures as residence and roads. Therefore, the main objective of this study is to evaluate the condition of urban stormwater under different runoff conditions using Stormwater Management Model (SWMM) in Arba Minch town, specifically Sekela sub city. A combination of field, satellite, observed and laboratory test-based data on drainage systems, infiltration and % imperviousness was collected. The catchment is divided into 47 sub-catchments depend on the building block, flow direction, and drainage networks. The sub-catchments with the average surface runoff revealed 0.07 m3/s, 0.14 m3/s, 0.25 m3/s, 0.65 m3/s, and 0.75 m3/s over a 2-year, 5-year, 10-year, 25-year, and 30-year return period, respectively. The maximum nodes flooded occur at junctions' number (J7, J8, J24, and J25), as well as conduits (C14, C18, and C27), according to simulation findings of 2-year return period design rainfall which align with the major cause area. For return periods of 2, 5, 10, 25, and 30 years, the peak runoff result was greatest in sub-catchments SC-1, SC-6, SC-8, SC-9, and SC-30. This depicts sub-catchments in the area are flooded, hence resizing of canals and other drainage structures are necessary to mitigate the stormwater. The SWMM simulated results for 2-year, 5-year, 10-year, 25-year, and 30-year return periods showed peak runoff was greatest in sub-catchments No.8, 1, 6, 30, and 9 because of the slope of the sub-catchment and their large area with high percent imperviousness that results in less infiltration into the soil. The finding of this study shows a rapid increase in surface runoff, which mainly related to impermeable surface and inadequate urban drainage systems leading to damage to infrastructures and properties. This study suggests, a mitigation measures should be adopted to minimize the effect of stormwater using stormwater various intervention approaches following multi program combined with various runoff condition which is very important for road protection authorities, decision makers, and the scientific community to support future water related researches.

Keywords: Urbanization, Stormwater, SWMM, Runoff, Urban drainage, Arba Minch

BMC Pediatrics
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24 (2024)

Feeding modalities, HIV transmission and its predictors among HIV-exposed infants visited Gamo and Gofa zones public health facilities, Southern Ethiopia: a retrospective follow up study

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Abstract

Background: Despite the highest (88%) Prevention of Mother-To-Child Transmission (PMTCT) of HIV coverage in Eastern Africa, 50% of new HIV infections in children aged 0–14 years occur in the region.
Objective: The aim of this study was to assess the feeding modalities, the rate of HIV transmission and its predictors among HIV exposed infants (HIV-EIs) visited Gamo and Gofa Zones public health facilities, Southern Ethiopia from January 2013 to February 2019.
Method and materials: Institution-based retrospective follow up study was employed among 450 HIV-EIs having DNA/PCR test results. All infant-mother pair records in selected health facilities were reviewed using a standard data extraction tool from March to July 2019. HIV transmission probabilities were assessed by Kaplan–Meier time-to-event analysis method and log-rank tests were used to compare the risk among different groups. The Cox-proportional hazards model, adjusted on infant feeding modalities and other co-variants was used to identify predictors of HIV transmission, and statistical significance was declared at a p-value of < 0.05.
Results: In total, 383 complete records were analyzed. In the study, 85.6% (95%CI: 81.6%, 89.1%) of HIV-EIs were exclusively breastfed in the first six months. The 18 months probability of infant HIV transmission was 64 (16.7%) (95%CI: 13.1%–20.8%). The risk of HIV-transmission was higher among infants who were delivered at the hospital than health centers/health posts (AHR = 3.07; 95%CI: 1.19, 7.95); discontinued Cotrimoxazole prophylaxis in at least one visit (AHR = 6.32; 95%CI: 3.35, 11.94); did not exclusively breastfeed (AHR = 3.07; 95%CI: 1.72, 5.47) and came from urban areas (AHR = 5.90; 95%CI: 1.40, 24.85). **Conclusions:** The study showed that HIV-EIs had a greater rate of 18 months HIV transmission than the national pooled prevalence. The risk of transmission is higher among infants who do not breastfeed exclusively for the first 6 months, and the risk increases with the number of months spent by breastfeeding. Therefore, strengthening counselling on safer feeding options and Cotrimoxazole prophylaxis use; provision of quality PMTCT service with special focus in hospitals and urban residents were recommended.

Keywords: HIV-exposed infants, Feeding modality, HIV-transmission, Risk factors, Ethiopia

Nutrition and Metabolism
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Exploratory dietary patterns, the global diet quality score, and their associated socio-demographic factors among young adults in Rwanda: a cross-sectional study using a food list-validated, semi-quantitative food frequency questionnaire

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Abstract

Background: Economic growth in Rwanda is associated with significant changes in food systems, access to health and other services, lifestyle, and nutritional transitions. Nevertheless, our knowledge of dietary patterns in Rwanda remains limited. The present study aimed to identify the dietary habits of young adult population in Rwanda and to assess associated factors.

Methods: A developed and validated semi-quantitative food frequency questionnaire covering a one-year period was used to collect data on food intake of 1,218 participants (18–35 years old) from end of January to April 2023 in a cross-sectional study. Dietary habits were assessed using two indicators: the Global Diet Quality Score (GDQS) and dietary patterns. The latest was developed using exploratory factor analysis.

Results: Rwandan adults had a mean GDQS of 24.1; 64.4% had high GDQS, especially urban, and educated respondents. The Southern province led at 77.4%. Three dietary patterns were identified: “Modern” (high in processed foods and drinks), “Traditional” (rich in cereals, roots, and plant-based proteins), and “low variety” (low in diverse foods but high in sugar and salt). Dietary patterns significantly varied by residency, province, sex, age, social category, asset, and education level.

Conclusion: This study identified distinct dietary patterns among adult population of Rwanda, suggesting a nutritional transition associated with urbanization. The findings highlight the need for further research into the relationships between diet, obesity, and metabolic syndrome in Rwandan population.

Keywords: Dietary patterns, Global Diet Quality score, Food frequency, questionnaire, Urbanization, Exploratory Factor Analysis, Rwanda

Materials Research Express
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Synthesis of polyaniline nanomaterials for an effective supercapacitor application

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Abstract

Polyaniline-based materials have been widely used for supercapacitors due to their outstanding properties, such as high specific capacitance, excellent electrochemical properties, and ease of synthesis methods; however, the short-cycle stability of PANI-based supercapacitors and swelling and shrinking of polymeric structures limit their commercialization. Herein, we synthesized polyaniline (PANI) nanomaterials, which meet high specific capacitance through the chemical oxidative polymerization of aniline with ammonium persulfate (APS) in aqueous salicylic acid. The electrode materials were characterized using UV-vis, TGA, SEM, XRD, BAS-50 W potentiostat, and FTIR instrumentations. The electrical conductivity of the prepared materials was analyzed and found to be relatively high. The electrochemical supercapacitance performance of PANI nanomaterials was characterized using cyclic voltammetry. The polyaniline nanomaterials with a [salicylic acid]/[aniline] molar ratio of 0.8 showed a maximum specific capacitance of 688.5 Fg-1 at a scan rate of 50 mV s−1. Polyaniline nanomaterials were found to exhibit better specific capacitance when compared to bulk polyanilines. Thus, PANI nanomaterials have been found to be a promising alternative for supercapacitor applications.

Keywords: electrochemical performance, polyaniline nanomaterials, supercapacitors

Mathematics in Applied Sciences and Engineering
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DIVERSITY AND ECOTOURISM ON MULTIPURPOSE MARINE PROTECTED AREAS

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Abstract

Beyond its ecological benefits, there is a growing call for the establishment of marine protected areas (MPAs) for varied economic activities. Due to the decline in the wild catch, there is an increase in demand for farmed fish and a call for the development of aquaculture production in marine protected areas. In addition, the diversity in marine protected areas is suitable for the introduction of a tourism industry. Therefore, we need to design a clear scientific management system that balances the main goal of marine protected areas with the economic benefits, of aquaculture and tourism activities. This paper aims to determine the optimal size of the marine protected areas, the aquaculture size in the protected areas, and the level of tourism activities that maximize the overall benefit of the stakeholders. This is vital for the co-existence and sustainability of different sectors such as aquaculture production, tourism activities, and open-access fisheries.

Keywords: Dynamical system, optimal control, aquaculture and tourism activities, prey-predator, space allocation.

BMC Infectious Diseases
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24 (2024)

Candidate serum protein biomarkers for active pulmonary tuberculosis diagnosis in tuberculosis endemic settings

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Abstract

Background: Identification of non-sputum diagnostic markers for tuberculosis (TB) is urgently needed. This exploratory study aimed to discover potential serum protein biomarkers for the diagnosis of active pulmonary TB (PTB).

Method: We employed Proximity Extension Assay (PEA) to measure levels of 92 protein biomarkers related to inflammation in serum samples from three patient groups: 30 patients with active PTB, 29 patients with other respiratory diseases with latent TB (ORD with LTBI+), and 29 patients with other respiratory diseases without latent TB (ORD with LTBI-). To understand the functional mechanisms associated with differentially expressed proteins, we performed Gene Ontology (GO) and Kyoto Encyclopedia of Genes and Genomes (KEGG) pathway analyses. Least absolute shrinkage and selection operator (LASSO) regression was employed to identify potential TB diagnostic protein biomarkers. Network interactions among the identified candidate diagnostic markers were then analyzed, and their diagnostic performance was evaluated using logistic regression and receiver operating characteristic (ROC) analysis.

Result: The analysis revealed 37 differentially expressed proteins (DEPs) in the active PTB group compared to both ORD with LTBI + and ORD with LTBI- groups. Gene Ontology analysis indicated that these DEPs were primarily involved in the inflammatory response, while KEGG enrichment analysis highlighted the cytokine-cytokine receptor interaction pathway as the top significant hit. LASSO regression identified eight promising candidate protein biomarkers: IFN-gamma, LIF, uPA, CSF-1, SCF, SIRT2, 4E-BP1, and GDNF. The combined set of these eight proteins yielded an AUC of 0.943 for differentiating active PTB from ORD with LTBI+, and an AUC of 0.927 for distinguishing PTB from ORD with LTBI-.

Conclusion: We have identified eight protein markers that reliably differentiate active PTB from ORD irrespective of LTBI presence. Further large-scale validation and translation of these protein markers into a user-friendly and affordable point-of-care test hold the potential to significantly enhance TB control in high-burden regions.

Keywords: Proximity extension assay, Serum protein markers, Tuberculosis diagnosis

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484 (2024)

Digital transformation and environmental sustainability in the hospitality industry: A three-wave time-lagged examination

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Abstract

Despite the ongoing discussions of strategies to attain the United Nations' Sustainable Development Goals, discourse on the role of digital transformation in bolstering environmental sustainability remains sparse. This study delves into the role of digital transformation in enhancing the environmental sustainability of hotels and scrutinizes the role of sustainable business model innovation in mediating the relationship between digital transformation and environmental sustainability. Data were gathered from managers of star-rated hotels using a survey questionnaire in three waves. The data was analyzed through the application of structural equation modeling. The findings of the study reveal a positive relationship between digital transformation and environmental sustainability and that this relationship is mediated by sustainable business model innovation and moderated by the hotel star category. The study highlights the strategic significance of digital transformation and sustainable business model innovation in achieving environmental sustainability. The study also provides implications for managers, scholars and policymakers.

Scientific Reports
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The application of Rumex Abysinicus derived activated carbon/bentonite clay/graphene oxide/iron oxide nanocomposite for removal of chromium from aqueous solution

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Abstract

Rapid industrialization has significantly boosted economic growth but has also introduced severe environmental challenges, particularly in water pollution. This study evaluates the effectiveness of a nanocomposite composed of Rumex Abyssinicus Activated Carbon/Acid Activated Bentonite Clay/Graphene Oxide, and Iron Oxide (RAAC/AABC/GO/Fe3O4) for chromium removal from aqueous solutions. The preparation of the nanocomposite involved precise methods, and its characterization was performed using Scanning Electron Microscopy (SEM), X-ray Diffraction (XRD), Fourier Transform Infrared Spectroscopy (FTIR), Brunauer–Emmett–Teller (BET) surface area analysis, and the point of zero charge (pHpzc). Batch adsorption experiments were designed using Design Expert software with a central composite design under response surface methodology. The factors investigated included pH (3, 6, and 9), initial Cr (VI) concentration (40, 70, and 100 mg/L), adsorbent dose (0.5, 0.75, 1 g/200 mL), and contact time (60, 90, and 120 min). Adsorption isotherms were analyzed using nonlinearized Langmuir, Freundlich, and Temkin models, while pseudo-first-order and pseudo-second-order models were applied to adsorption kinetics. Characterization revealed a pHpzc of 8.25, a porous and heterogeneous surface (SEM), diverse functional groups (FTIR), an amorphous structure (XRD), and a significant surface area of 1201.23 m2/g (BET). The highest removal efficiency of 99.91% was achieved at pH 6, with an initial Cr (VI) concentration of 70 mg/L, a 90 min contact time, and an adsorbent dose of 1 g/200 mL. Optimization of the adsorption process identified optimal parameters as pH 5.84, initial Cr (VI) concentration of 88.94 mg/L, contact time of 60 min, and adsorbent dose of 0.52 g/200 mL. The Langmuir isotherm model, with an R2 value of 0.92836, best described the adsorption process, indicating a monolayer adsorption mechanism. The pseudo-second-order kinetics model provided the best fit with an R2 value of 0.988. Overall, the nanocomposite demonstrates significant potential as a cost-effective and environmentally friendly solution for chromium removal from wastewater.

Keywords: Adsorption kinetics, Chromium, Nanocomposite, Removal efficiency, Wastewater treatment

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13 (2024)

Optimizing energy efficiency in MEC networks: a deep learning approach with Cybertwin-driven resource allocation

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Abstract

Cybertwin (CT) is an innovative network structure that digitally simulates humans and items in a virtual environment, significantly influencing Cybertwin instances more than regular VMs. Cybertwin-driven networks, combined with Mobile Edge Computing (MEC), provide practical options for transmitting IoT-enabled data. This research introduces a hybrid methodology integrating deep learning with Cybertwin-driven resource allocation to enhance energy-efficient workload offloading and resource management in MEC networks. Offloading work is essential in MEC networks since several applications require significant resources. The Cybertwin-driven approach considers user mobility, virtualization, processing power, load migrations, and resource demand as crucial elements in the decision-making process for offloading. The model optimizes job allocation between on-premises and distant execution using a task-offloading strategy to reduce the operating burden on the MEC network. The model uses a hybrid partitioning approach and a cost function to optimize resource allocation efficiently. This cost function accounts for energy consumption and service delays associated with job assignment, execution, and fulfilment. The model calculates the cost of several segmentation and offloading procedures and chooses the lowest cost to enhance energy efficiency and performance. The approach employs a deep learning architecture called "CNN-LSTM-TL" to accomplish energy-efficient task offloading, utilizing pre-trained transfer learning models. Batch normalization is used to speed up model training and improve its robustness. The model is trained and assessed using an extensive mobile edge computing public dataset. The experimental findings confirm the efficacy of the proposed methodology, indicating a 20% decrease in energy usage compared to conventional methods while achieving comparable or superior performance levels. Simulation studies emphasize the advantages of incorporating Cybertwin-driven insights into resource allocation and workload-offloading techniques. This research enhances energy-efficient and resource-aware MEC networks by incorporating Cybertwin-driven techniques.

Keywords: Deep learning, Cybertwin, Mobile edge computing, IoT, CNN, LSTM, Transfer learning, Workload offloading

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Vulnerability to multidimensional food insecurity: empirical evidence from wheat farmers in the Arsi Zone of Ethiopia

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Abstract

Although food security is multidimensional, most previous studies have measured households' vulnerability to food insecurity via unidimensional indices. To address this gap, this study assesses households' vulnerability to multidimensional food insecurity (VMFI) by employing the vulnerability-as-expected poverty technique for 422 randomly selected wheat-producing households from three districts of the Arsi Zone. Before households' VMFI was estimated by the three-stage feasible generalized least squares approach (FGLS), the multidimensional food security (MFS) index was developed by using principal component analysis (PCA). The MFS index was then calculated to be 0.4825 by the geometric aggregation technique to summarize the PCA results, and the descriptive summary indicated that 45.02% of the respondents were food secure. The three-stage FGLS revealed that 57.11% of the respondents were vulnerable to multidimensional food insecurity. Moreover, 33.41% of the respondents had stable food security, 45.5% were chronically food insecure, 9.48% experienced transitory food insecurity, and 11.61% were vulnerable to multidimensional food insecurity. The results of the probit model, which is employed to identify the determinants of VMFI, confirm that contact with agricultural extension agents, family size, and participation in off/nonfarm activities reduce VMFI, whereas the dependency ratio, credit utilization, shock experiences, and living in lowland areas increase it. Accordingly, it is important to adopt policies and strategies that enhance household interaction with agricultural extension agents and develop an efficient early warning mechanism to build a resilient food security system. To reduce household VMFI, it is also crucial to promote financial education and provide special support to drought-prone areas by developing drought-tolerant agricultural technologies and reducing agricultural rain dependency.

Keywords: Multidimensional food insecurity, Vulnerability, PCA, Vulnerability as expected poverty, Three-stage-FGLS, Ethiopia

BMC Public Health
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24 (2024)

Trends and determinants of child stunting in Ethiopia: a longitudinal analysis of sociodemographic factors and regional disparities

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Abstract

Stunting remains a critical issue affecting child health in Ethiopia, with significant implications for growth and development. Despite efforts to address stunting, understanding its determinants and trends over time is essential for developing effective interventions. The objective of this study is to examine the trends and determinants of child stunting in Ethiopia, focusing on sociodemographic factors and regional disparities. This longitudinal observational study utilized data from the Young Lives project covering the period from 2002 to 2016. An ordinal logistic regression model with generalized estimating equation (GEE) was used to analyse 7,680 observations from 1,536 children across Ethiopia. Variables included sociodemographic factors, access to resources, and parental education levels. Over the study period, there were notable improvements in child stunting rates, influenced by variables such as household wealth, maternal education, access to safe drinking water, and urban versus rural residence. Children in households with higher wealth and maternal education levels experienced lower rates of stunting. Regional disparities were evident, with a greater prevalence in Amhara and lower rates in Addis Ababa. The findings underscore the importance of targeted interventions to address socioeconomic disparities and improve resource access. Enhancing maternal education, ensuring access to safe water, and addressing regional disparities are critical to reducing child stunting rates in Ethiopia.

Keywords: Child stunting, Sociodemographic factors, Ordinal logistic regression, GEE

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A hybrid cloud load balancing and host utilization prediction method using deep learning and optimization techniques

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Abstract

Virtual machine (VM) integration methods have effectively proven an optimized load balancing in cloud data centers. The main challenge with VM integration methods is the trade-off among cost effectiveness, quality of service, performance, optimal resource utilization and compliance with service level agreement violations. Deep Learning methods are widely used in existing research on cloud load balancing. However, there is still a problem with acquiring noisy multilayered fluctuations in workload due to the limited resource-level provisioning. The long short-term memory (LSTM) model plays a vital role in the prediction of server load and workload provisioning. This research presents a hybrid model using deep learning with Particle Swarm Intelligence and Genetic Algorithm ("DPSO-GA") for dynamic workload provisioning in cloud computing. The proposed model works in two phases. The first phase utilizes a hybrid PSO-GA approach to address the prediction challenge by combining the benefits of these two methods in fine-tuning the Hyperparameters. In the second phase, CNN-LSTM is utilized. Before using the CNN-LSTM approach to forecast the consumption of resources, a hybrid approach, PSO-GA, is used for training it. In the proposed framework, a one-dimensional CNN and LSTM are used to forecast the cloud resource utilization at various subsequent time steps. The LSTM module simulates temporal information that predicts the upcoming VM workload, while a CNN module extracts complicated distinguishing features gathered from VM workload statistics. The proposed model simultaneously integrates the resource utilization in a multi-resource utilization, which helps overcome the load balancing and over-provisioning issues. Comprehensive simulations are carried out utilizing the Google cluster traces benchmarks dataset to verify the efficiency of the proposed DPSO-GA technique in enhancing the distribution of resources and load balancing for the cloud. The proposed model achieves outstanding results in terms of better precision, accuracy and load allocation.

Scientific Reports
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MIS 3 innovative behavior and highland occupation during a stable wet episode in the Lake Tana paleoclimate record, Ethiopia

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Abstract

Securely dated archaeological sites from key regions and periods are critical for understanding early modern human adaptive responses to past environmental change. Here, we report new radiocarbon dates of > 42,000 cal years BP for an intensive human occupation of Gorgora rockshelter in the Ethiopian Highlands. We also document the development of innovative technologies and symbolic behaviors starting around this time. The evidenced occupation and behavioral patterns coincide with the onset and persistence of a stable wet phase in the geographically proximate high-resolution core record of Lake Tana. Range expansion into montane habitats and the subsequent development of innovative technologies and behaviors are consistent with population dispersal waves within Africa and beyond during wetter phases ~ 60–40 thousand years ago (ka).

Keywords: Range expansion, Middle Stone Age, Innovative behavior, Lake Tana, Gorgora, Ethiopia

Discover Food
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4 (2024)

Production efficiency of wheat farmers in the Arsi Zone, Oromia Region of Ethiopia

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Abstract

Wheat is a cereal crop that contributes to food security; thus, Ethiopia must boost the production efficiency of wheat to meet the sustainable development goal of eradicating hunger and poverty. Consequently, a significant revolution is occurring in the Ethiopian wheat industry to improve production and productivity. Therefore, it is critical to understand the current level of wheat farmers' efficiency, as its production is highly influenced by existing agricultural technologies and climate change, which makes it dynamic. Accordingly, this study employed the parametric Cobb–Douglas stochastic frontier and two-limit Tobit models to evaluate wheat farmers' efficiency and determine their drivers in Ethiopia's largest wheat-producing area, the Arsi Zone. A multistage sampling strategy was applied to obtain a representative sample of 422 wheat farmers. The model's output suggested that the average technical, allocative, and economic efficiency scores were 80.8%, 88.1%, and 71.3%, respectively. It is confirmed that wheat farmers' efficiencies can increase with household head age, education level, livestock ownership, contact with extension agents, wheat mechanization, and involvement in non/off-farm activities but decrease with household distance from the main market and total land holdings. To realize the potential gains from wheat cultivation in Ethiopia, the government needs to develop policies and strategies that enhance farmers' education, livestock production, and extension contact, facilitate infrastructure, market development, and wheat mechanization, and promote non/off-farm activities.

Keywords: Wheat, Efficiency, Stochastic frontier model, Cobb–Douglas, Two-limit Tobit, Ethiopia

Computational Urban Science
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4 (2024)

Contributions of urban productive safety net program to enhancing food security and livelihood diversification: an in-depth analysis of household-Level perceptions among urban populations in Ethiopia

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Abstract

The Urban Productive Safety Net Program is one of Africa's most ambitious social protection initiatives, and it has achieved measurable successes. However, existing literature focusing on the role of programs in improving people's lives, especially in ensuring food security and income diversification, gives more focus to rural areas and depends on data from individuals beyond those directly targeted by the program. Hence, this study examines beneficiaries' perceptions of the program's contribution to food security and livelihood diversification in the South Ethiopia Regional State. The study used a mixed research approach that included a questionnaire, interviews, observation, and focus group discussions. To select 310 survey household heads, a multistage sampling procedure was employed. We analyzed the quantitative data using SPSS version 27, while the qualitative data was analyzed through narration and summarization. The findings indicate that the selection process for beneficiaries, activities performed by public work groups, and beneficiaries graduating with reliable sources of income are generally positive, whereas negative assumptions exist regarding the adequacy and timeliness of cash transfers and the overall living status of residents. Therefore, the program managers and zonal-level team leaders should collaborate closely to directly engage with beneficiaries, monitor the support system, and raise awareness.

Keywords: Household-level perceptions, Livelihood diversification, Southern Ethiopia, Urban food security, UPSNP

Scientific Reports
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14 (2024)

A precise model for skin cancer diagnosis using hybrid U-Net and improved MobileNet-V3 with hyperparameters optimization

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Abstract

Skin cancer is a frequently occurring and possibly deadly disease that necessitates prompt and precise diagnosis in order to ensure efficacious treatment. This paper introduces an innovative approach for accurately identifying skin cancer by utilizing Convolution Neural Network architecture and optimizing hyperparameters. The proposed approach aims to increase the precision and efficacy of skin cancer recognition and consequently enhance patients' experiences. This investigation aims to tackle various significant challenges in skin cancer recognition, encompassing feature extraction, model architecture design, and optimizing hyperparameters. The proposed model utilizes advanced deep-learning methodologies to extract complex features and patterns from skin cancer images. We enhance the learning procedure of deep learning by integrating Standard U-Net and Improved MobileNet-V3 with optimization techniques, allowing the model to differentiate malignant and benign skin cancers. Also substituted the crossed-entropy loss function of the Mobilenet-v3 mathematical framework with a bias loss function to enhance the accuracy. The model's squeeze and excitation component was replaced with the practical channel attention component to achieve parameter reduction. Integrating cross-layer connections among Mobile modules has been proposed to leverage synthetic features effectively. The dilated convolutions were incorporated into the model to enhance the receptive field. The optimization of hyperparameters is of utmost importance in improving the efficiency of deep learning models. To fine-tune the model's hyperparameter, we employ sophisticated optimization methods such as the Bayesian optimization method using pre-trained CNN architecture MobileNet-V3. The proposed model is compared with existing models, i.e., MobileNet, VGG-16, MobileNet-V2, Resnet-152v2 and VGG-19 on the “HAM-10000 Melanoma Skin Cancer dataset". The empirical findings illustrate that the proposed optimized hybrid MobileNet-V3 model outperforms existing skin cancer detection and segmentation techniques based on high precision of 97.84%, sensitivity of 96.35%, accuracy of 98.86% and specificity of 97.32%. The enhanced performance of this research resulted in timelier and more precise diagnoses, potentially contributing to life-saving outcomes and mitigating healthcare expenditures.

Keywords: Health care, Convolution Neural Network, Skin cancer, Transfer learning, U-Net, Deep learning

Malaria Journal
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23 (2024)

Anopheles arabiensis continues to be the primary vector of Plasmodium falciparum after decades of malaria control in southwestern Ethiopia

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Abstract

Background: Investigating the species distribution and their role in malaria transmission is important as it varies from place to place and is highly needed to design interventions appropriate to the site. The current study aimed to investigate the Anopheles mosquito species distribution and their infection rate in southwestern Ethiopia.
Methods: The study was conducted in 14 malaria-endemic kebeles (the smallest administrative unit), which were situated in eight different malaria-endemic districts and four zones in southwestern Ethiopia. Ten per cent of households in each village were visited to collect adult mosquitoes using Centers for Disease Control and Prevention (CDC) light traps. The larval and pupal collection was done from breeding sites within the villages, and reared to adults. Female mosquitoes were morphologically identified. The head and thorax of adult Anopheles mosquitoes were tested for circumsporozoite proteins (CSPs) using ELISA. At the same time, legs, wings, and abdomen were used to identify sibling species using PCR targeting the rDNA intergenic spacers region for species typing of the Anopheles funestus group and the internal transcribed spacer 2 region genes for Anopheles gambiae complex.
Results: A total of 1445 Anopheles mosquitoes comprising eight species were collected. Of 813 An. gambiae complex tested by PCR, 785 (97%) were Anopheles arabiensis, and the remaining 28 (3%) were not amplified. There were 133 An. funestus group captured and tested to identify the species, of which 117 (88%) were positive for Anopheles parensis, and 15 (11%) were not amplified. A single specimen (1%) showed a band with a different base pair length from the known An. funestus group species. Sequencing revealed this was Anopheles sergentii. Among 1399 Anopheles tested for CSPs by ELISA, 5 (0.4%) An. arabiensis were positive for Plasmodium falciparum and a single (0.07%) was positive for Plasmodium vivax.
Conclusions: Anopheles arabiensis continues to play the principal role in malaria transmission despite implementing indoor-based interventions for decades. Sequencing results suggest that An. sergentii was amplified by the An. funestus group primer, producing PCR amplicon size of different length. Therefore, relying solely on amplifying a specific gene of interest in grouping species could be misleading, as different species may share the same gene.

Keywords: *Anopheles arabiensis*, *Anopheles sergentii*, *Anopheles* species distribution, Circum-sporozoite proteins, Ethiopia

Food Science and Nutrition
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12 (2024)

Utilization of Fish Skin Gelatin for Nutritional Value Enhancement of Avocado-Based Low-Fat Ice Cream

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Abstract

Gelatin is one of the most widely used food ingredients, with wide applications in the food industry as stabilizing, gelling, and foaming agents. Fish skin is the basic source of gelatin, which contains a high amount of protein. The results show that the proximate compositions (protein, fat, ash, moisture, fiber, carbohydrate, and total energy) of the optimized ice cream product with ingredient compositions of (30% milk, 40% avocado pulp, 10% sugar, 15% gelatin, and 5% cream) show values of 3.26 ± 0.35, 9.32 ± 0.22, 2.79 ± 0.02, 57.83 ± 0.14, 3.46 ± 0.24, 23.26 ± 0.71, and 190.54 ± 0.02, respectively. Also, the microbe load in the optimized ice cream product was not detected up to 1 week, while total plate count and Staphylococcus aureus bacteria were starting to grow up after a week, and the results of panelists from sensory values indicate high acceptability of products with the aim of assessing the influence of fish skin gelatin on the nutritional values of avocado-based low-fat ice cream. Considering the results, gelatin has a significant effect on the nutritional and rheological properties of ice cream, specifically striking visibility on protein composition.

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Impact of NPSB fertilizer on yield of orange-fleshed sweet potato (Ipomoea batatas (L.) Lam.) Varieties in Southern Ethiopia's agro-ecological zones

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Abstract

Root and tuber crops, particularly sweet potatoes, are vital to global food security, yet their potential for enhancing household nutrition and income remains largely untapped. Orange-fleshed sweet potato (OFSP) varieties are rich in pro-vitamin A, crucial for health. Despite their significance in Ethiopia, yields are often low due to inadequate location-specific fertilizer recommendations and limited access to high-yielding varieties. This study aimed to determine the optimal blended NPSB fertilizer rates and high-yielding OFSP varieties in the contrasting environments of Wolaita and Gamo zones, where these crops are staples. We evaluated three OFSP varieties (Alamura, Dilla, and Kabode) and four NPSB rates (0, 79.5, 159, and 238.5 kg ha−1 in a 3x4 factorial experiment using a randomized complete block design (RCBD) with three replications during the 2022 cropping season. Data on root yield and yield components were analyzed using the GLM procedure in SAS 9.2. Partial budget analysis and agronomic efficiency were also computed. Results showed that marketable root yield and root dry matter were significantly affected by the interaction of site, fertilizer rates, and OFSP varieties. The highest marketable root yield (49.84 t ha−1 and net benefit (342,856.6 ETB ha−1) were achieved with the Kabode variety at 238.5 kg NPSB in Arba Minch, while the same variety yielded the highest net benefit from 159 kg NPSB in Areka. The highest agronomic efficiency was recorded at 159 kg NPSB and 79 kg NPSB in Arba Minch (174.71) and Areka (288.67), respectively, indicating a negative relationship between net benefit, agronomic efficiency, and increasing NPSB rates. In conclusion, cultivating the Kabode variety with 159 kg ha−1 NPSB in Arba Minch and 79.5 kg ha−1 NPSB in Areka is recommended for enhancing sweet potato productivity, thereby improving food security and nutritional benefits for smallholder farmers in the region.

Keywords: Orange-fleshed sweet potato, Variety response, Site-specific fertilizer management, Blended NPSB, Agronomic efficiency, Partial budget analysis, Storage root yield.

Scientific Reports
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14 (2024)

Generation of two mode mechanical squeezing induced by nondegenerate parametric amplification

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Abstract

Squeezing light in an optomechanical system involves reducing quantum noise in one of the light's quadratures through the interaction between optical and mechanical modes. However, achieving successful implementation requires careful control of experimental parameters, which can be challenging. Here, we investigate a two-mode squeezed light transfer from optical to mechanical modes induced by a non-degenerate optical parametric amplifier (OPA). The optomechanical system is driven by frequencies nearly resonant with the anti-stokes fields that can realize cooling mechanical oscillators and quantum state transfer within a resolved sideband (good cavity) limit. Our results show that when a non-degenerate OPA is placed inside the optical cavity, the degree of squeezing in both optical and mechanical modes is significantly enhanced. This leads to the two-mode squeezed light being transferred into two-mode mechanical squeezing in the presence of the non-degenerate OPA under weak optomechanical coupling strength. Interestingly, we found that with negligible thermal bath noise, the two-mode squeezed light completely transferred to yield 50% mirror-mirror squeezing. In contrast, at higher thermal noise, the transfer of squeezed light is weak, causing the system to lose its quantum properties and behave more classically. Furthermore, we have shown that the degree of squeezing in the weak coupling regime drastically decreases with increasing mechanical dissipation rates. We believe that our scheme can achieve strong mechanical squeezing in hybrid optomechanical systems and facilitate homodyne detection to measure the quadratures of the squeezed light.

Malaria Journal
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23 (2024)

Prevalence of malaria and associated risk factors among household members in South Ethiopia: a multi-site cross-sectional study

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Abstract

Background: Despite continuous prevention and control strategies in place, malaria remains a major public health problem in sub-Saharan Africa including Ethiopia. Moreover, prevalence of malaria differs in different geographical settings and epidemiological data were inadequate to assure disease status in the study area. This study was aimed to determine the prevalence of malaria and associated risk factors in selected rural kebeles in South Ethiopia.

Methods: A community-based cross-sectional study was conducted between February to June 2019 in eight malaria-endemic kebeles situated in four zones in South Ethiopia. Mult-stage sampling techniques were employed to select the study zones, districts, kebeles and households. Blood sample were collected from 1674 participants in 345 households by finger prick and smears were examined by microscopy. Sociodemographic data as well as risk factors for Plasmodium infection were collected using questionnaires. Bivariate and multivariate logistic regressions were used to analyse the data.

Results: The overall prevalence of malaria in the study localities was 4.5% (76/1674). The prevalence was varied among the study localities with high prevalence in Bashilo (14.6%; 33/226) followed by Mehal Korga (12.1%; 26/214). Plasmodium falciparum was the dominant parasite accounted for 65.8% (50/76), while Plasmodium vivax accounted 18.4% (14/76). Co-infection of P. falciparum and P. vivax was 15.8% (12/76). Among the three age groups prevalence was 7.8% (27/346) in age less than 5 years and 7.5% (40/531) in 5–14 years. The age groups > 14years were less likely infected with Plasmodium parasite (AOR = 0.14, 95% CI 0.02–0.82) than under five children. Non-febrile individuals 1638 (97.8%) were more likely to had Plasmodium infection (AOR = 28.4, 95% CI 011.4–70.6) than febrile 36 (2.2%). Individuals living proximity to mosquito breeding sites have higher Plasmodium infection (AOR = 6.17, 95% CI 2.66–14.3) than those at distant of breeding sites.

Conclusions: Malaria remains a public health problem in the study localities. Thus, malaria prevention and control strategies targeting children, non-febrile cases and individuals living proximity to breeding sites are crucial to reduce malaria related morbidity and mortality.

Keywords: Febrile**,** Malaria**,** Plasmodium**,** Risk factors**,** south Ethiopia

Health Science Reports
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7 (2024)

Women Autonomy in Health Care Decision Making and Associated Factors among Postpartum Women in Southern Ethiopia: A Cross-Sectional Study

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Abstract

Background and Aims: Women's autonomy in healthcare decision-making is crucial for improving maternal and child health. Despite its importance, there is limited evidence on autonomous healthcare decision making particularly in postpartum women. Thus, this study aimed to assess the prevalence of postpartum women's autonomy in healthcare decision making and its associated factors in Chencha town, Gamo zone, southern Ethiopia. Methods: A community based cross-sectional study was conducted among 617 postpartum women in southern Ethiopia from October 1 to November 30, 2023. A study participants were selected by a simple random sampling technique. The data were collected through pretested and interviewer administered questionnaire. Following coding and entry into Epi-data version 3.1, the data were exported into statistical package for social science software (SPSS version 26) for analysis. A logistic regression model was fitted and, variables with $p < 0.05$ were declared to be significantly associated with women autonomy in healthcare decision-making. Results: In this study, 61.6% of postpartum women have autonomous in their health care decision making with 95% confidence interval (CI): 57.4, 65.3. Women age over 35 years (AOR = 3.2, 95% CI: 1.7, 6.0), enrollment in community-based health insurance (AOR = 1.5 95% CI: 1.0, 2.3), having four and above antenatal care visits (AOR = 2.5, 95% CI: 1.6, 3.8), using skilled delivery service (AOR = 4.3, 95% CI: 2.9, 6.6), having primary educational level (AOR = 4.9, 95% CI: 3.0, 8.0), and secondary and above educational level (AOR = 5, 95% CI: 3.1, 8.0) were positively associated with women autonomy in health care decision making. Conclusion: This study revealed that majority of postpartum women were autonomous in their healthcare decision making. Maternal age, educational status, enrollment in community-based health insurance, having frequent ANC follow-up and using skilled delivery service were factors significantly associated with women's autonomy. Focus should be given to improve women antenatal care follow-up and the enrollment of community-based health insurance.

Keywords: Ethiopia | healthcare decision making | postpartum women | women autonomy

Discover Sustainability
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5 (2024)

Spatiotemporal variability and trends of intra-seasonal rainfall and temperature in the drought-prone districts of Northwestern Ethiopia

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Abstract

Agriculture in Ethiopia is highly dictated by spatial patterns and temporal distributions of climate variables. The analysis of these climate variables is crucial for understanding the impacts on agricultural productivity. This study aimed to analyze spatiotemporal variability and trends of intra-seasonal rainfall and temperature using site-specific daily data from the Ethiopian Meteorology Institute (1992–2021). Standardized methods explore variability, while Mann–Kendall tests identify trends, using the Modified version for data with autocorrelation. Inverse Distance Weighted interpolation was employed for spatial analysis of rainfall, length of growing season, and temperature. The findings identified that Kiremt dominated the mono-modal rainfall pattern, contributing 72%-86% of total annual rainfall. The study found that the season typically begins early on June 13 in Adiszemen, and July 6 in Arbgebiya and ends between October 6 and October 26. The duration of the season varied across locations, averaging 95 days at Ebenat and 148 days at Adiszemen. The seasonal rainfall anomaly index shows identical patterns between ENSO episodes and seasonal rainfall. These findings inform decision-making and adaptation strategies for ENSO-driven rainfall variability. Temperatures showed predictable seasonal patterns, but have significantly increased over time, with maximum and minimum temperatures rising 0.014 °C to 0.421 °C and 0.027 °C to 0.485 °C per year respectively. This warming trend is negatively impacting water, crops, and livestock, requiring adaptation measures to build regional resilience. This study underscores the critical impact of climate variability on agriculture in the study area. The findings reveal shifts in rainfall patterns and temperature trends, providing essential insights for adapting agricultural practices.

Keywords: Climate**,** ENSO**,** Growing season**,** Trends**,** Variability**,** Northwestern Ethiopia

Mathematics
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12 (2024)

Multiscale Change Point Detection for Univariate Time Series Data with Missing Value

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Abstract

This paper studies the autoregressive integrated moving average (ARIMA) state space model combined with Kalman smoothing to impute missing values in a univariate time series before detecting change points. We estimate a scale-dependent time-average variance constant that depends on the length of the data section and is robust to mean shifts under serial dependence. The consistency of the proposed estimator is shown under the assumption allowing heavy tailedness. Integrating the proposed estimator with the moving sum and wild binary segmentation procedures to determine the number and locations of change points is discussed. Furthermore, the performance of the proposed methods is evaluated through extensive simulation studies and applied to the Beijing multi-site air quality dataset to impute missing values and detect mean changes in the data.

Keywords: ARIMA; Kalman smoothing; time-average variance constant; robust estimation; moving sum; wild binary segmentation

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Global, regional, and national stillbirths at 20 weeks' gestation or longer in 204 countries and territories, 1990–2021: findings from the Global Burden of Disease Study 2021

GBD 2021 Global Stillbirths Collaborators

Abstract

Background: Stillbirth is a devastating and often avoidable adverse pregnancy outcome. Monitoring stillbirth levels and trends—in a comprehensive manner that leaves no one uncounted—is imperative for continuing progress in pregnancy loss reduction. This analysis, completed as part of the Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) 2021, methodically accounted for different stillbirth definitions with the aim of comprehensively estimating all stillbirths at 20 weeks or longer for 204 countries and territories from 1990 to 2021. **Methods:** We extracted data on stillbirths from 11 412 sources across 185 of 204 countries and territories, including 234 surveys, 231 published studies, 1633 vital statistics reports, and 10 585 unique location-year combinations from vital registration systems. Our final dataset comprised 11 different definitions, which were adjusted to match two gestational age thresholds: 20 weeks or longer (reference) and 28 weeks or longer (for comparisons). We modelled the ratio of stillbirth rate to neonatal mortality rate with spatiotemporal Gaussian process regression for each location and year, and then used final GBD 2021 assessments of fertility and all-cause neonatal mortality to calculate total stillbirths. Secondary analyses evaluated the number of stillbirths missed with the more restrictive gestational age definition, trends in stillbirths as a function of Socio-demographic Index, and progress in reducing stillbirths relative to neonatal deaths.
Findings: In 2021, the global stillbirth rate was 23·0 (95% uncertainty interval [UI] 19·7–27·2) per 1000 births (stillbirths plus livebirths) at 20 weeks' gestation or longer, compared to 16·1 (13·9–19·0) per 1000 births at 28 weeks' gestation or longer. The global neonatal mortality rate in 2021 was 17·1 (14·8–19·9) per 1000 livebirths, corresponding to 2·19 million (1·90–2·55) neonatal deaths. The estimated number of stillbirths occurring at 20 weeks' gestation or longer decreased from 5·08 million (95% UI 4·07–6·35) in 1990 to 3·04 million (2·61–3·62) in 2021, corresponding to a 39·8% (31·8–48·0) reduction, which lagged behind a global improvement in neonatal deaths of 45·6% (36·3–53·1) for the same period (down from 4·03 million [3·86–4·22] neonatal deaths in 1990). Stillbirths in south Asia and sub-Saharan Africa comprised 77·4% (2·35 million of 3·04 million) of the global total, an increase from 60·3% (3·07 million of 5·08 million) in 1990. In 2021, 0·926 million (0·792–1·10) stillbirths, corresponding to 30·5% of the global total (3·04 million), occurred between 20 weeks' gestation and 28 weeks' gestation, with substantial variation at the country level.
Interpretation: Despite the gradual global decline in stillbirths between 1990 and 2021, the overall number of stillbirths remains substantially high. Counting all stillbirths is paramount to progress, as nearly a third—close to 1 million in total—are left uncounted at the 28 weeks or longer threshold. Our findings draw attention to the differential progress in reducing stillbirths, with a high burden concentrated in countries with low development status. Scarce data availability and poor data quality constrain our capacity to precisely account for stillbirths in many locations. Addressing inequities in universal maternal health coverage, strengthening the quality of maternal health care, and improving the robustness of data systems are urgently needed to reduce the global burden of stillbirths.
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Biofilm formation and antibiogram profile of bacteria from infected wounds in a general hospital in southern Ethiopia

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Abstract

Biofilm-producing bacteria associated with wound infections exhibit exceptional drug resistance, leading to an escalation in morbidity, worse clinical outcomes (including delay in the healing process), and an increase in health care cost, burdening the whole system. This study is an attempt to estimate the prevalence and the relationship between the biofilm-forming capacity and multi-drug resistance of wound bacterial isolates. The findings intended to help clinicians, healthcare providers and program planners and to formulate an evidence-based decision-making process, especially in resource-limited healthcare settings. This study was done to assess the prevalence of bacterial infections in wounds and the antibiogram and biofilm-forming capacity of those bacteria in patients with clinical signs and symptoms, attending a General Hospital in southern Ethiopia. A cross-sectional study was performed in Arba Minch General Hospital from June to November 2021. The study participants comprised 201 patients with clinically infected wounds. Demographic and clinical data were gathered via a structured questionnaire. Specimens from wounds were taken from each participant and inoculated onto a series of culture media, namely MacConkey agar, mannitol salt agar, and blood agar, and different species were identified using a number of biochemical tests. Antimicrobial susceptibility tests were performed by means of the Kirby-Bauer disc diffusion technique following the guidelines of the Clinical and Laboratory Standards Institute. A micro-titer plate method was employed to detect the extent of biofilm formation. Bivariable and multivariable logistic regression models were applied to analyse the association between dependent and independent variables, and P values ≤ 0.05 were considered as statistically significant. Data analyses were done with Statistical Package for the Social Sciences version 25. Out of the 201 clinically infected wounds, 165 were found culture-positive with an overall prevalence of 82% (95% CI: 75.9–86.9). In total, 188 bacteria were recovered; 53.1% of them were Gram-positive cocci. The often-isolated bacterial species were Staphylococcus aureus, 38.3% (n = 72), and Pseudomonas aeruginosa, 16.4% (n = 31). The Gram-positive isolates showed considerable resistance against penicillin, 70%, and somewhat strong resistance against tetracycline, 57.7%. Gram-negative isolates showed severe resistance to ampicillin, 80.68%. The overall multi-drug resistance (MDR) among isolates was 48.4%. Extended beta-lactamase (ESBL)-producing Gram-negatives and methicillin-resistant Staphylococcus aureus (MRSA) accounted for 49 and 41.67%, respectively; 62.2% of the isolates were biofilm formers and were correlated statistically with MDR, ESBL producers, and MRSA ($P < 0.005$). The extent of biofilm formation and the prevalence of MDR bacteria associated with infected wounds hint at a public health threat that needs immediate attention. Thus, a more balanced and comprehensive wound management approach and antimicrobial stewardship program are essential in the study setting.

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Feed resources, feeding system and feed balance of dairy cattle in Chencha District, Southern Ethiopia

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Abstract

Background: Dairy cattle feed supplies in the tropics, and particularly in Ethiopia, are mostly derived from base diets (natural and improved grasslands, agricultural wastes, fodder trees and shrubs), agro-industrial by-products and non-conventional feeds. The availability of major feed resource kinds, sources and dairy cattle feeding practises is primarily influenced by agro-ecology and season, as well as their interactions.
Objectives: The research was carried out in the Chencha District of Gamo Zone, Southern Ethiopia, with the goals of assessing the available, feeding system, opportunity, limits and copying strategy of dairy cattle production, as well as estimating feed balance.
Methods: Data were gathered through primary and secondary data sources, field observations, key informant interviews, focus group talks and individual interviews. The survey data were stratified into altitudes, coded and analysed using the Statistical Package for Social Sciences version 20 and the general linear model approach. Cross-tabulation was used to examine the statistical variance of categorical data. Results: The presence of different feed resource types, distinct agro-ecologies ($p < 0.05$) and crop residue accessibility were the major opportunities for dairy cattle production in the study district, but land scarcity, a lack of dry season forages and land degradation due to erosion were the major constraints for dairy cattle feed production. In the research district, the main feed resource–copying approaches were reducing the number of dairy animals, saving optional feeds and purchasing optional feeds. The total mean of dairy cow feed supply to tropical livestock unit in terms of dry matter (DM) production each year was 3.86 t of DM/HH/annual, with a negative feed balance of 8.09 t that varied with seasons and agro-ecology ($p < 0.05$).
Conclusions: According to the findings of this study, the low production of dairy cattle in the district is clearly related to the scarcity of feed resources. To address these issues, alternative feed production technologies should be implemented, such as farmers practising forage development on their own crop land and collecting crop residues during crop harvesting times and storing them under shed; the nutritive value of different types of fodder trees and shrubs should be further determined in the future and feed storage methods, particularly hay and silage, should be used when there are an abundance of feed resources available.

Keyword: Saltitudes, dairy cattle, feed balance, feed resources, feeding system

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Seasonal and altitudinal dynamics in secondary metabolite composition of Commelina forage species in Konso zone, southern Ethiopia

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Abstract

Exploring the type and amounts of the secondary metabolites (SMs) in a given fodder species was considered as a meaningful act for safe and profitable utilization of that particular feedstuff in the livestock industry. This study was conducted in the Konso zone, southern Ethiopia, to explore the secondary metabolite composition of Commelina species in two seasons and at two different altitudes. Samples were collected from the two altitudes and seasons. A completely randomized design was used in a factorial arrangement (five species (C. benghalensis, C. imberbis, C. diffusa, C. albescens, and C. africana), two altitudes, and two seasons) with three repetitions per treatment. The SM contents of the Commelina species were reasonably influenced by both seasonal and altitudinal changes. The mean alkaloid (3.67%), total phenols (9.76 mg GAE/g), flavonoid (3.81 mg CE/g) and condensed tannin (1.10 mg CE/g) values for the herb species in wet season inclined ($p < 0.001$) to 7.02%, 14.07 mg GAE/g, 7.68 mg CE/g and 2.38 mg CE/g, respectively, in dry season. The wet season saponin concentration of the species (2.65 g/Kg) significantly decreased ($p < 0.001$) to 1.28 g/Kg in the dry season. Similarly, the lowland saponin (2.26 g/Kg), alkaloid (3.70%), total phenols (10.89 mg GAE/g), flavonoid (4.71 mg CE/g), and condensed tannin (0.98 mg CE/g) contents were increased ($p < 0.01$) to 3.03 g/Kg, 5.47%, 13.61 mg GAE/g, 6.37 mg CE/g, and 1.81 mg CE/g, respectively, in the midlands. Alkaloids, total phenols, flavonoids and condensed tannin concentrations showed positive correlations with each other ($P<0.05$) and with seasonal ($P<0.001$) and altitudinal changes ($P<0.001$) as well. The findings of this study suggested that the SM concentrations of Commelina species were within the limits tolerable for ruminants. In conclusion, Commelina species could serve as a safe and beneficial forage herb to boost nutrient intake, improve nutrient use efficiency and hinder methane emissions, for animals consuming them, in areas where they are available in abundance.

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A Comprehensive First Principle Investigation of Ti-Doped Ca (Hf1–xTix) S3 Alloys: Implications on Electronic Structure and Stability with Hubbard Correction

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Abstract

Abstract: This study investigates the potential of Ca (Hf1–xTix) S3 chalcogenide perovskite alloys (orthorhombic phase) for optoelectronic applications. Density functional theory (DFT) calculations explore the influence of titanium (Ti) doping (x = 0, 0.25, 0.50, 0.75, 1.00) on the material's structural, thermodynamic, electronic, and optical properties. The calculations confirm the structural and thermodynamic stability of the alloys through tolerance factor and formation energy calculations. Interestingly, Ti doping is found to influence the bulk modulus and its derivative, affecting the material's compressibility and hardness. A crucial finding is the decrease in bandgap with increasing Ti concentration, falling within the optimal range for efficient light absorption (1.0–1.6 eV). This suggests that Ti doping can enhance the optoelectronic properties of Ca (Hf1–xTix) S3. Furthermore, all studied compositions (x = 0, 0.25, 0.50, 0.75, 1.00) exhibit favorable light absorption across the visible to ultraviolet spectrum, making them promising candidates for solar cells and other optoelectronic devices.

Keywords: DFT**,** Hubbard correction**,** structural stability**,** thermodynamic stability**,** electrical property**,** optical property

Discover Food
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4 (2024)

Assessing the current status of food security under climate variability and the role of household-level adaption strategies near Ghibe III hydroelectric dam, Ethiopia

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Abstract

The food security problem is exacerbated by low production and crop loss in many parts of the world and Ethiopia in particular. Prior literature less documented the role of innovative adaptation strategies to climate variability in ensuring food security. This study investigated the current status of food security and the role of adaptation strategies in the context of climate unpredictability in the Ghibe III dam area, in Southern Ethiopia. To achieve the intended objective, data were collected from 175 adapters and 209 non-adapters through multi-stage sampling using a questionnaire supplemented with key informant interviews and focus group discussions. A probit regression model was used to determine the factors affecting farmers' adaptation. Propensity score matching (PSM) was employed to evaluate the impact of the adaptation strategies on food security. Food security was measured by the food balance sheet model (HBSM)). The rainfall anomaly index and Mann–Kendall tests were employed for the analysis of rainfall and temperature. The findings showed that throughout 30 years, temperatures were rising while rainfall was falling. Receiving early warning weather systems, credit services, extension services, family size, and farm size had a significant impact on adaptation strategies at a 1% level. Adapters showed an increase in food security (7–9%) than non-adapters. Adapters consumed 2101.6 mean calories per day/adult equivalent compared to non-adapters who consumed 1151.5 kcal. Conservation agriculture and climate-resilient crop varieties should be implemented by farmers supported by local-level government bodies at large.

Keywords: Adaptation, Climate variability, Crop cover, Food security, Tillage

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Geographical distribution of emergency obstetric and neonatal care signal functions in Ethiopian health facilities: 2021–2022 Ethiopian service Provision Assessment (SPA)

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Abstract

Background: The maternal mortality ratio in Ethiopia is still high, with an estimate of 412 deaths per 100,000 live births in 2016. Signal functions for emergency obstetric and neonatal care must be accessible and usable in order to successfully prevent maternal deaths. It is an important strategy to reduce maternal and newborn morbidity and mortality in countries with limited resources. Hence, an assessment of the availability of fully functioning EmONC services and their coverage per 500,000 people in Ethiopia is crucial.
Methods: This study is a retrospective analysis of data from the Ethiopian Service Provision Assessment Survey (ESPA), a national-level survey data source. Data collection for the survey took place from August 11, 2021, to February 4, 2022. For this investigation, 905 healthcare facilities in total were evaluated for the availability of emergency obstetric and new-born care (EmONC) services at all hospitals, selected health centers, and private clinics were evaluated. Descriptive data analysis was done by the using statistical package for social science version 26 (SPSS) to run frequency and cross-tabs. Global Positioning System (GPS) (arc map 10.8) Software was used for spatial distribution in order to locate the physical accessibility of EmONC providing health facilities on flat map surfaces. It was projected based on Ethiopia's geographic coordinate system at Adindan UTM zone 370N.
Results: Of 905 health facilities, only 442 (49%) could provide fully functioning BEmONC, and 250 (27.6%) health facilities have been providing fully functioning CEmONC. The overall coverage of BEmONC ratios in Ethiopia is 1.5–3.77 per 500,000 population and CEmONC (0.83–2.1) per 500,000 populations. Regions such as Amhara, SNNPR and Addis Ababa had found to have high BEmONC ratio. The geographical distribution of the EmONC showed that the central areas of the country, such as southwest Shewa and east Shewa, the Oromia region, the northern areas of the South Nation, nationalities, and peoples regions (SNNPR), including the Gurage zone and the Wolaita-Soddo zone, and the middle areas in the Amhara region (west Gojjam or around Bahir Dar town), and the southern areas, Debra Tabor and Debre Birhane zones, all had greater access to facilities offering complete EmONC services. **Conclusion:** Comprehensive emergency obstetrics and neonatal care (CEmONC) in Ethiopia met WHO recommendations, despite basic emergency obstetric and neonatal care (BEmONC) falling below those standards in Ethiopia. There are extremely large disparities in the accessibility of both basic and comprehensive emergency obstetrics and neonatal care in Ethiopia. Thus, Strategic planning is needed to improve infrastructures and inputs for EmONC services, particularly in remote areas of the country. Additionally, private facilities ought to place a priority on the provision of these services.

Key factors: BEmONC**,** CEmONC**,** EmONC**,** In Ethiopia

Midwifery
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139 (2024)

Fear of childbirth and its associated factors among pregnant women in East Africa: Systematic review and meta-analysis

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Abstract

Background: Tokophobia is a mild to extreme fear of pregnancy and/or childbirth that may cause a woman to avoid giving birth. It is a common obstetrical problem that affects women's health. Some studies have found that fear of childbirth is common in East African countries. However, there was inconsistency across those studies, and no study was undertaken to report the pooled prevalence of fear of childbirth and its associated factors. As a result, the purpose of this systematic review and meta-analysis is to identify the pooled prevalence of fear of childbirth and its associated factors in Eastern Africa.

Methods: We conducted a systematic review and meta-analysis of studies on the prevalence and associated factors of childbirth fear using Pub Med, Hinari, Google Scholar, and East African University archives. Data were extracted using a data extraction format developed in Microsoft Excel, and the analysis was carried out with STATA 14 statistical software. Each article's quality was assessed using the Joanna Briggs Institute's critical appraisal tool for prevalence studies. The Cochrane Q statistics and I2 test were used to examine heterogeneity between studies. Subgroup analysis was done by country and sample size. To assess publication bias, a funnel plot, and Egger's regression test were used.

Results: This systematic review and meta-analysis included eleven studies. The pooled prevalence of the fear of childbirth among pregnant women in East Africa was 27.86 %. A history of labor and delivery complications (OR = 5.41, 95 %CI = 2.20, 8.63), poor social support (OR = 4.50, 95 %CI = 1.70, 11.92), primiparity (OR = 1.91, 95 %CI = 1.17, 3.12), no ANC follow-up (AOR=2.65, 95 %CI=1.48, 4.74), and unplanned pregnancy (AOR=4.88, 95 %CI=1.23, 19.31) were statistically associated with the fear of childbirth.

Conclusion: The pooled prevalence of fear of childbirth was high. Previous labor and delivery complications, poor social support, primiparity, a lack of antenatal care follow-up, and unplanned pregnancy were all statistically associated with fear of childbirth. To address this, healthcare providers should focus on individualized psychological support for pregnant women who experience tokophobia. Furthermore, encouraging comprehensive antenatal care and strengthening social networks can reduce the fear of childbirth and promote maternal well-being.

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Forecasting the effects of smoking prevalence scenarios on years of life lost and life expectancy from 2022 to 2050: a systematic analysis for the Global Burden of Disease Study 2021

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Abstract

Background: Smoking is the leading behavioural risk factor for mortality globally, accounting for more than 175 million deaths and nearly 4·30 billion years of life lost (YLLs) from 1990 to 2021. The pace of decline in smoking prevalence has slowed in recent years for many countries, and although strategies have recently been proposed to achieve tobacco-free generations, none have been implemented to date. Assessing what could happen if current trends in smoking prevalence persist, and what could happen if additional smoking prevalence reductions occur, is important for communicating the effect of potential smoking policies.

Methods: In this analysis, we use the Institute for Health Metrics and Evaluation's Future Health Scenarios platform to forecast the effects of three smoking prevalence scenarios on all-cause and cause-specific YLLs and life expectancy at birth until 2050. YLLs were computed for each scenario using the Global Burden of Disease Study 2021 reference life table and forecasts of cause-specific mortality under each scenario. The reference scenario forecasts what could occur if past smoking prevalence and other risk factor trends continue, the Tobacco Smoking Elimination as of 2023 (Elimination-2023) scenario quantifies the maximum potential future health benefits from assuming zero percent smoking prevalence from 2023 onwards, whereas the Tobacco Smoking Elimination by 2050 (Elimination-2050) scenario provides estimates for countries considering policies to steadily reduce smoking prevalence to 5%. Together, these scenarios underscore the magnitude of health benefits that could be reached by 2050 if countries take decisive action to eliminate smoking. The 95% uncertainty interval (UI) of estimates is based on the 2·5th and 97·5th percentile of draws that were carried through the multistage computational framework. **Findings:** Global age-standardised smoking prevalence was estimated to be 28·5% (95% UI 27·9–29·1) among males and 5·96% (5·76–6·21) among females in 2022. In the reference scenario, smoking prevalence declined by 25·9% (25·2–26·6) among males, and 30·0% (26·1–32·1) among females from 2022 to 2050. Under this scenario, we forecast a cumulative 29·3 billion (95% UI 26·8–32·4) overall YLLs among males and 22·2 billion (20·1–24·6) YLLs among females over this period. Life expectancy at birth under this scenario would increase from 73·6 years (95% UI 72·8–74·4) in 2022 to 78·3 years (75·9–80·3) in 2050. Under our Elimination-2023 scenario, we forecast 2·04 billion (95% UI 1·90–2·21) fewer cumulative YLLs by 2050 compared with the reference scenario, and life expectancy at birth would increase to 77·6 years (95% UI 75·1–79·6) among males and 81·0 years (78·5–83·1) among females. Under our Elimination-2050 scenario, we forecast 735 million (675–808) and 141 million (131–154) cumulative YLLs would be avoided among males and females, respectively. Life expectancy in 2050 would increase to 77·1 years (95% UI 74·6–79·0) among males and 80·8 years (78·3–82·9) among females.

Interpretation: Existing tobacco policies must be maintained if smoking prevalence is to continue to decline as forecast by the reference scenario. In addition, substantial smoking-attributable burden can be avoided by accelerating the pace of smoking elimination. Implementation of new tobacco control policies are crucial in avoiding additional smoking-attributable burden in the coming decades and to ensure that the gains won over the past three decades are not lost.

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101 (2024)

Corrigendum to "Study of structural, electromagnetic and dielectric properties of cadmium substituted Ni–Zn nanosized ferrites"

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Abstract

Sol-gel auto-combustion method was adopted to prepare Cd2+ ions substituted Ni–Zn nanosized ferrites having a chemical formula Ni0.5Zn0.5-xCdxFe2O4 (0.0
. Their structural, electromagnetic, and dielectric properties were investigated by using XRD, FE-SEM, EDS, FTIR, VSM, and IS. The XRD analysis revealed a single-phase cubic structure of all samples. The addition of cadmium increased the lattice constant and cell volume of Ni–Zn ferrite due to the difference in the ionic radii between Cadmium (0.97 Å) and Zinc (0.74 Å). FESEM images showed irregularly shaped grain sizes in the range of 40 to 73 nm with random orientations and some agglomeration. The FTIR analysis also confirmed the presence of spinal ferrite phase functional groups in all samples. The saturation magnetization decreased (from 89.51 to 71.32 emu/g) with increasing cadmium content. However, the remanent magnetization and coercivity parameters increased with an increase in cadmium content. The dc resistivity as a function of the temperature of all samples was investigated, and the activation energies were found to be in the range of 0.48 to 0.51 eV. The dielectric loss decreased with increasing cadmium content. However, the dielectric constant and dielectric loss tangent (tan) varied non-monotonically with increased cadmium content.

Systematic Reviews
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Prevalence of thyroid dysfunction and associated factors among adult type 2 diabetes mellitus patients, 2000–2022: a systematic review and meta-analysis

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Abstract

Background: Thyroid dysfunction (TD) and type 2 diabetes mellitus (T2DM) frequently co-occur and have overlapping pathologies, and their risk increases with age. Thyroid dysfunction along with T2DM will worsen macro- and microvascular complications, morbidity, and mortality. **Methods:** The Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement guideline was followed. The databases used were Embase, ScienceDirect, PubMed, and Google Scholar. The Joana Briggs Institute (JBI) scale was used to assess the quality of the included studies. The data was extracted by Microsoft Excel and analyzed through STATA version 14 software. The overall pooled prevalence of TD and its main components were estimated using the random-effects model. The consistency of studies was assessed by I2 test statistics. Pooled meta-logistic regression was used to present the pooled prevalence with a 95% confidence interval (CI). Besides, subgroup and sensitivity analyses were employed.

Result: Thirty-eight studies were included. The pooled prevalence of TD was 20.24% (95% CI: 17.85, 22.64). The pooled prevalence of subclinical hypothyroidism, hypothyroidism, subclinical hyperthyroidism, and hyperthyroidism was found to be 11.87% (95% CI: 6.90, 16.84), 7.75% (95% CI: 5.71, 9.79), 2.49% (95% CI: 0.73, 4.25), and 2.51% (95% CI: 1.89, 3.13), respectively. Subgroup analysis based on continent revealed a higher prevalence of TD in Asia and Africa. Factors like being female, HbA1c ≥ 7%, DM duration > 5 years, family history of TD, central obesity, smoking, the presence of retinopathy, and neuropathy were found associated with TD. **Conclusion:** The current systematic review and meta-analysis showed that the TD's pooled prevalence was relatively higher than the general population. Therefore, regular screening of TD should be done for T2DM patients.

Keywords: Thyroid Dysfunction, Type two Diabetes mellitus, Factors, Meta-analysis, Systematic review

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587 (2024)

Corrigendum to "Study of Fe-doped and glucose-capped CeO2 nanoparticles synthesized by co-precipitation method"

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Abstract

CeO2, Fe-doped CeO2 (Fe-CeO2), and glucose-capped CeO2 (G-CeO2) nanoparticles (NPs) with crystallite sizes between 31.1 and 45.03 nm were prepared by co-precipitation method. XRD, FT-IR spectroscopy, UV–Vis spectroscopy, Photoluminescence, and bacterial analysis studies were conducted. The XRD patterns revealed a single-phase cubic structure formation of all samples. The formation of absorption bands in all samples was identified by FT-IR analysis between 400 and 4000 cm−1. All samples were optically activated in the ultraviolet light region. The band gap values were found as 3.21, 3.33, and 3.39 eV for CeO2, Fe-CeO2, and G-CeO2 NPs, respectively. Fe-CeO2, and G-CeO2 NPs delivered lower photoluminescence emission intensity. Enhancement of antibacterial activity was observed because of Fe-doping and glucose-capping in CeO2 NPs. Among all samples, G-CeO2 NPs exhibited excellent antibacterial activity against E. coli bacteria.

Scientific Reports
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14 (2024)

Determinants of breakfast skipping among pregnant women from South Ethiopia Gamo Zone: a case-control study

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Abstract

Skipping breakfast during pregnancy presents several challenges and potential health risks for both the mother and her baby. Breakfast plays a crucial role in providing essential nutrients and energy after an overnight fast. Skipping breakfast during pregnancy creates an unhealthy environment for the fetus. Thus, this study aimed to identify the determinants of breakfast skipping among pregnant women. An unmatched, community-based case-control study was conducted among 116 randomly selected cases (breakfast skippers) and 232 neighboring controls (regular breakfast consumers). Data was collected using pre-tested interviewer-administered structured questionnaire. Binary logistic regression analysis was employed to determine predictors of breakfast skipping using STATA version 16. The odds of non-formal education (AOR = 3.92; 95% CI: 1.75, 8.78), low socioeconomic status (AOR = 2.93; 95% CI: 1.12, 7.68), poor dietary knowledge (AOR = 2.89; 95% CI: 1.29, 6.47), and experiencing morning sickness (AOR = 2.57; 95% CI: 1.13, 5.84) were higher among cases than controls. The odds of breakfast skipping were higher for every increase in family size (AOR = 1.65; 95% CI: 1.25, 2.18), but decrease with every unit increase in mid-upper arm circumference (AOR = 0.58; 95% CI: 0.46, 0.72) and weekly frequency of drinking coffee leaf tea beverage (AOR = 0.84; 95% CI: 0.78, 0.89). Findings of this study showed that poor economic status, lack of formal education, poor dietary knowledge, having morning sickness, having large family size, maternal nutritional status, and frequent consumption of coffee leaf tea beverage were significantly associated with breakfast skipping among pregnant women. Thus, efforts should focus on improving dietary awareness during pregnancy, strengthening dietary counseling during antenatal care, enhancing access to contraceptive services, and ensuring timely management of morning sickness.

Keywords: AM-HDSS**,** Breakfast skipping Determinants**,** Pregnant women

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Time to death and its predictors among traumatic brain injury patients admitted to East Amhara comprehensive specialized hospitals, Ethiopia: retrospective cohort study

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Abstract

Background: Globally, 64–74 million individuals around the world are estimated to sustain traumatic brain injury every year. Moderate and severe traumatic brain injury can lead to a lifetime physical, cognitive, emotional, and behavioral changes. There were limited studies conducted in Ethiopia regarding to traumatic brain injury mortality.
Methods: An institutional based retrospective cohort study was conducted on 429 randomly selected traumatic brain injury patients aged 18 to 64 years who were admitted to East Amhara Comprehensive Specialized Hospitals from January 1, 2016 to December 31, 2021. Kobo toolbox was applied for data collection and exported to Stata version 17 for data processing and analysis. To estimate death free time, a Kaplan Meier failure curve was used. The Cox proportional hazards regression model was used at the 5% level of significance to determine effect of predictor variables on time to death.
Result: A total of 429 traumatic brain injury patients aged 18 to 64 years were included with response rate of 91.3% and 145(33.8%) were dead. Open injuries (AHR = 0.25; 95% CI: 0.18–0.36), co-existing injuries (AHR = 0.40; 95% CI: 0.24–0.66), ICU admission (AHR = 0.42; 95% CI: 0.29–0.60), arrival within 4–24 h (AHR = 3.48; 95% CI: 2.01–6.03), arrival after 24 h (AHR = 6.69; 95% CI: 3.49–12.28), subdural hematoma (AHR = 2.72; 95% CI: 1.77–4.19), serum albumin < 3.5 g/dL (AHR = 0.66; 95% CI: 0.49–0.94), moderate (AHR = 0.56; 95% CI: 0.21–0.89), and mild traumatic brain injury (AHR = 0.43; 95% CI: 0.29–0.56) were predictors of traumatic brain injury mortality.
Conclusion: The finding of this study showed that the mortality was 1/3rd of the total patients. Open injuries, co-existing injuries, ICU admission, arrival time (4–24 h and > 24 h), subdural hematoma, serum albumin < 3.5 g/dL and severity of traumatic brain injury (mild and moderate) were predictors of traumatic brain mortality. Therefore, working on these factors to reduce the morality of traumatic brain injury patients is very important.

Keywords: Predictors, Time to death, Traumatic brain injury, Ethiopia

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Spatial distribution and determinants of exclusive breastfeeding practice among mothers of children under 24 months of age in Ethiopia: spatial and multilevel analysis

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Abstract

Background: Breast milk is the first, highly valuable, and solely natural food recommended for infants in their first six months of life, which is critical for children's overall growth and development. Evidence suggests that exclusive breastfeeding differs by geographic area in Ethiopia. However, little is known regarding the geographic distribution of exclusive breastfeeding practice. Hence, this study aimed to assess exclusive breastfeeding practice, its geographic variation and associated factors among Ethiopian mothers.

Method: The study used the 2019 Ethiopian mini demographic and health survey data. All living children born 0–23 months before the survey were included. Global Moran's I statistics on Arc-GIS and Getis Ord Gi* statistics was used to visualize the spatial pattern and hotspot and cold spot areas, respectively. Kulldorff SaTScan was used to show purely significant spatial clusters. The associated factors were identified using a multilevel mixed-effects logistic regression model. Statistically significant factors were reported using the AOR with a 95% CI and a p-value of < 5%.

Result: The coverage of exclusive breastfeeding practice in Ethiopia was 56.05% (95% CI: 53.95%, 58.10%). The spatial pattern was non-random across the country's regions. Somalia, Gambela, Benshangul Gumuz, Dire Dawa, and Harari regions had low clustering of exclusive breastfeeding practices, whereas Amhara, Eastern SNNPR, and Central and Northern Oromia regions had high clustering. Children born through caesarean delivery [AOR = 0.36; 95% CI: 0.21, 0.63], initiated breastfeeding within the first 1 h [AOR = 0.55; 95% CI: 0.34, 0.90], after 1–24 h of delivery [AOR = 0.36; 95% CI: 0.24, 0.54], after a day [AOR = 0.04; 95% CI: 0.02, 0.08], and women residing in the pastoralist region [AOR = 0.22; 95% CI: 0.12, 0.39] or city administrations [AOR = 0.49; 95% CI: 0.27, 0.89] had lower odds of exclusive breastfeeding practice.

Conclusion: Exclusive breastfeeding practice in Ethiopia remained low. The practice had a spatial variation across the country. Caesarean section delivery, late breastfeeding initiation, and region were statistically significant variables. Therefore, promoting timely initiation of breastfeeding and improving the utilization of maternal health services and designing special intervention strategy for women residing in city administrations and pastoralist regions of the country may increase the coverage of exclusive breastfeeding practice.

Keywords: Spatial distribution, Exclusive breastfeeding, Early initiation of breastfeeding, Children, Ethiopia

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Probiotic potential of lactic acid bacteria isolated from Ethiopian traditional fermented Cheka beverage

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Abstract

Introduction: Lactic acid bacteria (LAB) are a cluster of microbes distributed in a variety of environments and have potential probiotic activity to improve human well-being. This study was aimed at assessing the probiotic potential of LAB isolated from Cheka, an Ethiopian traditionally fermented beverage.

Method: Pure isolates obtained from 16 Cheka samples from Konso (n = 8) and Derashe (n = 8) were characterized morphologically, biochemically, and physiologically by considering basic criteria to identify the LAB. The probiotics properties of the LAB were evaluated in vitro at low pH values (2.0 and 3.0), and two bile salt concentrations (0.3 and 0.5%) for 3 and 6 h. The 16 S rRNA gene sequencing was done using an ABI 3730xl sequencer, and the gene sequences were aligned.

Results: Of the 27 pure isolates, 11 isolates were proven to be LAB with non-motile, negative for catalase, and non-spore former characteristics. Based on cultural characteristics and sugar fermentation ability, the 11 isolates were assembled into the genera Lactobacillus (55%), Lactococcus (18%), Pediococcus (18%), and Leuconostoc (9%). At pH 3.0 and a bile salt concentration of 0.3%, isolate ChK-11 showed a better survival rate (97 and 94%) than other isolates [ChK-7 (93 and 80%) > ChD-5 (84 and 76%) > ChD-8 (46 and 36%) > ChK-4 (41 and 34%)] for 6 and 3 h, respectively. According to 16 S rRNA sequencing results, isolates ChK-11 and ChK-7 were found to be Weissella paramesenteroides and Leuconostoc pseudomesenteroides with sequence similarity of 99 and 91%, respectively.

Conclusions: In the present study, probiotic LAB (Weissella paramesenteroides and Leuconostoc pseudomesenteroides) was successfully isolated and sequenced from Cheka samples. The findings of this in vitro study indicated that fermented beverages like Cheka are a source of the LAB with probiotic functional properties. Overall, Weissella paramesenteroides and Leuconostoc pseudomesenteroides isolates, which showed promising probiotic properties under in vitro conditions, can be used for starter culture development for the Cheka fermentation process.

Keywords: Cheka**,** Derashe**,** Konso**,** Lactic acid bacteria**,** Probiotic**,** Starter culture

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Factors associated with essential newborn care practice among obstetric care providers in public hospitals in Gamo, Gofa, and Wolayta zones, southern Ethiopia: A facility-based cross-sectional study, 2022

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Abstract

Background: Almost everywhere, neonatal mortality can be decreased with ease if competent obstetricians give the necessary treatment. Unfortunately, observational techniques were not used to examine basic essential newborn care practice among obstetric care providers in Ethiopia. Thus, the purpose of this study was to evaluate factors related to essential newborn care practice using observational techniques among obstetric care providers in public hospitals in the Gamo, Gofa, and Wolayta zones, southern Ethiopia.

Methods: An institutional-based cross-sectional study carried out from May 15 to June 30, 2022. A simple random sampling method was used. Structured self-administered questionnaires with a clinical observational checklist were used to collect data. Data imported into Epidata version 4.6 and analyzed using the SPSS Version 25. Bivariable and multivariable analyses were used to identify factors associated with essential newborn care practices. An odds ratio with a 95% confidence interval was used to assess the direction and strength of the association.

Results: The overall magnitude of good essential newborn care practice among obstetric care providers was 53.5% (95% CI = 49, 58). Factors positively associated with the practice of essential newborn care were having interest on working in delivery room (AOR = 3.16, 95% CI = 1.71,5.83), having no work load (AOR = 2.96, 95% CI = 1.78,4.49), received in-service training (AOR = 3.09, 95% CI = 1.75,5.45), having supportive supervision (AOR = 3.41, 95% CI = 1.25, 9.24), and having good knowledge on essential newborn care (AOR = 3.04, 95% CI = 1.89,4.90). **Conclusion**: The observed level of essential newborn care practices among obstetric care providers underscores the necessity for targeted interventions that stimulate interest in delivery room work, effectively manage workloads, and offer comprehensive training along with supportive supervision. By concentrating on these aspects and enhancing providers' knowledge, we can significantly improve essential newborn care practices.

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Contextual success and pitfalls of mHealth service for maternal and child health in Africa: An Intervention, Context, Actors, Mechanism, and Outcome (ICAMO) framework guided systematic review of qualitative evidence

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Abstract

Introduction: Mobile health (mHealth) interventions have shown potential to improve maternal and child health outcomes in Africa, but their effectiveness depends on specific interventions, context, and implementation quality. Challenges such as limited infrastructure, low digital literacy, and sustainability need to be addressed. Further evaluation studies are essential to summarize the impact of mHealth interventions. Thus, this synthesis focuses on qualitative evidence of the impact of mHealth on maternal and child health in Africa to summarize such evidence to help policy decisions.
Methods: A qualitative systematic review guided by the concepts of Intervention, Context, Mechanism, and Outcome (ICAMO) was employed in this study. The GRADE CERQual assessment and methodological constraints tools were utilized in the review to ascertain the level of confidence in the evidence and to examine the methodological limitations. The JBI checklist for qualitative research appraisal was also consulted during the review.
Results: The current review contains 32 eligible studies from databases such as CINAHL, EMBASE, MEDLINE, Scopus, Web of Science, HINARI, and Cochrane Library. The review demonstrated substantial improvements in the HCP-woman relationship, communication system, maternal and child healthcare uptake, health-seeking behavior, and HCP skills. Economic capacities, maternal education, and the low quality of existing services challenged participants. **Conclusion:** mHealth significantly improves maternal and child health outcomes in Africa. This review showed it can improve healthcare access, empower women, and contribute to the region's goal of universal health coverage. However, the challenges such as low partner support, high costs for services, and poor quality of current care as narrated by women need commitment from health authorities in the continent. The evidence from this review suggests that mHealth can be implemented to improve maternal and child health in Africa. Trial registration: PROSPERO: CRD42023461425.
Keywords: MHealth**,** Child health**,** maternal health**,** Qualitative**,** Africa

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Knowledge, attitude, and practice towards hepatitis B and C virus infection and associated factors among adults living at selected woredas in Gamo Zone, Southern Ethiopia: a cross-sectional study

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Abstract

Background: Hepatitis is an inflammation of the liver tissue. It is one of the serious public health problems. Though an individuals' knowledge, attitude, and practice level is very vital in order to ensure the control of its adverse health impacts, little is known regarding these issues in the community level. Therefore, this study was aimed to assess knowledge, attitude, and practice towards hepatitis B and C virus infection and associated factors among adults living at selected woredas in Gamo Zone, Southern Ethiopia.

Methods: Community based cross-sectional study design was conducted among 633 adults living at selected woredas in Gamo Zone, Southern Ethiopia. Data were collected by pretested, well-structured questionnaire. The collected data were checked, coded and entered into Epi-data version 4.6.0.2 and were exported to SPSS version 25 for analyses. Bivariable and multivariable logistic regression were done to identify independent factors associated with knowledge, attitude, and practice towards hepatitis B and C virus infection.

Results: According to this study, 366(58.1%), 95% CI: (54.23–61.96) of the participants had good knowledge. 381(60.5%), 95% CI: (56.65–64.30) of the participants had favourable attitude. 317(50.3%), 95% CI: (46.40–54.23) of the participants had good practice. From factor analysis, sex, number of sexual partners, sharing sharp material, and vaccination status were significantly associated with knowledge; residence, occupational status, income level, sharing sharp material, and vaccination status were significantly associated with attitude; and residence, occupational status, and vaccination status were identified to be significantly associated with practice towards Hepatitis B and C virus infection.

Conclusion: Based on the study findings, it could be observed that good knowledge, favourable attitude, and good practice were indicated nearly above the half, only by half, and nearly above the half of the study participants respectively. Implementing actions that could increase awareness regarding limiting the number of sexual partner, not sharing sharp materials, and urbanization is recommended. Moreover, woreda administrators, and other related authorities should consider knowledge, attitude, and practice as an implementation area, and also it would be better to create an opportunities to promote vaccination practices.

Keywords: Hepatitis, Knowledge, Attitude, Practice, Adults, Southern Ethiopia

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Reflective Practice in Higher Education Institutions: Exploring Teachers' Reflective Experiences and Challenges in Ethiopian Public Universities

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Abstract

Teachers are the most important resource in any school system. However, operating at the intersection of knowledge, skills, and the transmission capacity of values through reflective practice can be challenging. This study focuses on the experience and challenges of teachers in higher education institutions (HEIs) in Ethiopian public universities when it comes to reflective practice. To achieve our objective, we used a descriptive survey research design with a mixed research approach to collect primary data from 140 HEIs teachers (127 male and 13 female) at four public universities in Ethiopia. We employed a random sampling technique and utilized questionnaires, and interviews. We used two types of questions to gather data: one to assess the teachers' experience with reflective practice and levels of instruction, and the other to identify problems and instruction levels. Qualitative data were analyzed through subject description, while quantitative data were tested using descriptive, Pearson correlation, and univariate analysis of ANOVA statistics. The results indicate that the experience of HEIs teachers reveals significant associations in all favorable aspects of reflective practice components (i.e., reflection-in-action, reflection-on-action, reflection-with-action, and self-appraisal). However, some teachers agreed or disagreed that they faced challenges in their teaching experience. Some problems encountered were agreed upon, while others were not. Based on these findings, we provide recommendations for improvement.

Keywords: Challenges in reflective practice**,** HEIs teachers**,** Public universities**,** Reflective Practice**,** Teachers' experiences in reflective practice

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Insights into psychosocial problems and associated factors among higher education students in Ethiopia: a cross-sectional study

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Abstract

While there has been extensive research on well-known psychosocial problems like depression, anxiety, and stress among higher education students, emerging issues such as emotional problems, antisocial behavior, trauma experiences, and academic difficulties are not as thoroughly studied, particularly in the context of Ethiopian higher education students. These updated psychosocial problems are crucial to explore due to their potentially significant impact on students' academic performance, personal development, and future prospects. Therefore, this study aims to explore the current psychosocial issues faced by adolescent students at Arba Minch University and identify the factors associated with them. To accomplish this objective, a survey questionnaire was distributed to a sample of 300 university students through a cross-sectional study. The survey questionnaire was designed to provide a thorough understanding of the various types of psychosocial problems experienced by the students. The findings revealed that the most prevalent psychosocial problems among higher education adolescent students were emotional problems (6.7% high/severe, 46.3% moderate), antisocial behavior (5% high/severe, 54.7% moderate), trauma experiences (7% high/severe, 23% moderate), and academic problems (8.3% high/severe, 23% moderate). The prevalence of no/low psychosocial problems was 47%, 40.3%, 69.3%, and 68.7%, respectively. Additionally, statistically significant ($p < 0.05$) associated factors to these psychosocial problems were identified: gender for academic problems, religion affiliation for antisocial behavior, trauma experiences, marital status for trauma experiences, living situation during holidays for emotional problems, age for emotional problems and antisocial behavior, and educational sponsorship for antisocial behavior. The study found that students who lacked a support system, such as family or friends, were more likely to experience psychosocial problems. In conclusion, psychosocial problems among adolescent students in higher education are a pressing issue that requires immediate attention. By understanding the challenges faced by these students, universities can implement effective interventions to support their mental well-being.

Keywords: Adolescent students, associated factors, Cross-sectional study, Higher education, psychosocial problems

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Magnitude and factors associated with benign prostatic hyperplasia among adult male patients visiting Wolaita Sodo University comprehensive specialized hospital southern Ethiopia

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Abstract

Worldwide, in Africa and Ethiopia prevalence of Benign Prostatic Hyperplasia among patients with lower urinary tract symptoms was 26.2%, 44.2%, and 33.4% respectively. However, there is limited evidence regarding Benign Prostatic Hyperplasia in southern Ethiopia and it was not well explored. Therefore, this study aimed to assess the magnitude and associated factors of Benign Prostatic Hyperplasia among adult male patients visiting Wolaita Sodo University Comprehensive Specialized Hospital, southern Ethiopia 2022. A hospital-based cross-sectional study was conducted from July to September 2022. A systematic random sample technique was employed to select 376 participants. Data were gathered using a structured questionnaire and entered, cleaned, coded, and analyzed using SPSS Version 25.0. To describe the study respondents, descriptive statistics were used. Bivariate and multivariate analyses were conducted and an adjusted odd ratio with 95% Confidence Interval (CI) was utilized to quantify the degree of association, and statistical significance was declared at p-value < 0.05. A total of 376 male patients admitted to the surgical department of the Urology ward were included in this study and the magnitude of Prostatic Hyperplasia was 21.3%; 95% CI: 17.3, 25.8. The vegetable consumption, fruit consumption, physical activity, sleeping time and sexual dysfunction [(AOR = 7.57, 95% CI: (2.78, 20.60)], [(AOR = 21.06,95% CI: (7.06,27.53)], [(AOR = 0.57,95% CI: (0.19, 0.67)], [(AOR = 3.23, 95% CI: (1.18,8.79)] and [(AOR = 17.05, 95% CI: (4.82,60.28)] were factors associated with Benign Prostatic Hyperplasia respectively. The benign prostatic hyperplasia is a prevalent disease among men in this study. Sexual dysfunction, consumption of vegetables, consumption of fruits, practice of physical activity and sleeping time were factors associated with BPH. Hence, screening programs for higher-risk people to ensure the early presentation of benign prostatic hyperplasia and practicing eating balanced diets are vital areas to reduce the prevalence.

Keywords: Benign prostatic hyperplasia**,** Magnitude**,** Urology**,** Wolaita Sodo University

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Novel Ag-Doped- Poly (aniline-co-pyrrole)/Titanium-Dioxide Nanocomposite Sensor Material for Ammonia Detection in Spoiled Meat

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Abstract

Silver-doped poly(aniline-co-pyrrole)/titanium dioxide (Ag-doped PANI-PPy/TiO2) conducting copolymer-based nanocomposite ammonia gas sensor was synthesized through in situ chemical oxidative polymerization by taking different amounts (4%, 5%, 6%, 7%, and 8%) of Ag-TiO2 (1:1 ratio) nanoparticles. Zetasizer; dynamic light scattering, scanning electron microscopy, transmit ion electron microscopy, Fourier transform infrared, X-ray diffraction, UV-vis spectroscopy, differential scanning calorimetry, thermogravimetric analysis, and cyclic voltammetry characterization techniques were used to confirm the real formation of nanocomposites and to evaluate the detection performance of the sensor. The interaction sensitivity of the synthesized nanocomposite sensor with ammonia (NH3) was determined by changing the amounts of nanoparticles. Spectroscopic determination exhibited excellent porosity and a better shift in the absorption bands having band gaps (1.87 eV) for the Ag-doped PANI-PPy/TiO2 nanocomposite sensor than the PANI-PPy copolymer (3.17 eV). Morphological (10 μm) and nanoparticle arrangement studies (20 μm) have shown the uniform allocation of nanoparticles in the copolymer matrix when 6% of Ag-TiO2 (1:1 ratio) was added, while agglomeration occurred when <6% or >6% of Ag-TiO2 was added to the copolymer. A decrease in the amorphous domain of the copolymer with an increase in nanoparticles was observed from the X-ray diffraction and other results.

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Profiling vivax malaria incidence, residual transmission, and risk factors using reactive case detection in low transmission settings of Ethiopia

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Abstract

Background: Identification of local Plasmodium vivax transmission foci and its hidden reservoirs are crucial to eliminating residual vivax malaria transmission. This study assessed whether reactive case detection (RCD) could better identify P. vivax cases and infection incidences in Arjo-Didessa, Southwestern Ethiopia.
Methods: A RCD survey was conducted from November 2019 to October 2021 in Arjo-Didessa and the surrounding vicinity in southwestern Ethiopia. RCD was performed at 0, 30, and 60 days following reports of P. vivax infections by health facilities to detect further cases and potential transmission networks. Household members of the index case and neighbours living within 200 m of the index household were screened for P. vivax. Households 200–500 m away are considered controls and were also screened for P. vivax. Plasmodium vivax was detected by microscopy, rapid diagnostic testing (RDT), and quantitative polymerase chain reaction (qPCR). Risk factors associated with vivax malaria were analysed using generalized estimating equations (GEE).
Results: A total of 3303 blood samples were collected from the index (n = 427), neighbouring (n = 1626), and control (n = 1240) household in the three rounds of follow-up visits for malaria infection, the overall positivity rate of P. vivax malaria was 1.6% (95% CI 1.2–2.2%), 1.9% (95% CI 1.5–2.4), and 3.9% (95% CI 3.2–4.6%) by microscopy, RDT, and qPCR, respectively. Microscopy and RDT detected 41.5% (54 of 130) and 49.1% (64 of 130) of the qPCR-confirmed P. vivax cases, respectively. Of qPCR-positive samples, 77.7% of the total P. vivax infections circulated in the index and neighbouring households, while control households accounted for 23.3% of the infections. Of the P. vivax infections detected 81.0% (95% CI 72.9–87.1%) were asymptomatic. In this study, P. vivax infection incidence was higher in index case households (53.8 cases per 1000 person-months) and (44.0 cases per 1000 person-months) in neighbouring households compared to the control households (25.1 cases per 1000 person-months) with statistical difference (p = 0.02). In index case households, children < 5 years and school-age children were at higher risk of P. vivax infection (AOR: 6.3, 95% CI: 2.24–18.02, p = 0.001 and AOR: 2.7, 95% CI: 1.10–6.64, p = 0.029).
Conclusions: This study found clustering of asymptomatic and sub-microscopic P. vivax infections in the index case household and their neighbours using RCD and molecular methods. Children under 5 years and of school age were more likely to have P. vivax infection in index households. Thus, tailored RCD approaches and targeted interventions for interrupting residual P. vivax transmission networks are needed to eliminate P. vivax malaria in low transmission settings.

Keywords: Vivax malaria**,** Residual malaria transmission**,** Clustering**,** Reactive case detection**,** Ethiopia

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10 (2024)

Secondary school EFL teachers' awareness for formative assessment for effective learning

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Abstract

The aim of this study was to examine the extent to which English as a Foreign Language (EFL) teachers in secondary schools were aware of formative assessment for effective learning, and whether this awareness level differed based on their teaching experience. The study used a survey design, collecting both quantitative and qualitative data from 167 participants, and analyzed the data using various statistical and analytical techniques. The results of the study indicated that EFL teachers had limited knowledge of formative assessment and that their practical understanding of the topic had not been addressed in teacher education curriculums or training programs. The study recommends that educational authorities, such as the Ministry of Education (MOE), teacher education institutions, and universities, take steps to promote the practicality of formative assessment in teacher education programs and on-the-job learning initiatives. The findings of this study can also serve as a reference point for further research and interventions to improve the effectiveness of EFL teacher education in different contexts.

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Aerobic vaginitis, bacterial vaginosis, and vaginal candidiasis among women of reproductive age in Arba Minch, southern Ethiopia

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Abstract

Reproductive tract infections (RTIs) are a persistent public health threat worldwide, particularly among women in low-income countries of Africa, including Ethiopia, where drug resistance is also a growing problem. It is crucial to address this problem to ensure women's health and well-being. A cross-sectional study was carried out among a cohort of 398 women of reproductive age who sought medical attention at the Gynecology Department of the Arba Minch General Hospital, southern Ethiopia, from January to June 2020. They were chosen through systematic random sampling, and a pre-tested structured questionnaire was used to collect the data. The collection of vaginal and/or cervical swabs were done to diagnose bacterial vaginosis (BV) and aerobic vaginitis (AV) using Nugent and AV score analyses, respectively. The swabs were subjected to standard microbiological culture techniques to detect the isolates causing AV and vaginal candidiasis (VC). The susceptibility profiles of the causative agents of AV were checked by the Kirby-Bauer disc diffusion technique. Descriptive and inferential statistical analyses were also done. Aerobic vaginitis was the predominantly diagnosed RTI (n = 122, 30.7%), followed by BV (n = 117, 29.4%) and VC (n = 111, 27.9%). The prominent bacteria of AV were Escherichia coli (n = 36, 34.2%) and Klebsiella pneumoniae (n = 30, 28.5%). The overall rate of multidrug-resistant (MDR) bacteria was 65.71% (n = 69). History of abortion (p = 0.01; AOR = 4.0, 95% CI = 2.1, 7.7) and the habit of using vaginal pH-altering contraceptives (p = 0.01; AOR = 4.7, 95% CI = 2.5, 8.8) have the greatest odds of RTI. The high prevalence of RTIs in our study warrants an urgent intervention to minimize the associated morbidities and complications. The overall rate of MDR bacterial isolates necessitates the implementation of an effective surveillance program in the study setting.

Keywords: Susceptibility, Arba Minch, Bacterial vaginosis, Candidiasis, Lower reproductive tract infections

Energy Exploration and Exploitation
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An advanced hybrid deep learning model for accurate energy load prediction in smart building

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Abstract

In smart cities, sustainable development depends on energy load prediction since it directs utilities in effectively planning, distributing and generating energy. This work presents a novel hybrid deep learning model including components of the Improved-convolutional neural network (CNN), bidirectional long short-term memory (Bi-LSTM), Graph neural network (GNN), Transformer and Fusion Layer architectures for precise energy load forecasting. Better feature extraction results from the Improved-CNN's dilated convolution and residual block accommodation of wide receptive fields reduced the vanishing gradient problem. By capturing temporal links in both directions, Bi-LSTM networks help to better grasp complicated energy use patterns. Graph neural networks improve predictive capacities across linked systems by characterizing the spatial relationships between energy-consuming units in smart cities. Emphasizing critical trends to guarantee reliable forecasts, transformer models use attention methods to manage long-term dependencies in energy consumption data. Combining CNN, Bi-LSTM, Transformer and GNN component predictions in a Fusion Layer synthesizes numerous data representations to increase accuracy. With Root Mean Square Error of 5.7532 Wh, Mean Absolute Percentage Error of 3.5001%, Mean Absolute Error of 6.7532 Wh and R2 of 0.9701, the hybrid model fared better than other models on the ‘Electric Power Consumption’ Kaggle dataset. This work develops a realistic model that helps informed decision-making and enhances energy efficiency techniques, promoting energy load forecasting in smart cities.

Keywords: Energy load prediction, deep learning, improved-CNN, Bi-LSTM, GNN, sustainable development

Scientific Reports
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Microbial profile and associated factors of external ocular bacterial and fungal infections in Arba Minch General Hospital: a cross-sectional study

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Abstract

External ocular infections are of serious global concern, which cause significant visual morbidity and even blindness, particularly in low-income and resource-limited countries. Herewith, we are reporting the profile of bacteria and fungi causing external ocular infections and the associated factors in Arba Minch, southern Ethiopia. An institution-based cross-sectional study was conducted among 259 suspected individuals with external ocular infections from 01 January to 10 June 2020 in Arba Minch General Hospital. The demographic data were obtained using a structured questionnaire, while corneal scrapings and conjunctival swabs were collected for culture. Samples were inoculated onto MacConkey, blood, mannitol salt and Sabouraud dextrose agar plates. Bacteria were characterised using conventional microbiological techniques. Fungal isolates were identified by culture and morphology by means of microscopy. Antibiotic susceptibility tests for bacteria were performed via the Kirby-Bauer disk diffusion technique. A logistic regression analysis determined the association between dependent and independent variables; P values ≤ 0.05 were considered statistically significant. The most common clinical manifestations in culture-proven cases were conjunctivitis (38.6%, n = 100) and blepharoconjunctivitis (25.9%, n = 67). The overall prevalence of external ocular bacterial and fungal infections was 73.2 (n = 115) and 26.8% (n = 42), respectively. Isolates of Staphylococcus aureus (24.8%, n = 39) and Pseudomonas aeruginosa (13.4%, n = 21) were the predominant Gram-positive and Gram-negative bacteria, respectively. The prevalence of multidrug-resistant bacteria was 71.3% (n = 82). The World Health Organisation-prioritised bacteria such as methicillin-resistant S. aureus (61.5%, n = 24), extended-spectrum beta-lactamase (22.6%, n = 12), and carbapenemase-producing Enterobacteriaceae (15.1%, n = 8) were also detected. The prominent fungi recovered from patients with keratitis and conjunctivitis were Aspergillus spp. and Candida albicans, respectively (9.5%, n = 15 each). Age (26–49 years) and family income were statistically associated with ocular infections (P ≤ 0.05). The results provide insights into the characteristics of major ocular bacterial and fungal pathogens circulating in the ophthalmic patients of Arba Minch. Conjunctivitis is the main ocular manifestation observed, with a predominance of S. aureus. More than two-thirds of the ocular bacteria were MDR, and the highest prevalence corresponds to S. aureus. The aggravation of multi-drug resistance, including the WHO-prioritised ones, warrants periodic evaluations.

Keywords: Blepharitis**,** Conjunctivitis**,** External ocular infections**,** Keratitis**,** Drug resistance

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Comparative analysis of static and vibration characteristics of glass fiber reinforced epoxy mono composite leaf spring and conventional steel leaf spring

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Abstract

Leaf springs play a vital role in heavy-duty vehicles by offering substantial load support, durability, and convenient maintenance. Lightweight leaf springs enhance vehicle performance, offering benefits like improved fuel efficiency and a smoother ride. Glass fiber reinforced composites enhance fuel efficiency and durability, providing corrosion resistance. Their design flexibility improves ride comfort, and damping properties enhance vehicle stability. The examination conducted through finite element analysis, utilizing ANSYS software, demonstrated a substantial 75.32% decrease in weight for the E-Glass-Epoxy composite leaf spring (GECLS), affirming its efficacy in enhancing strength, reducing weight, and enhancing stiffness. This underscores its superiority as a viable alternative to traditional steel leaf springs (SLS) in vehicular applications. The mono-GECLS exhibited a natural frequency that was found to be 1.9 times higher than that observed in the traditional SLS. It indicates the potential to mitigate resonance issues. After analysing the SLS and GECLS using ANSYS, it was observed that the GECLS exhibits greater values in deflection, natural frequency, and strain energy, measuring 4.659 mm, 29.98 Hz, and 440.68 mJ, respectively, compared to its steel counterpart. Conversely, the SLS demonstrates elevated values in stress, mass, and density, with readings of 283.84 MPa, 3.7695 kg, and 5920 kg/m^3, respectively.

Keywords: Leaf springs, lightweight, E-Glass-Epoxy composite, natural frequency, strain energy, finite element analysis

Aquaculture and Fisheries
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Optimal effort, fish farming, and marine reserve in fisheries management

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Abstract

In this paper, we develop a bioeconomic model to determine an optimal wild catch harvest and freshwater commercial aquaculture production in a lake that uses cages or floating rafts. Although off-bottom aquaculture activities have less impact on the environment compared to on-bottom aquaculture, it has negative externalities. It takes away the fishing area and hence creates pressure in the open-access fishing ground. It also changes the nutrient and ecological composition of the environment. We recommend the implementation of a reserved area to minimize the impact of fishing and aquaculture activities. The reserve also helps in improving the habitat and restocking the fish population which is declining rapidly. We determine the optimal sizes of the aquaculture and reserve and the optimal effort level that maximizes social welfare. We illustrate our findings using numerical simulations and perform an analysis of the optimal solutions with respect to biological and economic parameters involved in the model.
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Keywords: Optimal effort, Marine reserve, Aquaculture production, Growth rate

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Correction to: Effect of Cu substitution on the structural, magnetic, and dc electrical resistivity response of Co0.5Mg0.5-xCuxFe2O4 nanoferrites (Applied Physics A, (2021), 127, 5, (371), 10.1007/s00339-021-04521-w)

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Abstract

Co0.5Mg0.5-xCuxFe2O4 (x = 0.0, 0.2 and 0.4) nanoferrites were prepared by sol–gel auto combustion method. XRD, FT-IR, and HRTEM studies revealed the single-phase spinel cubic crystal structure of all samples with Fd-3 m space group. The lattice constant, calculated using the XRD data, was found in the range 8.3936–8.4735 Å. The average crystallite sizes were found to be in the range of between 38.8 and 49.9 nm. The microstructural behavior and elemental composition of all samples were detected by FE-SEM and EDS, respectively. FTIR curves showed two absorption bands υ1 with higher frequency and υ2 with a lower frequency, indicating metal cation and oxygen bond stretching at tetrahedral and octahedral sites. DC resistivity was decreased with increasing the content of copper. VSM study confirmed the ferrimagnetic behavior of all samples. The values of remnant ratios obtained from VSM data showed their isotropic nature forming single domains ferrimagnetic particles

Keywords: Sol-gel auto-combustion**,** Nanoferrite**,** XRD**,** VSM**,** Ferrimagnetic

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Global, regional, and national burden of stroke and its risk factors, 1990–2021: a systematic analysis for the Global Burden of Disease Study 2021

GBD 2021 Stroke Risk Factor Collaborators

Abstract

Background: Up-to-date estimates of stroke burden and attributable risks and their trends at global, regional, and national levels are essential for evidence-based health care, prevention, and resource allocation planning. We aimed to provide such estimates for the period 1990–2021.

Methods: We estimated incidence, prevalence, death, and disability-adjusted life-year (DALY) counts and age-standardised rates per 100 000 people per year for overall stroke, ischaemic stroke, intracerebral haemorrhage, and subarachnoid haemorrhage, for 204 countries and territories from 1990 to 2021. We also calculated burden of stroke attributable to 23 risk factors and six risk clusters (air pollution, tobacco smoking, behavioural, dietary, environmental, and metabolic risks) at the global and regional levels (21 GBD regions and Socio-demographic Index [SDI] quintiles), using the standard GBD methodology. 95% uncertainty intervals (UIs) for each individual future estimate were derived from the 2·5th and 97·5th percentiles of distributions generated from propagating 500 draws through the multistage computational pipeline.

Findings: In 2021, stroke was the third most common GBD level 3 cause of death (7·3 million [95% UI 6·6–7·8] deaths; 10·7% [9·8–11·3] of all deaths) after ischaemic heart disease and COVID-19, and the fourth most common cause of DALYs (160·5 million [147·8–171·6] DALYs; 5·6% [5·0–6·1] of all DALYs). In 2021, there were 93·8 million (89·0–99·3) prevalent and 11·9 million (10·7–13·2) incident strokes. We found disparities in stroke burden and risk factors by GBD region, country or territory, and SDI, as well as a stagnation in the reduction of incidence from 2015 onwards, and even some increases in the stroke incidence, death, prevalence, and DALY rates in southeast Asia, east Asia, and Oceania, countries with lower SDI, and people younger than 70 years. Globally, ischaemic stroke constituted 65·3% (62·4–67·7), intracerebral haemorrhage constituted 28·8% (28·3–28·8), and subarachnoid haemorrhage constituted 5·8% (5·7–6·0) of incident strokes. There were substantial increases in DALYs attributable to high BMI (88·2% [53·4–117·7]), high ambient temperature (72·4% [51·1 to 179·5]), high fasting plasma glucose (32·1% [26·7–38·1]), diet high in sugar-sweetened beverages (23·4% [12·7–35·7]), low physical activity (11·3% [1·8–34·9]), high systolic blood pressure (6·7% [2·5–11·6]), lead exposure (6·5% [4·5–11·2]), and diet low in omega-6 polyunsaturated fatty acids (5·3% [0·5–10·5]).

Interpretation: Stroke burden has increased from 1990 to 2021, and the contribution of several risk factors has also increased. Effective, accessible, and affordable measures to improve stroke surveillance, prevention (with the emphasis on blood pressure, lifestyle, and environmental factors), acute care, and rehabilitation need to be urgently implemented across all countries to reduce stroke burden.

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Contraception and Reproductive Medicine
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Modern contraceptive utilization among women of reproductive age in Ghana: a multilevel mixed-effect logistic regression model

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Abstract

Background: Worldwide, sexual and reproductive health remains a prominent public health concern for women of reproductive age. Modern contraceptive methods play a crucial role in enabling individuals and families to regulate fertility, thereby reducing unintended pregnancies, abortions, pregnancy-related complications, and mortality. Due to the scarcity of reliable and current data regarding the factors affecting the adoption of modern contraceptives among women of reproductive age at the national level in Ghana, this research aimed to explore the determinants of modern contraceptive usage among reproductive age women.
Methods: The study analyzed data from the 2022 Ghana Demographic and Health Survey, including a weighted sample of 6,839 reproductive-age women. By employing a multilevel logistic regression model, the study sought to determine factors associated with the utilization of modern contraceptives. Associations between explanatory variables and the outcome were evaluated using adjusted odds ratios (AORs) along with 95% confidence intervals (CIs). Statistical significance was established using a p-value threshold of less than 0.05. All statistical analyses were conducted using STATA version 17 software.
Results: The study found that 26.36% (95% CI: 25.33-27.34%) of women of reproductive age in Ghana used modern contraceptives. Secondary education (AOR = 1.26, 95% CI = 1.03–1.53), poorer household (AOR = 1.30, 95% CI = 1.05–1.61), women's marital status, i.e. married (AOR = 1.46, 95% CI = 1.16–1.83), living with a partner (AOR = 1.65, 95% CI = 1.32–2.06), divorced (AOR = 2.53, 95% CI = 1.48–4.31), and separated (AOR = 1.70, 95% CI = 1.21–2.37), multipara (AOR = 1.39, 95% CI = 1.04–1.87), were the factors that promote modern contraceptive utilization. Women's age in years, i.e. 35–39 (AOR = 0.71, 95% CI = 0.52–0.97), 40–44 (AOR = 0.63, 95% CI = 0.44–0.90), and 45–49 (AOR = 0.45, 95% CI = 0.25–0.79), history of pregnancy loss (AOR = 0.86, 95% CI = 0.76–0.98), region, i.e. Greater Accra (95% CI = 0.42–0.92), Bono East (95% CI = 0.32–0.81), Northern (95% CI = 0.28–0.67), Savannah (95% CI = 0.28–0.81), and North East (95% CI = 0.20–0.63), were all associated with a lower use of modern contraceptives.
Conclusions: Modern contraceptive utilization was low in this study. Factors such as women's education, socioeconomic status, and marital status were associated with increased modern contraceptive utilization, whereas women's age and regional disparities were linked to lower usage rates. These findings emphasize the need for targeted interventions to address socioeconomic barriers and regional disparities in access to family planning services across Ghana.

Keywords: Contraceptive utilization**,** Reproductive age**,** multilevel analysis**,** Ghana

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7 (2024)

The Practices of Peacebuilding in South Omo: A Qualitative Case Study in Hammer, Dassanech, Nyangatom Woreda and the Turkana Kenya Community

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Abstract

The study examined the practices of peacebuilding in the south Omo zone pastoralist and agro-pastoralist communities of Dassanech, Hamer, Nyangatom, Woreda of Ethiopia and the Kenya-Turkana cross-border resource-based conflicts. The study investigated internal and cross-border peacebuilding practices. To achieve the objective of the study, a qualitative research approach and case study research design were used. The study revealed that peace is the highest priority of the pastoral and agro-pastoral community who view conflict as synonymous with starvation, and poverty. The study also revealed that peacebuilding efforts between the two communities involve a range of actors and approaches. Key actors include: the Government, non-state actors, international organizations, public administrators, intergovernmental organizations and indigenous community-based institutions. They play a significant role in conflict management, prevention, and resolution as part of the broader peacebuilding process. While the outcomes of these practices have been less effective, these initiatives are recognized as valuable foundations for advancing peacebuilding efforts. The study also finds that there is relative peace in the study area and the trends of conflict are reduced. However, the objective of building peace is still not achieved because of the lack of government commitment to engage in peacebuilding and the complex nature of conflicts. Factors such as environmental changes, land disputes, resource scarcity, drought, the proliferation of small arms, livestock raiding, and killings are identified as key causes and triggers of conflict and violence between the two communities The peacebuilding practices need to be done by various peace actors to create peace in the area. Moreover, developing new peace initiatives and peace leadership could play a vital role in the realization of peace in the area.

Keywords: Peacebuilding; Resources; Conflict; Cross-border conflict; Pastoralism; Agro-pastoralism; Land

Parasites and Vectors
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Higher outdoor mosquito density and Plasmodium infection rates in and around malaria index case households in low transmission settings of Ethiopia: Implications for vector control

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Abstract

Background: Understanding the clustering of infections for persistent malaria transmission is critical to determining how and where to target specific interventions. This study aimed to determine the density, blood meal sources and malaria transmission risk of anopheline vectors by targeting malaria index cases, their neighboring households and control villages in Arjo-Didessa, southwestern Ethiopia.
Methods: An entomological study was conducted concurrently with a reactive case detection (RCD) study from November 2019 to October 2021 in Arjo Didessa and the surrounding vicinity, southwestern Ethiopia. Anopheline mosquitoes were collected indoors and outdoors in index case households and their surrounding households (neighboring households), as well as in control households, using pyrethrum spray cache (PSC) and U.S. Centers for Disease Control and Prevention (CDC) light traps. Adult mosquitoes were morphologically identified, and speciation in the Anopheles gambiae complex was done by PCR. Mosquito Plasmodium infections and host blood meal sources were detected by circumsporozoite protein enzyme-linked immunosorbent assay (CSP-ELISA) and cytochrome b-based blood meal PCR, respectively.
Results: Among the 770 anopheline mosquitoes collected, An. gambiae sensu lato (A. gambiae s.l.) was the predominant species, accounting for 87.1% (n = 671/770) of the catch, followed by the Anopheles coustani complex and Anopheles pharoensis, which accounted for 12.6% (n = 97/770) and 0.26% (n = 2/770) of the catch, respectively. From the sub-samples of An. gambiae s.l.analyzed with PCR, An. arabiensis and Anopheles amharicus were identified. The overall mean density of mosquitoes was 1.26 mosquitoes per trap per night using the CDC light traps. Outdoor mosquito density was significantly higher than indoor mosquito density in the index and neighboring households (P = 0.0001). The human blood index (HBI) and bovine blood index (BBI) of An. arabiensis were 20.8% (n = 34/168) and 24.0% (n = 41/168), respectively. The overall Plasmodium sporozoite infection rate of anophelines (An. arabiensis and An. coustani complex) was 4.4% (n = 34/770). Sporozoites were detected indoors and outdoors in captured anopheline mosquitoes. Of these CSP-positive species for Pv-210, Pv-247 and Pf, 41.1% (n = 14/34) were captured outdoors. A significantly higher proportion of sporozoite-infected mosquitoes were caught in index case households (5.6%, n = 8/141) compared to control households (1.1%, n = 2/181) (P = 0.02), and in neighboring households (5.3%, n = 24/448) compared to control households (P = 0.01).
Conclusions: The findings of this study indicated that malaria index cases and their neighboring households had higher outdoor mosquito densities and Plasmodium infection rates. The study also highlighted a relatively higher outdoor mosquito density, which could increase the potential risk of outdoor malaria transmission and may play a role in residual malaria transmission. Thus, it is important to strengthen the implementation of vector control interventions, such as targeted indoor residual spraying, long-lasting insecticidal nets and other supplementary vector control measures such as larval source management and community engagement approaches. Furthermore, in low transmission settings, such as the Arjo Didessa Sugarcane Plantation, providing health education to local communities, enhanced environmental management and entomological surveillance, along with case detection and management by targeting of malaria index cases and their immediate neighboring households, could be important measures to control residual malaria transmission and achieve the targeted elimination goals.

Keywords: Index case**,** Reactive case detection**,** Sporozoite rate**,** Residual malaria**,** Ethiopia

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Maternal feeding practices for sick children under 2 years in Wolkite town, Gurage Zone, Central Ethiopia, 2024: a community-based cross-sectional study

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Abstract

Background: Optimal feeding practices for sick children are crucial to prevent morbidity and mortality. Despite global and national policies emphasizing the importance of optimal feeding practices for sick children, studies have revealed varying levels of practice in different regions, including Ethiopia. However, there is a research gap in focusing on community-based contexts to determine sick child feeding practices among mothers with young children.

Objective: To assess maternal feeding practices for sick children under 2 years in Wolkite town, Gurage zone, Central Ethiopia: 2024.

Methods: A community-based cross-sectional study involving a total of 419 mothers of young children was conducted in Wolkite town, Gurage zone, Central Ethiopia from September 15 to November 15, 2023. Participants were chosen using computer-generated random numbers. Structured, interviewer-administered, and pretested data collection tool were used. The data were coded and entered into EpiData 3.1 before being exported to SPSS version 25 for analysis. Logistic regression was employed to identify factors influencing mothers' practice. Statistical significance was set at $p < 0.05$ with a 95% confidence interval.

Results: The study found that 54.4% (95% CI: 50–59%) of mothers demonstrated good feeding practices for their sick children. Significant factors contributing to these practices included mothers having at least a secondary education (AOR: 3.7, 95% CI: 1.5–9.1), delivering their child in a health facility (AOR: 2.3, 95% CI: 1.4–3.8), and receiving support from the father (AOR: 2.3, 95% CI: 1.4–3.8). Additionally, mothers who were counseled on infant and young child feeding had higher odds of practicing good feeding (AOR: 4.1, 95% CI: 2.3–7.03), access to postnatal care (AOR: 3.8, 95% CI: 2.1–6.95) and having a good knowledge of feeding practices (AOR: 2.5, 95% CI: 1.4–4.5) were also strongly associated with effective feeding practices.

Conclusions: The study highlights more than half of mothers in Wolkite town, Gurage zone, Central Ethiopia have good sick child feeding practices. Factors such as the higher educational status of the mother, having the father's support, place of delivery, receiving PNC services, counseling on infant and young child feeding, and knowledge about sick child feeding were significantly associated with their practice. Implementing targeted education programs, strengthening postnatal care services, counseling on infant and young child feeding, and encouraging the involvement of fathers in childcare and feeding were strongly recommended.

Keywords: Sick child**,** Feeding practice**,** Childhood illness**,** Infant and young child feeding**,** Ethiopia

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English language teacher educators' knowledge and skills on early grade reading instruction

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Abstract

This study investigated English language teacher educators' knowledge and skills on early grade reading instruction. It employed a quantitative design, particularly the descriptive comparative one, utilizing cluster random sampling method to include all (N = 43) English language teacher educators from three teacher education colleges (15 from Arba Minch, 11 from Hosana and 17 from Hawassa) in Ethiopia. The study used test and years of teaching experience as instruments to collect data. It employed descriptive statistics and One sample t-test to identify level of knowledge and skills English language teacher educators had on early grade reading, Multiple regression and Beta weights to determine the combined and relative contributions of domains of the early grade reading for English language teacher educators' knowledge and skills while Spearman's rho Correlation to examine the relationship between English language teacher educators' years of teaching experience and their knowledge and skills test score. Findings revealed that majority of English language teacher educators were at low level of knowledge and skills; they scored the skills test better than the knowledge one. Moreover, English language teacher educators in the current study had significantly low' level of early grade reading knowledge and skills compared to participants' early grade reading knowledge and skills in the hypothesized population, indicating that there are substantial differences on early grade reading knowledge and skills between the two groups. Although early grade reading domains together significantly contributed to English language teacher educators' level of content knowledge and skills, phonemic was the most while morphology was the least contributor. However, English language teacher educators' years of teaching experience did not show any significant correlation with their early grade reading knowledge and skills. The study concluded that English language teacher educators might not fully equip the preservice English language teachers with the content knowledge and skills to teach the early grade reading.

Keywords: English language teacher educators**,** Early grade reading test**,** Knowledge**,** Skills**,** Experience**,** Reading instruction**,** Phonemic awareness**,** Morphology

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525 (2024)

Enhancement of opto-electro-mechanical entanglement through three-level atoms

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Abstract

We address the dynamical bipartite entanglement in an opto-electro-mechanical system that involves a three-level atom. The system consists of a degenerate three-level atom, a mechanical resonator, an optical cavity, and a microwave cavity. By utilizing the linearization approximation and nonlinear quantum-Langevin equations, the dynamics of the system are analyzed, and the bipartite entanglement is evaluated using the logarithmic negativity. The research findings indicate that the entanglement between each subsystem increases with the atom injection rate, suggesting that a higher atom injection rate leads to enhanced information transmission between the subsystems. Additionally, it is observed that the correlation between subsystems increases with an increase in the coupling rate. Moreover, the study demonstrates that the correlation between each subsystem decreases as temperature rises. We also show that the degree of tripartite entanglement diminishes with increasing atomic decay rates. The results highlight the positive impact of three-level atoms on the bipartite entanglement in an opto-electro-mechanical system. Consequently, such electro-optomechanical systems can offer a framework for optomechanical information transfer.

Water (Switzerland)
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Optimizing Well Placement for Sustainable Irrigation: A Two-Stage Stochastic Mixed Integer Programming Approach

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Abstract

Utilizing groundwater offers a promising solution to alleviate water stress in Ethiopia, providing a dependable and sustainable water source, particularly in regions with limited or unreliable surface water availability. However, effective decision-making regarding well drilling and placement is essential to maximize groundwater resource potential, enhancing agricultural productivity, reducing hunger, and bolstering food security in Ethiopia. This study concentrates on the development of two-stage stochastic mixed integer programming (SMIP) models to optimize well placement for sustainable agricultural irrigation, considering uncertain demand scenarios. Additionally, a deterministic mixed integer programming model is formulated for comparison with the two-stage SMIP. Experiments are conducted to explore various demand scenario distributions, revealing that the optimized total cost for the two-stage SMIP generally exceeds that of a deterministic setting, aligning with the two-stage SMIP's focus on long-term benefits. Moreover, slight differences are observed in well layouts under different assumption scenarios. The study also examines the impact of selected parameters, such as fixed construction costs, per-meter drilling costs, and demand scenarios. The out-of-sample performance shows that the stochastic model is more flexible and resilient, with 11% and 4% lower costs than deterministic cases 1 and 3, respectively. This flexibility provides a more robust long-term strategy for well placement and resource allocation in groundwater management.

Keywords: well placement optimization, well layout optimization, mixed integer programming (MIP), two-stage stochastic mixed integer programming (SMIP), Bilate watershed, southern Ethiopia, sustainable irrigation

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Survival status and its predictors among undernourished children on antiretroviral therapy in Bahir Dar city, Northwest Ethiopia, 2010 – 2020, a multicenter retrospective cohort study.

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Abstract

Background: In environments with limited resources, undernutrition is a serious public health risk. Its dual relationship to human immunodeficiency virus infection (HIV) leads to crises in a child's physical, emotional, social, and economic spheres of life. Nevertheless, little research has been done on the survival rate and risk factors that lead to poor survival outcomes in undernourished children receiving antiretroviral therapy. This study sought to evaluate survival status and its predictors among undernourished children on antiretroviral therapy (ART) in public health facilities, Bahir Dar city, September 1, 2010 – December 31, 2020.
Methods: An institution-based retrospective cohort study design was used among 414 study participants from September 1, 2010 – December 31, 2020. A simple random sampling method was applied to select study participants. All collected data were entered into epi data version 4.6 and exported to STATA version 14.0 for analysis. Each independent predictor variable with a p-value < 0.05 in the multivariable Cox proportional hazard regression was considered statistically significant.
Results: The overall incidence of mortality was 11.6 deaths per 1000 child year observation (95%CI: 7.7- 17.5). Baseline weight for age < -3 Z score (adjusted hazard ratio (AHR) = 4.9, 95% CI: 1.30–18.98), height for age < -3 Z score (AHR = 4.34, 95%CI 1.13–16.6), cotrimoxazole prophylaxis given (AHR = 0.27, 95%CI 0.08–0.87), hemoglobin level < 10 g/dl (AHR = 3.7, 95%CI 1.1–12.7), CD4 cells < threshold (AHR = 4.86, 95%CI 1.9–12.7), and WHO clinical disease stage III and IV (AHR = 8.1, 95%CI 1.97–33) were found independent predictors of mortality.
Conclusion and recommendation: The incidence of mortality was determined in the study to be 11.6 per 1000 child years. Mortality was predicted by severe stunting, severe underweight, a low hemoglobin level, a low CD4 count, and WHO clinical stages III and IV. But the risk of death is reduced by starting cotrimoxazole preventative therapy early. The risk factors that result in a low survival status should be the primary focus of all concerned bodies, and early cotrimoxazole preventive treatment initiation is strongly recommended.

Keywords: Survival**,** Undernutrition**,** Children**,** HIV/AIDS**,** Predictors

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Asymptomatic malaria in pregnancy and associated risk factors in Majang Zone, Gambella Region, Southwest Ethiopia: a hard-to-reach malaria hotspot

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Abstract

Background: Asymptomatic malaria in pregnancy (AMiP) is a daunting public health problem with multifaceted adverse outcomes for mothers, fetuses, newborns and beyond. This study aimed to assess the prevalence and risk factors of AMiP and anaemia in Majang Zone, Gambella, Southwest Ethiopia. **Methods:** A facility-based cross-sectional study was conducted among 425 pregnant women attending the antenatal care (ANC) clinics of five health facilities in the Majang Zone from November 2022 to February 2023. Sociodemographic, obstetric, and anti-malarial intervention data were collected using an interviewer-administered questionnaire. A capillary blood specimen was collected to diagnose malaria and anaemia as well as determine the blood group. Malaria was diagnosed by rapid diagnostic test (RDT), microscopy, and quantitative polymerase chain reaction (qPCR). Statistical analyses were done by Statistical Package for Social Science (SPSS) version 26.0. The association between dependent and independent variables was assessed by multivariable binary logistic regression, considering $P < 0.05$ statistically significant. The magnitude of associations was quantified with the adjusted odds ratio (AOR) along with the corresponding 95% confidence interval (CI).
Results: The overall prevalence of AMiP was 15.3% (95% CI 12.1, 18.9). It was 11.3% (95% CI 8.4, 14.7) by RDT, 11.8% (95% CI 8.9, 15.2) by microscopy and 17.6% (95% CI 11.7, 24.9) by qPCR. Plasmodium falciparum, moderate parasitaemia and submicroscopic infection accounted for 55.4% of the AMiP prevalence, 50.8% of the parasite density, and 41.6% of the qPCR-positive AMiP, respectively. Nearly 32.3% of pregnant women with AMiP carried gametocytes. Risk factors of AMiP were: not utilizing insecticide-treated net (ITN) within the previous week (AOR: 9.43 95% CI 1.57, 56.62), having a history of malaria within the previous year (AOR: 2.26 95% CI 1.16, 4.42), lack of indoor residual spraying (IRS) within the previous year (AOR: 3.00 95% CI 1.50, 6.00), and ANC contact below two rounds (AOR: 4.28 95% CI 2.06, 8.87). The prevalence of anaemia was 27.7% (95% CI 23.6, 32.1), and it was higher among AMiP-positives (56.9%) than the negatives (22.5%) (P: 000).
Conclusion: The prevalence of AMiP and anaemia was high, and remained as a critical public health problem in the study area. Focus on the identified risk factors and introduction of more sensitive diagnostic tools should be considered to mitigate AMiP in the study area.

Keywords: Asymptomatic malaria in pregnancy, Anaemia, Prevalence, Risk factors, qPCR, Majang, Gambella

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Digital socialization: Insights into interpersonal communication motives for socialization in social networks among undergraduate students

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Abstract

Social interactions and communication between individuals have been completely transformed by digital technology (DT). People from all around the world can now communicate with each other thanks to social media platforms. The main focus of this study is on interpersonal communication motives (ICM) in social networks (SNs), aiming to examine how Ethiopian undergraduate students socialize in relation to digital technologies (DTs). A concurrent design with a mixed approach was utilized, including self-administered questionnaires and focus group discussions (FGD) during the data collection process. The students' ICM were used to gain a deeper understanding of their experiences and perspectives towards digital socialization (DS) in SNs. A total of 312 undergraduates aged 18 to 27 participated in the study, with 202 being male and 110 female. The results of the investigation highlighted the significance of SNs in shaping undergraduate students' ICM. The findings demonstrate the benefits of SNs in facilitating students' socialization process by providing a platform for interaction, communication, and relationship-building. Interestingly, there were no significant variations in ICM in DS using SNs based on gender. By exploring how students socialize within SNs, this study aims to contribute to the existing body of knowledge on the subject. Educational institutions and policymakers could leverage these findings to understand the advantages of incorporating SNs into students' academic experiences, ultimately enhancing their socialization process and overall well-being.

Keywords: Digital socialization, Digital technologies, Interpersonal communication motives, Social networks, Socialization behavior, Undergraduate university student

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Level of eye healthcare utilisation and associated factors in Gamo and Gofa Zones, Southern Ethiopia: A community-based, cross-sectional study

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Abstract

Objective: About 90% of eye health problems are preventable or curable with existing cost-effective interventions. There is limited evidence on eye healthcare utilisation (ECU) and the factors influencing it in the study area. This study aimed to determine the level of ECU and the associated factors in Southern Ethiopia.

Design: A community-based, cross-sectional study was conducted in Southern Ethiopia from 1 June to 15 July 2023. Data were analysed using SPSS V.27.

Setting: Two selected districts (Dita and Uba Debretsehay) in Southern Ethiopia.

Participants: Permanent residents living in randomly selected kebeles.

Outcome measure: The level of ECU was the outcome measure. A binary logistic regression model was used to check the association between explanatory variables and the dependent variable. To avoid many variables and unstable estimates and to control for possible confounders in the subsequent model, only variables that reached a p value of less than 0.25 on binary analysis were used in the multivariate logistic regression analysis to identify factors independently associated with ECU.

Results 992 respondents participated in this study, with a response rate of 95.4%. The prevalence of ECU within the past 2 years was 21.6% (95% CI 19.0, 24.3). The reported barriers to ECU were lack of awareness (123, 40.6%) and lack of money (58, 19.2%). Age <30 years (adjusted OR (AOR)=2.7; 95% CI 1.5, 4.6), being male (AOR=2.2; 95% CI 1.4, 3.6), shorter travel time (AOR=2.0; 95% CI 1.3, 3.1), undergoing regular vision check-ups (AOR=5.4; 95% CI 3.47, 8.37), history of eye diseases (AOR=4.8; 95% CI 2.5, 9.1) and having trichiasis (AOR=1.5; 95% CI 1.1, 2.3) were positively associated with eye care service utilisation. Low wealth quantile (AOR=0.62; 95% CI 0.39, 0.98) and poor knowledge (AOR=0.26; 95% CI 0.16, 0.44) were negatively associated with eye care service utilisation.

Conclusions The ECU within the past 2 years was a quarter. Socioeconomic factors, disease-related factors and respondent knowledge are independently associated with ECU. Designing strategies that can improve the capacity of healthcare facilities and patient awareness is important in order to reduce barriers and improve service utilisation. Researchers interested in working in the area should focus on community-specific approaches that can improve community health literacy by using stronger study designs.

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Postnatal cord care practices and associated factors in Arba Minch town, southern Ethiopia

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Abstract

Background Cord care is one component of essential newborn care that reduces newborn morbidity and mortality. Poor cord care practice leads to a large amount of neonatal death due to infection. In Ethiopia, many women give birth at home, where neonates are exposed to unclean cord care practices or application of different traditional substances. Despite the severity of the problem, studies related to postnatal cord care practice are scarce. Hence, this study is aimed to assess umbilical cord care practices and associated factors in the postnatal period in Arba Minch town.

Objective To assess postnatal cord care practices and associated factors among mothers who gave birth in the last six months in Arba Minch Town, southern Ethiopia, 2019.

Methods Cross-sectional study design was conducted and using simple random sampling method 423 mothers who gave birth with in the last six months in Arba Minch town from November 11 to December 02, 2019, were selected. Data was collected using structured questionnaire administered by the interviewer. EpiData version 4.4 was used for data entry and SPSS version 25 was used for data analysis. Variables with $p \leq 0.25$ in bivarible logistic regressions were considered as potential candidates for multivariable logistic regression analysis to control confounders. Adjusted Odds Ratio with 95% confidence interval was applied in multivariable logistic regression models, to identify variable, which has significant association.

Results The overall proportion of women who had good postnatal cord care was 67.1%. The maternal age group of 25 to 29 years (AOR = 2.51; 95% CI: 1.35–4.68), maternal educational status of secondary school and above (AOR = 4.19; 95% CI: 2.05–8.54), mothers with good knowledge of cord care (AOR = 1.77; 95% CI: 1.03–3.05), and health facility delivery (AOR = 2.60; 95%CI: 1.05–6.41) were independent factors associated with good cord care.

Conclusions The proportion of good cord-care practice reported in this study was relatively worthy. Maternal age group of 25–29 years, maternal educational status of secondary school and above, having good knowledge of cord care, and delivering at health facility were factors that increased good postnatal cord care practice. Therefore, investing in improving these factors would positively affect maternal postnatal cord care practice. In order to reduce neonatal morbidity and mortality, routine counseling of cord care practice to mothers would attain good knowledge about postnatal cord care practices. Community health education would also increase awareness and practice of postnatal cord care.

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Effectiveness and cost-effectiveness of models of maternity care for women from migrant and refugee backgrounds in high-income countries: A systematic review

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Abstract

Background: Different models of care may be appropriate for various groups of women during their perinatal period, depending on their risk level, location, and accessibility of healthcare practitioners and facilities. Evaluating these models' effectiveness and cost-effectiveness is critical to allocating resources and offering sustained care to women from refugee backgrounds. This systematic review aimed to synthesize evidence on the effectiveness and cost-effectiveness of maternity care models among women from migrant and refugee backgrounds living in high-income countries.

Methods: A comprehensive search of major databases for studies published in English between 2000 and 2023 was developed to identify literature using defined keywords and inclusion criteria. Two authors independently screened the search findings and the full texts of eligible studies. The quality of the included studies was appraised, and qualitative and quantitative results were synthesised narratively and presented in tabular form. The review was reported using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines.

Results: Forty-seven research papers from six countries were included in the review. The review highlighted the positive impact of community and stakeholders' involvement in the implementation of models of maternity care for women from migrant and refugee backgrounds. The review summarised the models of care in terms of their effectiveness in improving perinatal health outcomes and minimising medical interventions, continuum of care in maternity services, enhancing health literacy, maternity service use and navigating the healthcare system, social support, and sense of belongingness, and addressing cultural and linguistic barriers. Notably, only one study conducted a partial economic evaluation to determine the cost-effectiveness of the model.

Conclusion and implications for practice and research: While the reviewed models demonstrated effectiveness in improving perinatal health outcomes, there was considerable variation in outcome measures and assessment tools across the models. Thus, reaching a consensus on prioritised perinatal outcomes and measurement tools is crucial. Researchers and policymakers should collaborate to enhance the quality and quantity of economic evaluations to support evidence-based decision-making. This includes thoroughly comparing costs and outcomes across various health models to determine the most efficient interventions. By emphasizing the importance of comprehensive economic evaluations, healthcare systems can better allocate resources, ultimately leading to more effective and efficient healthcare delivery.

Keywords: Migrant, Refugee background, perinatal care, High-income countries, Model of care

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Patterns and probabilities of dry spells and rainfall for improved rain-fed farming in Northwestern Ethiopia

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Abstract

Dry spells and rainfall variability significantly impact rain-fed agriculture in Ethiopia, necessitating targeted adaptation strategies. This study used rainfall data from Ethiopia's Meteorological Institute (1992–2021) to evaluate the likelihood of rainfall and dry spells lasting more than 7, 10, 15, and 20 days in northwestern Ethiopia. Markov chain modeling assessed the probabilities of these events, while Modified Mann–Kendall tests examined trends in dry days at a significance level of $P < 0.05$. The area has a Kiremt-dominated monomodal rain, with 80–100% rainfall probability following dry days in July–August. June (40–67%) and September (37–60%) experienced high dry days with moderate to high variability (CV: 26–45%), underscoring the need for monitoring dry day risks during planting and crop maturation. In contrast, July (10–19%) and August (10–29%) had lower frequencies of dry days. The Belg (77–89%) and Bega (79–95%) seasons showed high dry day frequencies with low variability, indicating that rain-fed agriculture is impractical during these times. Trend analysis revealed significant increases in dry days at Ebenat and decreases at Simada, with most stations showing rising dry day patterns. Dry spell analysis found minimal (0–10%) likelihood during Kiremt, but a 100% risk from late September to February. Spatial analysis revealed a high risk of extended dry spells: 20–40% in August, 40–60% in July, 100% in October, and 75–100% in September-June. May has a 60–80% chance of a 7-day dry spell, likely delaying the growing season to June and reducing yields for rain-fed crops, suggesting targeted interventions, like using drought-tolerant crops or mitigation strategies.

Keywords: Rainfall, Dry spell, Rain fed agriculture, Ethiopia

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Estimating soil erosion in response to land use/cover change around Ghibe III hydroelectric dam, Southern Ethiopia

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Abstract

Soil erosion is a hazard in every part of the world. The small-scale farmers often grapple with low agricultural production and food insecurity. This study was conducted to estimate soil loss in response to land use/cover change in 1990, 2000, 2010, and 2020 around Ghibe hydroelectric III dam in Southern Ethiopia. The Revised Universal Soil Loss Equation (RUSLE) model was applied using a geographic information system (GIS). Digital elevation model with 30 m to determine topographic factor and supportive practice (P) factor, rainfall from the National Meteorological Institute to calculate the erosivity (R) factor, a digital soil map of the world for erodibility (K) factor, and Landsat 5TM images of 1990, 2000, 2010, and the Landsat 8 OLI of 2020 to determine trends of land use/cover change and the cover management (C) factor were employed. The raster layers of topography, cover management, rainfall erosivity, soil erodibility, and conservation techniques were processed and multiplied using the GIS platform. The overall accuracy of supervised classification was 89.89. The results showed that the percentage of cropland and built-up areas increased by 11.93 and 32.44%, respectively throughout the three study periods. Conversely, the proportion of forest land, grassland, bare land, and bushland declined by 8.2, 9.3, 10.13, 8.6%, respectively. The average annual soil loss rates increased from 30.95 t ha−1 yr−1 in 1990 to 43.85 t ha−1 yr−1in 2020. This is significantly higher than the maximum threshold rate of erosion for Ethiopian highlands (11 t ha−1 yr−1). The local government officers, non-governmental organizations, and farmers who are trained should strengthen watershed management techniques.

Keywords: Agriculture, Soil erosion, Land use, RUSEL, Sustainability

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Optimizing additive manufacturing parameters for graphene-reinforced PETG impeller production: A fuzzy AHP-TOPSIS approach

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Abstract

Additive manufacturing, particularly 3D printing, has transformed production by enabling precise, layer-by-layer construction with minimal material waste. This study aims to optimize the mechanical properties and production efficiency of impellers manufactured using Graphene-Reinforced Polyethylene Terephthalate Glycol (G-PETG) filament. By employing the Fuzzy Analytic Hierarchy Process (FAHP) and the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS), we identified optimal 3D printing parameters. The results showed that a 65 % infill density, 0.20 mm layer height, 50 mm/s printing speed, 90 °C platform temperature, 240 °C extruder temperature, and 90 mm/s traverse speed led to a 15 % improvement in tensile strength and a 12 % reduction in production time compared to baseline settings. Additionally, the impellers produced demonstrated superior surface finish and structural integrity, making them suitable for high-performance applications. These findings underscore the importance of parameter optimization in enhancing the performance of 3D-printed components, particularly for applications requiring high mechanical strength and precision.

Keywords: Additive manufacturing, Process parameter optimization, Fuzzy AHP-TOPSIS, Composite thermoplastic polymer, Sustainable materials, Mechanical property, Fused deposition modeling, Material performance, Impeller application

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Assessing willingness to accept a compensation for evicted land in peri-urban areas: A contingent valuation method

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Abstract

Urban expansion in developing countries like Ethiopia is causing political turmoil in peri-urban areas due to inadequate compensation for evicted farmers because of the absence of a land market, which is prohibited by Ethiopia's land policy. This paper applies the contingent valuation method to measure the compensation value considered acceptable to those who are evicted from their farm land. The west Gojjam and Awi zones of Amhara region, Ethiopia are chosen for the case study based on 393 completed questionnaires. It has been demonstrated that a willingness to accept compensation is essential for maintaining sustainable livelihoods. The study applied single-bounded contingent valuation and double-bounded contingent valuation methods to estimate the mean willingness to accept compensation value. Based on the finding, double-bounded contingent valuation could be more optimal for the welfare of the evictees in detecting and correcting respondent's bias due to its narrow confidence interval. Pilot survey was employed to ensure reliability and validity of the methods employed. Therefore, the optimal bid vector for multiplying the average land output preceding three years of eviction is 29.27. Additionally, variables such as initial bid, age, education, and total annual income significantly affect the willingness to accept compensation. The study recommends that federal and local governments should provide adequate compensation offers that prioritize the well-being of peri-urban communities during urban expansion programs, as farmers are losing their most valuable asset. This is crucial for sustainable living and poverty reduction among those who have been evicted.

Keywords: Compensation, Willingness to accept, Contingent valuation method

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Modeling of surface water allocation under current and future climate change in Keleta Catchment, Awash River Basin, Ethiopia

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Abstract

The water resources of Keleta catchment in the Awash River basin are utilized by various users. However, the current and future demands for water and its availability in the catchment have not been quantified. Therefore, this study aimed to evaluate the current and future water demand and availability by employing multiple climate models under the representative concentration pathways (RCP 4.5 and 8.5) scenarios. A power transformation method was applied for precipitation and linear shifting and scaling techniques were used for temperature to obtain bias-corrected future climate data. These bias-corrected daily precipitation and temperature datasets were utilized to simulate surface water availability for reference (1971–2000) and future climate scenarios (2041–2070) periods under RCP 4.5 and 8.5 using the Hydrologic Engineering Center-Hydrologic Modeling System (HEC-HMS) hydrological model. The Water Evaluation and Planning (WEAP) model was employed to assess water allocation within the catchment.The HEC-HMS model simulation results revealed that the simulated hydrograph better captured the pattern of observed hydrograph for both calibration and validation periods. The results of the maximum and minimum temperature for the future period from 2041 to 2070 revealed increase on average by 1.62 °C and 1.43 °C for RCP 4.5, while by 2.26 °C and 1.71 °C for RCP 8.5, respectively. The average annual water availability and demand under current condition were found to be 247.4 million cubic meters (MCM) and 7.13 MCM, respectively. Future surface water availability is expected to increase by 23.9% under RCP 4.5 and 28.9% under RCP 8.5 compared to the refernce period. The WEAP simulation revealed monthly variations in water availability, highlighting unmet demand during the dry months of December to February due to reduced water availability during this period. This study suggests for integrated planning and management of the catchment area, particularly focusing on various water resource development activities, especially during dry seasons.

Keywords: Climate change, Water availability, HEC-HMS, WEAP, Awash river Basin, RCP, Keleta catchment

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Quantifying phenotypic variability of indigenous chickens using morphometric traits by applying multivariate analysis: Input for sustainable rural chicken farming

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Abstract

Despite environmentally influenced performance traits in farm animals, variations in morphometric characters reflect unswerving genetic effects. In this study, body weight and body dimension measurements of indigenous chickens reared in four rural communities were investigated using multivariate statistical procedures to elucidate the existence of phenotypic variability between chicken populations. The study districts were selected based on higher indigenous chicken population, geographic distance, and agro-ecological distinctiveness. Eleven morphometric traits were measured on 1060 adult chickens from the districts. The results revealed that there were significant ($p < 0.0001$) variations between populations across districts. Significantly ($P < 0.0001$) higher mean values for morphometric traits were obtained in chickens reared in the Hula (highland district) than in those of the three districts. Likewise, multivariate discriminant analysis showed that most of the variables had significant power to differentiate the chicken populations into separate groups. Accordingly, three discriminant functions were extracted, of which the first two explained 95.6 % of the total variances in the populations. Moreover, in cluster analysis, chickens were differentiated into two sub-groups: Hula as a separate population, and Shebedino, Aleta Chuko and Boricha populations clustered together. Furthermore, the discriminant analysis correctly assigned 56.7 %, 55.1 %, 51.5 %, and 53.3 % to their source populations of Hula, Aleta Chuko, Shebedino, Hula, and Boricha, respectively, showing high mixing and mobility of chickens across neighboring districts. Therefore, this study confirmed the existence of significant morphometric variability between the studied populations, which could be used as a valuable source of information for selective breeding and sustainable use of indigenous chickens, particularly for rural farmers who almost rely on phenotypic features to select breeding stocks. In addition, the higher morphometric measurements shown for Hula chickens should be confirmed by on-station evaluation, and further molecular tools should be applied to validate the genetic distinctiveness of the studied chicken populations.

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International water conventions, the exploitation of trans-boundary rivers and the Nile water dispute among Ethiopia, Sudan and Egypt

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Abstract

Ethiopia, Sudan and Egypt entered into dispute since Ethiopia began the construction of the Renaissance Dam along the Blue Nile in 2011. This article is aimed at assessing the core facts about water conventions, the use of trans-boundary rivers and the main argument points of Egypt and Sudan against Ethiopia's use right of the Nile. Data were obtained from conventions and laws, study reports and television interviews. Percent and ratios were used for quantifying data. The 1997 UN Water Convention, having seven criterions for equitable water use by riparian nations, is a better platform for the negotiation on the Nile water. Ethiopia contributes 86.52 billion m3 to the Nile water although Egypt's contribution is negligible. Despite the built-up of 3 huge dams by Egypt and over 10 by Sudan, these countries aggressively contest the Renaissance Dam of Ethiopia. Egypt diverts about 46 billion m3 water for irrigation. Turk, an upstream nation (alike Ethiopia in the Nile basin), built 11 dams along the Tigris and Euphrates Rivers with rare contest from the downstream nations. The existence of 'adequate rainfall' and 'other rivers' in Ethiopia, the colonial treaties, the Nile as the only resource, and the impact of the Renaissance Dam are among the main points of argument of Egypt and Sudan against Ethiopia's use right of the Nile. The Nile water use by Ethiopia is inevitable as 73.7 % of the rivers' flow, 65.3 % of the hydropower and 50.6 % of the irrigation potential of all Ethiopian rivers is in the Nile basin; besides, significant share of the population has no electric service (>60), no pure water access (42.7 %) and is below poverty line (29.6 %). Thus, the three countries need to be flexible for the 'give and take' principle-based negotiation and ensuring the equitable use of the Nile water.

Keywords: Transboundary watercourse**,** Water conventions**,** Equitable water use**,** Nile**,** Ethiopia**,** Egypt

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Health risk assessment of trace metal concentrations in cereal-based infant foods from Arba Minch Town, Ethiopia

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Abstract

The study aimed to determine the trace metal concentrations and assess the associated health risk of consuming cereal-based infant foods sold in supermarkets and local shops (baltena) in Arba Minch town, Ethiopia. Samples were subjected to a microwave digestion process and the trace elements were analyzed using Flame Atomic Absorption Spectrometry (FAAS). The method's accuracy was validated through a recovery test, yielding optimal results within the range of 94–100 %. The average concentrations of trace elements in the infant food samples were as follows: Iron (36.51–47.58 mg/kg), Copper (1.86–2.57 mg/kg), Zinc (13.90–21.56 mg/kg), Nickel (0.02–0.04 mg/kg), Chromium (0.034–0.10 mg/kg), Cobalt (0.012–0.02 mg/kg). Notably, potentially toxic heavy metals like Cadmium and Lead were not detected in the samples. The hazard quotient (HQ) for (6−9) month old infants was less than one (HQ<1) for all the trace elements analyzed. The same holds good for (9−12) month old infants except few food samples such as Selam, Zini, Mimi and Mulga baltena, which had HQ values greater than one (HQ>1). It is inferred that the continuous consumption of these foods might cause risk over a longer period.

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Assessment of mothers' satisfaction towards child vaccination service in South Omo zone, South Ethiopia region: a survey on clients' perspective

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Abstract

Background: Even though childhood vaccination is a common and cost-effective public health intervention in preventing and reducing childhood disease and death, significant numbers of children do not complete vaccination within the first year of life. Studies indicated that user satisfaction influences service utilization and used as a key indicator of quality care. However, evidence on the level of mothers' satisfaction with immunization service are limited in urban and accessible places and not well investigated among remote and pastoral communities. As such, this study aimed to address this gap and investigated mothers' satisfaction towards child vaccination in a pastoralist and agrarian community of the South Omo zone in Southern region of Ethiopia.

Methods: An institution-based cross-sectional study was conducted among 1221 randomly selected mothers with children eligible for childhood vaccination using a structured, pretested, and interviewer-administered questionnaire. Maternal positive evaluations of the overall vaccination service were measured using 5-point Likert scale questions. Data were entered into Epi data version 3.5.1 and analyzed using IBM SPSS statistical package version 25. Exploratory factor analysis was used for Likert scale questions to extract factor scores which facilitate treatment of variables as continuous for further analysis. Bivariate and multivariable logistic regression analysis was employed to identify factors associated with the outcome variable. A P-value < 0.05 and adjusted odds ratio with 95% CI respectively were used to declare statistical significance and degree of association.

Result: A total of 849 (69.53%) study participants were satisfied with the vaccination care provided for their children. Factors associated with mother's satisfaction with child vaccination care include maternal age less than 30 years (AOR = 2.12; 95% CI = 1.61–2.79), infants age between 8 and 12 months (AOR = 1.83; 95% CI = 1.28, 2.62), not having history of adverse events following immunization (AOR = 1.57; 95% CI = 1.01–2.45), having 1 child under the age of 5 years (AOR = 1.34; 95% CI = 1.02–1.76), waiting 30 min or less to get the service (AOR = 1.39; 95% CI = 1.05–1.85), traveling 30 min or less to the vaccination center (AOR = 1.46; 95% CI = 1.08–1.98), having poor knowledge about the importance of vaccination (AOR = 1.51; 95% CI = 1.06–2.16), and having moderate knowledge about the importance of vaccination (AOR = 1.52; 95% CI = 1.06–2.18).

Conclusion: Interestingly, mothers' satisfaction with their children's vaccination service was relatively higher in a predominantly pastoral community compared with most of previous studies conducted in Ethiopia. Maternal and child age, number of children under the age of 5 years, history of adverse events following immunization, distance to the vaccination center, waiting time to get service and maternal knowledge were factors significantly associated with mothers' satisfaction. Proactive measures with focus on increasing access to vaccination service, improving waiting time and raising awareness among mothers were recommended.

Keywords: Client's perspective, Childhood vaccination, South Omo zone, Ethiopia

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Patient satisfaction with pharmacy services among users and non-users of community-based health insurance scheme at public health facilities in Gamo Zone, South Ethiopia: a comparative cross-sectional study

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Abstract

Background: Patient satisfaction is a crucial humanistic outcome metric in pharmacy services. There was a lack of evidence on patients' satisfaction with pharmacy services in Gamo zone among users and nonusers of the CBHI scheme. Therefore, the aim this study is to compare the level of patient satisfaction with pharmacy services among users and nonusers of community-based health insurance scheme at public health facilities in Gamo zone, South Ethiopia.

Method: A facility based comparative cross sectional study design with mixed approach was conducted from June 1 to 30, 2023. A total of 522 study participants and 16 key informants were included as the sample size for quantitative and qualitative study, respectively. The quantitative data was gathered from the study participants who visited the outpatient pharmacy department during the study period by using a simple random sampling technique, while the purposive sampling technique was used to select clients and key informants for the qualitative study. The adjusted odds ratio (AOR) was used to measure the association between independent variables and patient satisfaction toward outpatient pharmacy services at the P values < 0.05 and 95% confidence interval (CI).

Results: From the total of study participants, 195 (73.9%) of insured and 175 (67.8%) of noninsured clients were satisfied with pharmacy services offered at public health facilities. The gender of insured (95% CI = 2.00-12.36, (p 0.01)), and noninsured (95% CI = 0.658–2.881, (p 0.02)), waiting time of insured (95% CI = 0.057–0.766, (p 0.0027)), and noninsured (95% CI = 0.084–0.925, (p 0. 0021)) and premium affordability of insured (95% CI = 0.0605-4.860, (p 0.00)) were significantly associated factors with client satisfaction at p < 0.05 and 95% CI. Based on qualitative finding, as member of the CBHI scheme, the members had a greater opportunity to receive a good pharmacy services, because they were more familiar with the physicians and the institutions.

Conclusion: The clients with insurance perceived high level of satisfaction with pharmacy services in public health facilities than noninsured. The gender and waiting times at outpatient pharmacy department for both groups of study participants and the premium affordability for the insured groups of clients were factors affecting client satisfactions with pharmacy services.

Keywords: Community based health insurance, Patient satisfaction, Pharmacy services, Ethiopia

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Assessing the effectiveness of integrated watershed management practices and suggesting innovative strategies in southern Ethiopia

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Abstract

Integrated watershed management plays a vital role in promoting sustainable water resource management and addressing environmental challenges. This study aims to analyze and assess the effectiveness of existing IWM practices and develop new strategies to improve watershed management. The data collection process encompassed comprehensive field observations, surveys, and consultations with the stakeholders. According to a hydrometer test, loam soil was the average dominant soil type in Elgo and Kola shell kebele. The assessment of existing soil water conservation initiatives adhered to the rigorous standards set by the Ministry of Agriculture. From 2016 to 2022, Elgo Kebele saw significant land use changes: agriculture expanded by 11.24 %, bare land by 2.05 %, water bodies by 1.79 %, and settlements by 0.54 %, while forests declined by 15.34 %. In Kola Shele, agriculture, water bodies, and settlements slightly increased by 0.5 %, 1.03 %, and 0.033 %, respectively, with decreases in bare land (1.82 %) and forest (0.05 %). Only 25 % of sampled plots met the criteria for effective soil water conservation systems, indicating challenges in current practices. For cultivated land with less than a 15 % slope and vertisol, recommended conservation practices include broad bed and furrow, conservation tillage, grass strips, grassland improvement, and mulching. For slopes greater than 50 %, hillside terracing, graded bunds, and trenches are advised. Additional measures, such as water harvesting, grass waterways, revegetation, and actions against illegal farming, were proposed. In summary, this study highlights the urgent need for improved IWM practices, and used to enhance watershed management, address environmental and socio-economic issues, and promote sustainable land use in the study.

Keywords: Alternative management strategies**,** Community perceptions on conservation practices**,** Effectiveness of IWM practices**,** Land use land cover change**,** Soil water conservation

PLOS Global Public Health
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4 (2024)

Prevalence of anemia and its associated factors among under-five children living in Arba Minch Health and Demographic Surveillance System Sites (HDSS), Southern Ethiopia

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Abstract

Childhood anemia affects around half of under five children and has impacts on physical, mental, and social development, both in the short and long term. The objective of the study was to determine the prevalence of anemia and its associated factors among under-five children living in Arba Minch Health and Demographic Surveillance System Sites (HDSS). A community-based cross-sectional study was conducted among randomly selected under-five children with their caregivers living in Arba Minch HDSS from June to August 2023. The questionnaire was developed to assess sociodemographic, nutrition, healthcare, and environmental characteristics. Hemoglobin concentration was adjusted for altitude of the village. Anemia was defined as the hemoglobin concentration below 11 g/dL. It was further categorized as mild (between 10–10.9 g/dL), moderate (7–9.9 g/dL), and severe (less than 7 g/dL). The analysis of factors associated with anemia was assessed by using logistic regression and significance was determined at p-value <0.05. A total of 332 under-five children with a mean (SD) age of 33(15) months participated. The overall prevalence of anemia among under-five children was 35.3% (95% CI: 30.4, 40.7). The magnitude of mild, moderate, and severe anemia was 12.4% (95%CI: 9.2, 16.4), 22.1% (95%CI: 17.9, 26.9), and 0.9% (95% CI: 0.3, 2.8), respectively. Anemia had a negative association with the advancing age of the children (0.95, 95%CI: 0.93, 0.97) and improvement in the family wealth score (0.86, 95% CI: 0.75, 0.99). Nearly one-third of the under-five children were anemic and childhood anemia is a moderate public health problem in the study area. The magnitude of anemia was negatively associated with the advance in child age and with the increase in the wealth status of the household. It is important to provide due attention to reduce the magnitude of anemia specifically for the youngest children and for those children from poor households.

International Journal of Anthropology and Ethnology
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8 (2024)

Impact of environmental change on the indigenous belief system of the Bayso Community of Gidicho Island, Southern Ethiopia

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Abstract

The environment and human existence are inextricably intertwined. Consequently, alterations in the environment's natural characteristics can lead to severe resource shortages. This affects the institutions that have been crucial in shaping and guiding human lives and preserving the environment's richness, as well as the endeavours of communities to sustain their livelihoods. This article examines the impact of environmental change on the indigenous belief system of the Bayso community of Gidicho Island, southern Ethiopia. Ethnographic data were collected through interviews, focus group discussions, observation, and photographs. The results showed that environmental change on Gidicho Island and its environs has disrupted the socio-economic and cultural life of the Bayso, essentially their religious rituals. Thus, we advise the federal government to amend the country's development policies that exacerbate environmental degradation and intervene to reduce the effects of poverty on the resource-use behaviours of its people.

Keywords: Bayso**,** Environmental change**,** Gidicho Island**,** Indigenous belief system

BMC Primary Care
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25 (2024)

Acceptability and use of HIV self-testing among young people in sub-Saharan Africa: a mixed methods systematic review

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Abstract

Background: Young people (YP) are disproportionately affected by the HIV pandemic in sub-Saharan Africa (SSA), but testing rates remain low despite global targets of testing 95% of people with HIV infection by 2030. HIV self-testing (HIVST) has been recently introduced to reach high-risk population groups such as these. Thus, synthesis of emerging evidence on the acceptability and use of HIVST among YP in SSA is needed so that comprehensive information can be generated to inform policy and practice.

Methods: We employed a mixed methods systematic review of quantitative and qualitative literature reporting on HIVST among YP involving any design and published in English by 31st of October 2023. The review synthesized quantitative evidence on acceptability and use of HIVST, and qualitative evidence on perspectives of YP about HIVST. We searched databases of published articles (e.g. MEDLINE, CINAHL) and Gray literature sources (e.g. Google, Google Scholar). The concepts for the search included self-testing, HIV/AIDS, and countries in SSA. Two authors independently screened, retrieved full-text, and assessed quality of the studies. **Results:** A total of 4150 studies were retrieved and 32 studies were finally included in the review. Acceptability of HIVST computed from a single item asking YP on their preference or willingness or demand for HIVST was moderate (34–67%) to high (≥ 67%) among YP in SSA. Nine of the fourteen studies that reported on acceptability found high acceptability of HIVST. Use of HIVST ranged from 0.8 to 100% while in most studies the use rate was below 50%. Key barriers to HIVST use were coping with a positive test in the absence of counselling and support, physical discomfort, and cost of kits. Perceived enablers included perceptions of HIVST as promoting personal empowerment and autonomy; privacy and confidentiality; and convenience in location, time, and skill.

Conclusions: HIVST was highly accepted but not well utilized among YP in SSA. YP showed diversified needs with mixed preferences for location, and modalities of service provision. Overall, the review identified heterogeneous evidence in terms of methods, population, outcome measures, and results. The review was registered in the International Prospective Registry of Systematic Reviews (PROSPERO: ID = CRD42021278919).

Keywords: HIV, Self-testing, Young people, Adolescents, Youths, Acceptability, Use, Barriers, Enablers, Facilitators

Chemistry Africa
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7 (2024)

Synthesis of 4-Hydroxy Coumarin Hybrid with 2H-Thiopyran and Imidazolidine-2,4-Dione Derivatives and the Investigation of their Antimicrobial, Anticoagulant and Cytotoxic Activities, and Molecular Docking

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Abstract

This study encompasses the synthesis of 2H-thiopyran-connected imidazolidine-2,4-dione (3a–h, 4, and 4a–h) derivatives and the evaluation of their anticoagulant, cytotoxic, and antimicrobial activities. A series of unique 2H-thiopyran-connected imidazolidine-2,4-dione derivatives (3a–h) was prepared using cyclisation methods; 4-hydroxycoumarin hybrid containing 2H-thiopyran-connected imidazolidine-2,4-dione derivatives (4a–h) were obtained via Knoevenagel condensation. The synthesised compounds were characterized by elemental analysis, FT-IR, NMR, and mass spectroscopy. The cytotoxic, anticoagulant, and antibacterial properties of them were assessed. The compound 4e efficiently inhibited the growth of methicillin-resistant Staphylococcus aureus compared to the positive control, whereas other compounds showed only a moderate level of activities; compound 4f demonstrated more efficient antifungal activity against the type culture, Trichophyton mentagrophytes than clotrimazole, with an MIC of 2 µg/mL. Also, the latter compound displayed higher anticoagulant activity compared to other molecules synthesized and the standard. The results of cytotoxicity activity of the compound 4f was impressive against MCF-7, HeLa, and HepG2 cancer cell lines (GI50 = 0.51 ± 0.08, 0.02 ± 0.65, and 0.03 ± 0.15 µm, respectively); the compound 4f exhibited greater binding affinity than the compound 4 when employing 1KZN, 1FI4, and 1Z11 proteins in in silico molecular docking experiments. Overall, the compounds 4e, and 4f showed a wide spectrum of activities and therefore could be used as antimicrobial, anticoagulant, and cytotoxic agents.

Keywords: 4-Hydroxycoumarin, Antibacterial activity, Anticoagulant activity, Antifungal activity, Cytotoxic activity, Imidazolidin-2,4-dione, Thiopyran

African Journal of Business and Economic Research
DOI: https://hdl.handle.net/10520/ejc-aa_ajber_v19_n4_a28
19 (2024)

Age Diversity and Organizational Performance with the Mediation Role of Organizational Citizenship Behavior

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Abstract

The study is conducted in the food and beverage industry to determine the relationship between age diversity and organisational performance. A Blau index measure of diversity illustrates that the industry has a moderate level of age diversity, with an actual index of 0.24. Age diversity positively affects organizational performance, and this effect is stronger in the presence of higher organizational justice. This study also finds that organizational justice strengthens the positive relationship between age diversity and organizational performance. The findings imply that pursuing the policy of boosting age diversity in the industry is vital, and augmenting it through efforts of flourishing organizational citizenship behaviour and organizational justice is a plus to further increase organizational productivity and performance.

Advances in Bamboo Science
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9 (2024)

An assessment of bamboo charcoal briquettes derived from the two main bamboo species in Ethiopia

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Abstract

The primary aim of this research was to study the manufacturing process of bamboo charcoal briquettes following the principles of life cycle assessment. Charcoal briquettes produced from lowland bamboo exhibited good fuel characteristics, higher calorific value and fixed carbon, and low moisture content. The ash content was in compliance with the international acceptable standard. Bamboo charcoal briquettes from highland bamboo (Oldeania alpina) and lowland bamboo (Oxytenanthera abyssinica) had calorific values of 6785 cal/gm and 7106 cal/gm, respectively. Manufacturing the briquettes at an ideal moisture content for carbonization saves time and leads to a maximum yield. Bamboo bioenergy (briquettes) produced in regulated kilns using locally available materials have gained popularity. Bamboo biomass utilization contributes to reducing deforestation and creates employment opportunities in bamboo value chains, as well as and contributing to UN SDG 7. Developing sustainable bamboo biomass energy use requires informing entrepreneurs about suitable business ecosystems. This research should encourage the proper utilization of the biomass feedstock and should ensure a healthier environment through the supply of a renewable source of energy. The most relevant findings in the present work were the production of environmentally friendly charcoal briquettes and their characterization (proximate and calorific value analysis) within the context of life cycle assessment of bamboo charcoal briquette technology.

Keywords: Bamboo Charcoal Briquette, Biomass Conversion, Calorific Value, Life Cycle Assessment, Proximate Analysis

PLoS Neglected Tropical Diseases
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18 (2024)

High prevalence of intestinal schistosomiasis in school-age children in the villages adjacent to Lake Chamo in the southern Rift Valley of Ethiopia

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Abstract

Background: The prevalence of intestinal schistosomiasis remains a challenge despite government efforts to eliminate the disease. This study aims to assess the prevalence of intestinal schistosomiasis in school-age children living in the villages surrounding Lake Chamo in southern Rift Valley of Ethiopia.

Methodology/Principal findings A cross-sectional study was conducted from January to July 2023 in Shele Mela Kebele in Gamo Zone, South Ethiopia. Stool samples were collected from 597 school-age children. A singe Kato-Katz for helminths and formalin-ether concentration technique for protozoan parasites were used to process the samples. The intensity of Schistosoma mansoni infection among school-age children was determined by counting the number of eggs per gram of stool. Of the 597 children screened, 52.3% (95% CI: 48.4.4–56.4) were positive for Schistosoma mansoni. These findings showed that 55% of the infections were light, 30.3% were moderate, and 14.7% were heavy. The mean egg count of S. mansoni parasites was 182.1 eggs per gram. The prevalence of other intestinal parasites (Hymenolopis nana, Ascaris lumbricoides, Hookworm, Taenia species, Giardia lamblia and Entamoeba histolytica) was found to be 7.7% (46/597). The overall prevalence of S. mansoni co-infection with other intestinal parasites was 5.0% (30/597). Specifically, the co-infection rates were 1.5% for A. lumbricoides, 1.3% for H. nana, 1.0% for Taenia species, 0.2% for Hookworm, 0.2% for E. histolytica, and 0.2% for G. lamblia.

Conclusions/Significances: The study showed a high rate of S. mansoni infection among school-age children. This calls for immediate action, such as school-based deworming, to protect these children from the disease and reduce the burden. Further research is needed to understand the transmission of the infection by the intermediate host.

Archaeological and Anthropological Sciences
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16 (2024)

The emergence of large flake-based Acheulian technology: perspective from the highland site-complex of Melka Wakena, Ethiopia

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Abstract

Isaac GL (1969) proposed that Large Cutting Tools (LCTs) made on large flake blanks detached from giant/boulder cores are the key technological variable that distinguishes the Acheulian from the Oldowan. The production of large flake blanks was initially observed in the earliest records of the Acheulian technology in Africa ca. 1.75 Ma, subsequently becoming a technological feature of many sites across eastern Africa. Still, the mode and tempo of evolution of the large flake-based Acheulian technology remains poorly understood. Here we report on the large flake-based Acheulian assemblage at locality MW5 in the Melka Wakena site-complex, chronologically constrained between 1.37 and 1.34 Ma. At the site-complex level we note that aspects related to small flake production remain relatively unchanged since ~ 1.6 Ma. Secondary modification of small flakes by retouch remained marginal and there is only a slight increase in the frequency of structured reduction of cores, compared to the earlier 1.6 Ma assemblage. In contrast, the MW5 lithic assemblages inform of the diachronic shift of lithic techno-economy into a large flake-based LCTs technology. This shift is characterized by: (1) A highly selective use of a specific raw material (glassy ignimbrite) for the production of large flake blanks; (2) transport of prepared large flake blanks from relatively distant sources into the sites as part of a spatially and temporally fragmented reduction sequence; (3) improved know-how of large flake production, (4) the introduction of the Kombewa technology; (5) a unified technological concept for the production of handaxes and cleavers, diverging only in the specific decisions determining their final shape parameters. Taken together, these trends indicate changes in techno-economic strategies related to LCT production, including higher levels of pre-planning in the raw material acquisition stage and higher investment in controlling the morphometric properties of the artifacts.

Keywords: African Acheulian**,** Lithic technological evolution**,** Highland paleoenvironment**,** Eastern Africa**,** Late early Pleistocene

BMC Public Health
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24 (2024)

Predictors of CD4 cell count progression over time among adolescents and young adults transitioning to adult-oriented HIV care in Southern Ethiopia from 2017 to 2021: a retrospective cohort study

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Abstract

Background: Human immunodeficiency virus (HIV), a viral infection impacting CD4 cells, requires an understanding of factors influencing CD4 cell counts to reduce acquired immunodeficiency syndrome(AIDS)-related morbidity and mortality. Despite its importance, no studies have examined predictors of CD4 cell count progression post-transition to adult-oriented HIV care in Ethiopia. This study aimed to identify predictors affecting CD4 cell count trends among adolescents and young adults transitioning to adult-oriented HIV care. Therefore, this study aimed to identify the predictors that affect the trends of CD4 cell count over time among adolescents and young adults who transitioned to adult-oriented HIV care.
Methods: A retrospective cohort study was conducted among 206 adolescents and young adults who transitioned to adult-oriented HIV care and had at least two CD4 cell counts in eight selected health facilities in Southern Ethiopia. These facilities were chosen due to their high volume of people living with HIV. A multivariable linear mixed effect model was fitted to identify the predictors of CD4 cell count progression through time. Multi-collinearity between variables was checked using the variance inflation factor. Model comparisons were done using Akaike and Bayesian information criteria. Regression coefficients with 95% confidence intervals (CI) and P-value ≤ 0.05 were used to measure the strength of association and significance level.
Results: The average CD4 cell count was raised by 6.7 cells/mm3 every six months among the study participants. Transitioning at the age of 18 or older (β = 204.71; 95% CI = 81.86347, 327.5574; P < 0.001), being rural residents (β= -119.776; 95% CI = -215.362, -24.189; P < 0.014), having World Health Organization (WHO) stage III & IV HIV (β= -182.161; 95% CI = -318.475, -45.847; P < 0.009), were the predictors for CD4 cell count progression over time.
Conclusion: Based on the identified predictors of CD4 cell count progression over time among HIV-positive adolescents and young adults transitioning to adult-oriented HIV care in southern Ethiopia, such as observation time, age at transition, residence, and WHO staging, the study highlights the need for interventions focused on tailored support. Specifically, these interventions should target individuals transitioning with less ART time, those younger than 18, those residing in rural areas, and those with advanced WHO staging, to improve their CD4 cell counts over time.

Keywords: CD4 cell, Predictors, Adolescents, and young adults, Linear mixed effect model, Southern Ethiopia

Scientific Reports
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14 (2024)

A community-based study of intention to use HIV self-testing among young people in urban areas of southern Ethiopia

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Abstract

In sub-Saharan Africa, young people are at high risk of HIV infection, representing nearly 4 out of 5 new infections. HIV self-testing (HIVST), a new and proactive testing scheme that involves self-collection of a specimen and interpretation of results, is deemed potentially helpful for increasing testing amongst population groups like young people who do not frequently use routine testing services. This study assessed young people's intention to use HIVST in urban areas of southern Ethiopia drawing on the Theory of Planned Behaviour. A community-based cross-sectional study was conducted with 634 participants aged 15–24 years from six town administrations of two zones in January to February 2023. The participation rate was 634/636 yielding 99.7%. The OraQuick HIVST kit was demonstrated to young people recruited in a door-to-door survey with a face-to-face interview using an electronic questionnaire in a mobile phone-based application. Intention to use HIVST was measured from a 6-point Likert scale with scores of agreements ranging from 1 to 6. Descriptive statistics and ordinal logistic regression analysis were done using STATA version 18. Most of the participants agreed that they would use HIVST if it was available (86.3% agreeing or strongly agreeing). Interestingly, young people who perceived themselves at some to high risk were 0.51 times less likely to be in the higher order of intention to use when HIVST is available to them than those who perceived themselves at no to low risk. Intention to use HIVST increased by a factor of 1.29, 1.84 and 2.35 for every one-unit increase on the mean favourable attitude, perceived behavioural control, and acceptability scores, respectively. The majority of young people intended to use HIVST. Young people's perceived behavioural control, and acceptability of HIVST affected their intention to use. Intention and subsequent use of HIVST can be enhanced through an understanding of the role of risk perception and positive attitude, confidence to perform and acceptance of the test. Implementation studies are required to examine the actual uptake of HIVST among young people.

Keywords: Intention, HIV self-testing, Young people, Urban, Ethiopia

Discover Food
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4 (2024)

Evaluation of aflatoxin content in "Cheka" (traditional beverage in South-Western Ethiopia) and its major ingredient (maize)

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Abstract

Background: Aflatoxin is a toxic cancerous fungal secondary metabolite produced by Aspergillus species. Consumption of aflatoxin-contaminated cereals and their products can cause several health-related effects including acute and chronic aflatoxicosis. This study aims to evaluate the total aflatoxin content in "Cheka" and its major ingredients using the Immuno-Affinity Column Clean-up technique by sensitive HPLC (High-Performance Liquid Chromatography) with fluorescence detection. Methods: This study followed a completely randomized experimental design to evaluate the level of aflatoxin in traditionally brewed "Cheka" and its major ingredients (maize) by HPLC from November 2019 to June 2020. Traditionally brewed 6 "Cheka" beverages and 6 maize seed samples were collected randomly from Konso and transported to Bless Agri Food Laboratory in Addis Ababa for laboratory evaluation of aflatoxin in samples. The data were analyzed by SPSS version 25. Results: In the present study aflatoxin contamination was detected in all maize and "Cheka" samples. A mean total aflatoxin level of 6.78 ± 8.28 µg/kg and 10.76 ± 4.50 µg/kg were observed in maize and "Cheka" samples respectively. The maize taken from above-ground storage ("Gotera") and underground storage (pitfall) showed a mean total aflatoxin level of 10.23 ± 10.12 µg/kg and 3.35 ± 5.79 µg/kg respectively. The samples taken from "Cheka" prepared from maize of above-ground storage ("Gotera") and underground storage (pitfall) showed a mean total aflatoxin level of 11.34 ± 3.06 µg/kg and 10.19 ± 6.35 µg/kg respectively. Aflatoxin G family was not detected in both maize and "Cheka" samples while aflatoxin B1 and B2 contributed to the total aflatoxin level. AFB1 predominantly contributed to the contamination of all samples. Although there was no significant difference while comparing between mean total aflatoxin of any other sample types, a significant difference was observed for the AFB1 mean level of pitfall maize and their respective "Cheka" samples (P = 0.033). Conclusion: The mean level of AFB1 in pitfall maize differs from a respective "Cheka" sample. As most of the samples evaluated for aflatoxin contamination showed levels above healthy cut-off points of aflatoxin set by different authorities like the European Union, CODEX, and Ethiopian Standards Agency, there must be a protracted interventional approach to reduce aflatoxin contamination in maize and its products in the region.

Keywords: Aflatoxin, Aspergillus, "Cheka", Ingredients, Konso

Chemical Engineering Journal
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499 (2024)

Exploring the integrated potential of pyrolysis and low-temperature wet torrefaction for typical medical waste valorization: A multifaceted approach leveraging online TG-FTIR-MS, 2D-COS, iso-conversional kinetics, and reaction mechanisms

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Abstract

The rapid growth of medical waste, exacerbated by the COVID-19 pandemic and advancements in healthcare, has drawn increased public scrutiny regarding its proper disposal and treatment. This research aimed to characterize the wet torrefaction of a typical medical waste biomass (MWB) composition, comprising bamboo swabs, skewers, splints, cotton balls, tongue depressors, toothpicks, and chopsticks, followed by its co-pyrolysis with medical waste plastic (MWP) including catheter bags, drapes, IV tubing, IV bags, oxygen masks, syringes, and test tubes. The study employed thermogravimetric analysis, TG-FTIR, 2D correlation spectroscopy, iso-conversional kinetics, and mass spectrometry techniques elucidated the driving factors, behaviors, products, mechanisms, and pathways involved. The pyrolysis temperature ranges were 180.15 to 400 °C for TMWB and 380.04 to 550 °C for MWP, with average activation energies of 150.22 and 221.59 kJ/mol for their respective devolatilization processes. Incorporating 20 % and 40 % MWP into the co-pyrolysis process yielded the best performance, characterized by the lowest activation energy. The co-pyrolysis process promoted the release of cyclic hydrocarbons and chain hydrocarbons, but decreased the yields of alcohols, esters, ethers, phenols, and acids, through synergistic mechanisms. Unraveling the pyrolysis pathways and dynamics of these representative medical waste streams offers valuable insights into improving energy recovery, mitigating pollution, diminishing waste volumes, and optimizing industrial thermochemical conversion processes for safely treating these hazardous materials.

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Enhancing Healthcare Information Systems in Ethiopian Hospitals: Exploring Challenges and Prospects of a Cloud-based Model for Smart and Sustainable Information Services

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Abstract

Hospitals are the primary hubs for healthcare service providers in Ethiopia; however, hospitals face significant challenges in adopting digital health information systems solutions due to disparate, non-interoperable systems and limited access. Information technology, especially via cloud computing, is crucial in healthcare for efficient data management, secure storage, real-time access to critical information, seamless provider communication, enhanced collaboration, and scalable IT infrastructure. This study investigated the challenges to standardizing smart and green healthcare information services and proposed a cloud-based model for overcoming them. We conducted a mixed-methods study in 11 public hospitals, employing quantitative and qualitative approaches with diverse stakeholders (N = 103). The data was collected through surveys, interviews, and technical observations by purposive quota sampling with the Raosoft platform and analyzed using IBM SPSS. Findings revealed several shortcomings in existing information systems, including limited storage, scalability, and security; impaired data sharing and collaboration; accessibility issues; no interoperability; ownership ambiguity; unreliable data recovery; environmental concerns; affordability challenges; and inadequate policy enforcement. Notably, hospitals lacked a centralized data management system, cloud-enabled systems for remote access, and modern data recovery strategies. Despite these challenges, 90.3% of respondents expressed interest in adopting cloud-enabled data recovery systems. However, infrastructure limitations, inadequate cloud computing/IT knowledge, lack of top management support, digital illiteracy, limited innovation, and data security concerns were identified as challenges to cloud adoption. The study further identified three existing healthcare information systems: paper-based methods, electronic medical catalog systems, and district health information systems2. Limitations of the paper-based method include error-proneness, significant cost, data fragmentation, and restricted remote access. Growing hospital congestion and carbon footprint highlighted the need for sustainable solutions. Based on these findings, we proposed a cloud-based model tailored to the Ethiopian context. This six-layered model, delivered as a Software-as-a-Service within a community cloud deployment, aims to improve healthcare services through instant access, unified data management, and evidence-based medical practices. The model demonstrates high acceptability and potential for improving healthcare delivery, and implementation recommendations are suggested based on the proposed model.

Index-terms: Health care Information Systems, Cloud based Model, Interoperability, Sustainability, Information Technology, Cloud Computing

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24 (2024)

Barriers and facilitators of transition of adolescents living with HIV into adult care in under-resourced settings of Southern Ethiopia: a qualitative study

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Abstract

Background: Adolescence is commonly perceived as a distinct and typically healthy stage of life. However, in regions with a high prevalence of HIV, like Ethiopia, numerous adolescents are contracting the virus. Upon testing and diagnosis, they encounter care-related issues, particularly barriers and facilitators of the healthcare transition from adolescent to adult clinics. Hence, the study aimed to investigate the barriers and facilitators influencing the transition of adolescents living with HIV (ALWHs) in the resource-limited settings of Southern Ethiopia.

Methods: The research employed a phenomenological study design with a qualitative methodology. Purposive sampling was used to gather data through in-depth interviews (IDIs) and focus group discussions (FDGs) involving ALWHs and their parents. The data analysis followed Van Manen's principles.

Results: Following Van Manen's guidelines, the data analysis revealed a conceptual framework with two major themes: "Barriers" and "Facilitators". The theme barrier was derived from three sub-themes including behavioral barriers, social barriers, and system barriers in the transition. The theme facilitator was derived from four sub-themes including self-acceptance as an adult, a desire to experience new things, a supportive family, and friendly healthcare services. The study identified three levels of factors influencing the transition into adult clinics: individual, family/peer, and healthcare-related factors. The barriers to transition included lack of knowledge, being in a romantic relationship, psychosocial struggles, perceiving us as immature, stigma, negative peer pressure, lack of timely disclosure, absence of transition guidelines, disrespectful treatment, and absence of separate clinics. On the other hand, facilitators such as self-acceptance as an adult, desire for new experiences, family support, informed support and promising outcomes, flexible appointment scheduling, and psycho-social support groups were found to improve the transition process and enhance the overall well-being of adolescents living with HIV.

Conclusion: The study highlights the complex transition process for ALWHs into adult healthcare. Barriers such as lack of knowledge, stigma, and disrespectful treatment pose challenges during this critical period. Conversely, facilitators like self-acceptance, family support, and youth-friendly healthcare services can enhance the transition experience and well-being of ALWHs. Collaborative efforts among ALWHs, families, and healthcare providers are crucial for successful transitions and improved health outcomes. Separated clinics catering to the unique needs of ALWHs are recommended to address privacy concerns.

Keywords: Adolescent, HIV/AIDS, Transition, Barriers, Facilitators, Ethiopia

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Intestinal parasitic co-infections associated with Helicobacter pylori among paediatric patients with gastrointestinal illness attending a general hospital in southern Ethiopia

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Abstract

Background: Concurrent infections or co-infections caused by intestinal parasites and Helicobacter pylori are quite rampant in paediatrics living in endemic areas of sub-Saharan Africa, including Ethiopia, and if left untreated, can result in severe complications and hence must be addressed to ensure their health and well-being.
Objectives: To determine the prevalence of intestinal parasitic and H. pylori co-infections and associated factors among paediatric patients with gastrointestinal symptoms who attended the Arba Minch General Hospital (AMGH), Arba Minch, southern Ethiopia, from September to November 2020.
Methods: A cross-sectional study was conducted among a study population of 299 paediatric patients with gastrointestinal symptoms who visited AMGH. Stool samples were collected and analysed to detect H. pylori and intestinal parasites. A rapid lateral flow chromatographic immunoassay was employed to identify the H. pylori copra antigen, whereas the latter was detected using wet mount saline preparation and formol-ether concentration method. Socio-demographic, clinical, behavioural and other factors were obtained by means of a pre-tested structured questionnaire. Descriptive statistics and logistic regression analysis were done by Statistical Package for Social Service (SPSS) version 25; P values < 0.05 were considered statistically significant.
Results: The prevalence of Helicobacter pylori and intestinal parasites was 14% (n = 42) and 37.1% (n = 111), respectively, whereas that of the co-infections with these pathogens was 6.4% (n = 19). Giardia lamblia was the most prevailing parasite, 21.4% (n = 64). Informal maternal education [AOR = 5.14; 95% CI: 1.98–15.70] and lack of hand washing practice were significantly associated with the extent of co-infections [AOR = 4.18; 95% CI: 1.36–12.80].
Conclusion: Nearly one in twenty pediatric patients with gastrointestinal symptoms had intestinal parasitic infections and H. pylori co-infections, representing a silent health problem that is to be addressed through effective control strategies. Health administrators should consider the importance of co-infections in clinical diagnosis and planning aimed at its prevention.

Keywords: Arba Minch**,** Co-infections**,** Gastroenteritis**,** Paediatric patients

Natural Hazards
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Land subsidence and groundwater storage change assessment using InSAR and GRACE in the arid environment of Saudi Arabia

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Abstract

Najran region in Saudi Arabia has been affected by groundwater storage decline and consequent land subsidence for a long period of time. In this study, we utilized Sentinel-1 data for ground surface mapping, to generate interferograms and coherence maps using the Looking into Continents from Space with Synthetic Aperture Radar (LiCSAR) processor to estimate land subsidence rates from 2016 to 2020. Therefore, LiCSBAS-InSAR technique allowed for the identification and study of the changes in surface deformation over a selected period. We validated the observed displacement field by processing the Global Navigation Satellite System (GNSS) station's time series, which spanned from 2017 to 2019. In addition, we also analyzed Gravity Recovery and Climate Experiment (GRACE)-based Terrestrial Water Storage Anomalies observations to estimate groundwater depletion trends in the region. The result of the study indicates the occurrence of subsidence along the valley, as observed using the Small Baseline Subset InSAR technique. The average annual subsidence rate was observed ranging from 1.1 to 5.1 mm per year between 2016 and 2020. Correspondingly, the GRACE analysis showed that groundwater storage depletes at ~ 11.2 mm per year. Moreover, this finding provides valuable information about the excessive use of groundwater for growing vegetation. NDVI analysis has shown a considerable increasing vegetation area change of approximately 34.5 km2 between 2013 and 2020 with a 0.2 threshold. Overall, the analysis reveals that the time series obtained from InSAR, GRACE, GNSS, and well data exhibits a consistent downward trend over time.

Keywords: LiCSBAS**,** InSAR**,** GRACE**,** GNSS**,** Subsidence**,** NDVI

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24 (2024)

Erratum: Correction to: Barriers and facilitators of transition of adolescents living with HIV into adult care in under-resourced settings of Southern Ethiopia: a qualitative study

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Abstract

Background: Adolescence is commonly perceived as a distinct and typically healthy stage of life. However, in regions with a high prevalence of HIV, like Ethiopia, numerous adolescents are contracting the virus. Upon testing and diagnosis, they encounter care-related issues, particularly barriers and facilitators of the healthcare transition from adolescent to adult clinics. Hence, the study aimed to investigate the barriers and facilitators influencing the transition of adolescents living with HIV (ALWHs) in the resource-limited settings of Southern Ethiopia.

Methods: The research employed a phenomenological study design with a qualitative methodology. Purposive sampling was used to gather data through in-depth interviews (IDIs) and focus group discussions (FDGs) involving ALWHs and their parents. The data analysis followed Van Manen's principles.

Results: Following Van Manen's guidelines, the data analysis revealed a conceptual framework with two major themes: "Barriers" and "Facilitators". The theme barrier was derived from three sub-themes including behavioral barriers, social barriers, and system barriers in the transition. The theme facilitator was derived from four sub-themes including self-acceptance as an adult, a desire to experience new things, a supportive family, and friendly healthcare services. The study identified three levels of factors influencing the transition into adult clinics: individual, family/peer, and healthcare-related factors. The barriers to transition included lack of knowledge, being in a romantic relationship, psychosocial struggles, perceiving us as immature, stigma, negative peer pressure, lack of timely disclosure, absence of transition guidelines, disrespectful treatment, and absence of separate clinics. On the other hand, facilitators such as self-acceptance as an adult, desire for new experiences, family support, informed support and promising outcomes, flexible appointment scheduling, and psycho-social support groups were found to improve the transition process and enhance the overall well-being of adolescents living with HIV.

Conclusion: The study highlights the complex transition process for ALWHs into adult healthcare. Barriers such as lack of knowledge, stigma, and disrespectful treatment pose challenges during this critical period. Conversely, facilitators like self-acceptance, family support, and youth-friendly healthcare services can enhance the transition experience and well-being of ALWHs. Collaborative efforts among ALWHs, families, and healthcare providers are crucial for successful transitions and improved health outcomes. Separated clinics catering to the unique needs of ALWHs are recommended to address privacy concerns.

Keywords: Adolescent**,** HIV/AIDS**,** Transition**,** Barriers**,** Facilitators**,** Ethiopia

Zoonoses and Public Health
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Awareness of fish-borne zoonoses and prevalence of Contracaecum in Oreochromis niloticus and Lates niloticus collected from Lake Chamo, Arba Minch, Ethiopia

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Abstract

Aim: Many fish species can harbour a wide range of pathogenic agents in their tissues. Of many pathogens, the parasitic nematode of genus Contracaecum, which resides in the tissues of fish species, can results in fish-borne infections in humans. This study was planned to assess consumers' awareness of fish-borne zoonoses in the fishing sites of Lake Chamo, Arba Minch, Ethiopia. The study was also aimed at demonstrating the zoonotic nematode, Contracaecum parasites in the Oreochromis niloticus and Lates niloticus fishes collected from Lake Chamo, Arba Minch, Ethiopia.
Methods and Results: Assessment of awareness about fish-borne zoonoses was conducted in randomly selected participants (n = 162) using face-to-face interviews via a structured and semi-structured questionnaire. Besides, 70 fishes (O. niloticus = 35 and L. niloticus = 35) were examined for the presence of larva of Contracaecum and other anisakid genera through standard dissection, pepsin-hydrochloric acid digestion and microscopic observation. Consumers have inadequate awareness about fish-borne zoonoses based on the answers they provided to the questions. The majority of respondents (82%) consume raw fish in the area. Of these, a significantly higher proportion were male ($p < 0.001$), completed their elementary or high school ($p = 0.004$), Orthodox Christian ($p = 0.044$), fishermen ($p < 0.001$) and participants without previous information about fish-borne zoonoses ($p < 0.001$). Overall, of examined fishes (n = 70), n = 15 (21.4%, 95% CI, 12.8–33.2) were infected with Contracaecum larva. A significant ($p = 0.028$) higher infection prevalence was noted in L. niloticus (34.3%, 95% CI, 19.7–52.3) compared to O. niloticus (8.6%, 95% CI, 2.2–24.2). A unit gram addition in the total weight of fish would significantly raise the risk of Contracaecum infection by 1% ($p < 0.001$).
Conclusions: The presence of Contracaecum, a zoonotic nematode in the fishes, which are often preferred by consumers for raw dishes, designates a high risk of possible fish-borne infections in the area. Thus, providing education and training for fishermen, visitors of the area, and local people who visit the area for fish consumption, it is inevitably important to minimize the risk. Furthermore, health workers should suspect fish-borne infections, such as anisakidosis in patients who have a history of raw fish consumption in Arba Minch, Ethiopia.

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Integrating temporal-aggregated satellite image with multi-sensor image fusion for seasonal land-cover mapping of Shilansha watershed, rift valley basin of Ethiopia

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Abstract

Accurate land-cover mapping in regions with frequent cloud-cover and rapidly changing agricultural land cover by crop growth cycles cannot be guaranteed by use of single sensor images, or an image from a single-acquisition-date. This study addressed these challenges by applying temporal-aggregation of single sensor image features that is integrated with multi-sensor image fusion. Results of land-cover classification target fallow, growing, and harvest/post-harvest agricultural seasons. Satellite based features used were frequency bands of Sentinel-1 (S1) and Sentinel-2 (S2), including vegetation indices (VIs) and biophysical variables (BPVs). Temporal aggregation improved classification accuracy. The single-acquisition-date S2 image, overall accuracy (OA) ranged from 0.81 to 0.85, increased to 0.86 to 0.87 after temporal-aggregation. Meanwhile, for single-acquisitions of S1, OA ranged from 0.44 to 0.79 increased to 0.6 to 0.86 across respective seasons. Fusing temporally aggregated S1 and S2 image features including VIs and BPVs increased OA up to 0.90. Selecting 11, 8, and 10 out of 18 optimum numbers of features for fallow, growing, and harvest/post-harvest seasons respectively improved OA by 3%, 2%, and 1.86%. PCA fusion of the temporally aggregated best performing feature set enhanced harvest/post-harvest season, fallow, and growing seasons with OA of 0.98, 0.96 and 0.94 respectively. Accuracy was enhanced when selecting different best performing feature set for the three seasons. The study enhanced knowledge of advanced remote sensing for agricultural land cover mapping, with practical implications of land monitoring and management.

Keywords: Feature selection, Temporal-aggregation, PCA, Multi-sensor fusion, Machine learning

Inorganic Chemistry Communications
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170 (2024)

Impact of Fe3+ and Al3+ co-doping on the structure, optical properties, and antibacterial activities of ZnO nanoparticles

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Abstract

Understanding the potential role of nanoparticles (NPs) in the global antibiotic resistance threat is essential. This study focuses on the potential antibacterial applications of Zn1−2x(Fe, Al)xO (x = 0.0, 0.02, 0.035, 0.05, and 0.065) NPs synthesized using the citrate–nitrate solution combustion method. The synthesized NPs were characterized using XRD, FESEM, FTIR, UV–Vis, and PL spectroscopies. Their antibacterial performance was assessed using the standard disc diffusion method. The synthesized NPs exhibited a single-phase hexagonal wurtzite structure (P63mc space group), with crystallite sizes ranging from 8.5 to 19.74 nm, which decreased with increasing dopant concentration. Incorporation of Fe3+ and Al3+ significantly altered key parameters of ZnO NPs, including lattice constant, bond length, dislocation density, and microstrain. Furthermore, FESEM revealed the formation of relatively spherical grains with sizes ranging from 28.42 to 56.54 nm. FTIR confirmed the presence of metal–oxygen bonds, and changes in optical properties of ZnO NPs were observed in the UV and PL spectra due to the dopants. The direct optical band gap energies ranged from 3.29 eV to 3.43 eV, indicating a notable effect of doping. Incorporating Fe3+ and Al3+ into Zn1−2x(Fe, Al)xO led to a substantial enhancement in antibacterial efficacy against Escherichia coli (E. coli) and Staphylococcus aureus (S. aureus), increasing the zones of inhibition (ZOI) (at a concentration of 33.33 mg/mL) from 14.14 mm to 16.14 mm and from 17.14 mm to 19.18 mm, respectively. Among all samples, Zn0.96Fe0.02Al0.02O NPs exhibited outstanding antibacterial activity, with ZOIs of 16.14 mm and 19.18 mm against S. aureus and E. coli, respectively. This study also suggests enhanced antibacterial mechanisms for the Zn0.96Fe0.02Al0.02O NPs.

Environmental Challenges
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17 (2024)

Standard physical designs of land management technologies and determinants of household adoption intentions in Goyrie watershed, southern Ethiopia

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Abstract

The adoption of land management technology (LMT) is crucial for minimizing soil erosion and increasing agricultural productivity, both of which are essential components of sustainable development. Therefore, different LMTs have been adopted in the Goyrie Watershed of southern Ethiopia. However, the technical designs of the adopted technologies have not yet been assessed. Thus, the objective of this study is to evaluate the technical designs of adopted LMTs in relation to standards as well as to identify the factors that influence households' intentions to adopt LMT dimensions in the suggested standards. Data were collected through field measurements, observations, focus group discussions, key informant interviews, and 291 randomly selected heads of household. Data were analyzed using frequency, mean, standard deviation, and structural equation modeling (SEM). This study found that 30 % of the technical aspects of the adopted LMTs on private farmlands and 12 % on communal lands met the recommended national standards. However, field measurements found that 70 % of private farmlands and 88 % of communal lands in the adopted LMT technical designs failed to fulfill the required national standards. This problem was more pronounced on communal land. The SEM estimation revealed that households' assumptions about development agents and households' perceptions of the benefits of LMTs were found to significantly and positively influence the probability of households' intentions to adopt LMTs in line with the referenced standards. Whereas households trust village memberships, the nature of soil types and training opportunities significantly but negatively predicted the probability of households' intention to adopt LMTs in relation to standards. The study suggests that national and regional governments provide adequate training opportunities for farmers on how to design and implement LMT dimensions in accordance with recommended standards.

Keywords: Technical design, Standards, Land management technology, Structural equation modeling.

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23 (2024)

Missed nursing care and associated factors among nurses and midwives in maternity wards of Sidama region public hospitals, Ethiopia

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Abstract

Background: Missed nursing care refers to any aspect of care performed by nursing staff that is omitted or significantly delayed. Even though the potential impact of missing nursing care on maternal and fetal outcomes is significant, there is currently limited evidence regarding the extent of this issue specifically within the maternity wards. Therefore, this study aimed to assess missed nursing care and associated factors in the maternity wards of public hospitals in the Sidama region, Ethiopia 2022.

Methods: A hospital-based cross-sectional study was conducted among 361 nurses and midwives in maternity wards of Sidama region public hospitals from March 28 to April 26, 2022. Simple random sampling was used to select participants. The data was collected using the MISSCARE survey tool and analyzed with SPSS version 26. Simple linear and multiple linear regression analyses were used to identify the factors associated with missed nursing care.

Results: The overall mean missed nursing care score was 67 out of 130 (95% CI: 65.92, 68.02) and the average score for each nursing intervention was 2.58 out of 5 (95% CI: 2.54, 2.62). The intention to leave the institution (β = 3.812, 95% CI: 2.285, 5.340) and increasing weekly work hours (β = 0.203, 95% CI: 0.134, 0.272) were factors positively associated with missed nursing care. However, increased work experience (β= -0.963, 95%CI: -1.475, -0.452) and job satisfaction (β= -4.976, 95%CI: -6.431, -3.522) were negatively associated with missed nursing care. **Conclusion:** This study found that the level of missed nursing care was significant. Factors positively associated with missed nursing care included an intention to leave the institution and an increase in weekly work hours. In contrast, an increase in work experience and higher job satisfaction were negatively associated with missed nursing care.

Keywords: Omitted care**,** Delayed care**,** Neglected care**,** Obstetrics Ward

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Ethnozoological study of medicinal animals used by the inhabitants of the Kucha District, Gamo Zone, Southern Ethiopia

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Abstract

Background: An ethnozoological study of medicinal animals in the Kucha district, Gamo zone, Southern Ethiopia, was conducted to investigate and document the use of traditional medicinal animals and the associated indigenous knowledge. Tribal people still make abundant use of animals and their parts to manage diseases in humans and even livestock.

Method: A cross sectional study design and purposively sampling techniques were used. Data were collected from 132 respondents based on semi structured questionnaires. Focus group discussions (FGD) and Key informant interviews (KII) were conducted; Fidelity level (FL), Relative frequency of citation (RFC) and Informants' consensus factor (ICF) were used to analyze species preference and importance.

Results: A total of 24 medicinal animals were identified with 13 species (54.2%) being mammals of which 5 species (20.8%) dominated. They were followed by arthropods, reptiles and fishes. Seven out of the total were domestic species (29%) and 17 (70%) were wild animals. The majority of these animals, i.e. 22 (91.7%), were used to treat human ailments; whereas 2 (8.3%) were used to treat livestock ailments. The ICF values varied from 0.8 to 1.The highest FL value (98%) was linked to the cow (cattle), the lowest (1.5%) to the scorpion. The RFC value (1.0) was highest for the cow and lowest (0.02) for the scorpion. Honey, milk, and butter were the most commonly used therapeutic animal products, but regarding direct uses, fresh/raw meat dominated. Out of ten ailment categories, headaches had the lowest ICF value (0.8). All others scored at least 0.9. **Conclusions:** In rural areas, sick people often do not only have limited access to modern medical facilities, they actually prefer traditional treatments considering them to be more reliable and effective. It is therefore important to focus on documenting, conserving, and safeguarding the indigenous knowledge so that strategies to manage the traditional wisdom can be implemented in the future. To achieve these goals, it is important to make sure that medicinal animal species are available in sufficient numbers and neither threatened by habitat changes or overexploitation.

Keywords: Medicinal animals**,** Fidelity level**,** Informant consensus factor, Relative frequency of citation**,** Ethnozoology**,** Indigenous knowledge**,** Traditional remedies

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6 (2024)

An intelligent transformer enabled medium voltage AC network for loss minimization and node voltage improvement

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Abstract

The research work presented here discusses about design and integration of intelligent transformer (IT) to the 15 kV/0.4 kV overloaded distribution feeder in Wolaita Sodo Town. The feeder contains 113 distribution transformers with different capacities ranging from 50 kVA to 1250 kVA. The proposed intelligent transformer is a three-stage modular type using phase shift multicarrier modulations for MMC front end converter. Its middle stage is dual active bridge having input series output parallel (DAB-ISOP) configuration using a phase shift modulation. The smart transformer's back end uses an MMC inverter using interleaved phase shift modulation. The distribution feeder is modeled in MATLAB/Simulink and the designed intelligent transformer is allocated to it using voltage stability index (VSI). The peak load data, feeder data and transformer data of the distribution system under study are obtained from the utility office. The existing distribution feeder's performance was evaluated by using backward-forward sweep load flow simulation for peak loading condition. The line flows and voltage profile at all nodes were observed and candidate nodes for enhancement were identified. Placement of modular intelligent transformer by using voltage stability index (VSI) was conducted to improve the voltage profiles, minimize reactive power flows and losses. Based on the simulation results for base case scenario, total power loss of 936.5 kW is obtained. The minimum node voltage of 0.81PU and maximum reactive power flow of 10.9MVAr were observed for the base case simulation. Placement of intelligent transformer at weak node 67 and node 111 improves the node voltages to have a minimum value 0.965 PU and maximum value of 1.05PU. The total power loss is reduced to 511.5 kW (54.5% improvement) after integration of intelligent transformer.

Keywords: distribution system, multiport intelligent transformer, multicarrier modulation, voltage stability index (VSI)

Heliyon
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10 (2024)

Effect of maize (zea mays l.) and cowpea (vigna unguiculata l.) intercropping on agronomic performance, yield and nutritional values of maize and cowpea under supplementary irrigation

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Abstract

A field experiment was conducted to evaluate the effect of maize (Zea mays L.) and cowpea (Vigna Unguiculata L.) intercropping on agronomic performance, yield, and nutritional values at Arba Minch University. Treatments were only maize crop (T1), only cowpea (T2), intercrop (maize and cowpea) in a 1:1 ratio (T3) and alternative rows of 2:2 (T4) as treatments. Treatments were arranged in a randomized complete block design (RCBD). Data on plant morphology, yield, nutritional composition, and economic return were recorded. The height of the plant (145.5 cm) of maize was significantly ($P < 0.001$) higher at 1:1 intercropping than the height of the sole while the height of the cowpea was higher at the sole cropping. Higher number of branches ($P < 0.05$) per plant (5.28) of cowpea was recorded in pure stands of cowpea than intercropping. The grain yield of maize (6.9 t/ha) and cowpea (4.2 t/ha) was significantly ($P < 0.05$) higher in sole cropping than in intercropping. A higher dry matter yield of 9.06 t/ha of maize was obtained in a 1:1 maize-cowpea intercropping ratio than sole maize. Significantly ($P < 0.001$) highest dry matter cowpea yield of 5.77 t/ha was obtained at sole cultivation than intercropping. The intercropping of maize with cowpea had an advantage of resource utilization in terms of land equivalent ratio (LER) 41.7 %–62.5 %. The marginal rate of return (MRR) of intercropping in the ratio of 1:1 was as high as 48.23 % in intercropping maize-cowpea, which was much better than sole cropping. Therefore, it could be recommended that the ratio of 1:1 maize-cowpea intercropping for land resource use and economic food and feed production in Arba Minch and similar agro-ecology zones.

Keywords: Agronomic trait, Biological competition, Chemical analysis, Economic analysis

BMC Health Services Research
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Readiness of and barriers for community pharmacy professionals in providing and implementing vaccination services

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Abstract

Background: Community pharmacy professionals are essential for healthcare delivery, particularly for administering vaccination services. However, there is a lack of substantial evidence documenting their role in vaccination within Ethiopia.
Objectives: This study aimed to assess community pharmacy professionals' readiness to provide vaccination services, identify barriers hindering the implementation of these services, and determine factors influencing the provision of vaccination services by community pharmacy professionals.
Methods: A cross-sectional study was conducted among community pharmacy professionals in Debre Markos and Injibara Town from April 15 to May 13, 2024. The data were collected using a structured questionnaire, and descriptive statistics were used to analyze the findings.
Results: The study revealed that a significant majority of community pharmacy professionals perceived that they had adequate vaccine knowledge and were easily accessible to the community. However, barriers such as lack of regulation, time constraints, workload concerns, patient trust issues, and infrastructure challenges hinder the implementation of vaccination services. Factors influencing the provision of vaccination services included the need for enhanced education and training, financial reimbursement, patient demand, infrastructure improvements, collaboration with other healthcare providers, and pharmacists' special interest in vaccination.
Conclusions: Community pharmacy professionals exhibit readiness to provide vaccination services. However, significant barriers such as regulatory constraints, time pressures, workload concerns, patient trust issues, and infrastructure challenges hinder their full participation. Addressing these barriers and leveraging pharmacists' expertise is essential for optimizing service delivery and improving public health outcomes. Advocating for policy changes, developing comprehensive training programs, establishing clear guidelines, investing in infrastructure improvements, conducting public awareness campaigns, and fostering collaboration with other healthcare providers are recommended to facilitate the provision and implementation of vaccination services by community pharmacy professionals in Ethiopia.

Keywords: Community pharmacy**,** Vaccination services**,** Perception, Barriers**,** Implementation**,** Ethiopia

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Association between long-term $PM_{2.5}$ exposure and mortality on Sumatra Island: Indonesian Family Life Survey (IFLS) 2000–2014

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Abstract

The concentration of PM2.5 (particulate matter with a diameter < 2.5 μm) on Sumatra Island has increased, mainly because of forest and peatland fires, transportation, and industry. Biomass burning releases partially burned carbon into the atmosphere, resulting in a smoky haze containing PM2.5. Air quality has deteriorated quickly, and PM2.5 has become a major health hazard in Indonesia. Studies on long-term exposure to PM2.5 have indicated its associations with both morbidity and mortality. Here, we measured long-term (2000–2014) exposure to PM2.5 on the basis of satellite-derived aerosol optical depth measurements (1 × 1 km2) used to predict ground-level PM2.5 concentrations. Additionally, population data on Sumatra Island residents from the fourth wave of the Indonesian Family Life Survey (IFLS) were obtained. We investigated the association between long-term PM2.5 exposure and mortality with a retrospective cohort study design. A total of 2409 subjects aged ≥ 40 years participated in the IFLS-3 beginning in November 2000, and we examined mortality outcomes until the IFLS-5 in September 2014. We used Cox regression models to calculate hazard ratios (HRs) of mortality associated with PM2.5 exposure. According to the adjusted model, the mortality HRs per 10 μg/m3 increase in PM2.5 concentration were 1.10 (95% CI 1.03, 1.17) for all natural causes, 1.17 (95% CI 1.05, 1.25) for cardiovascular causes, and 1.19 (95% CI 1.04, 1.36) for respiratory causes. Long-term exposure to PM2.5 was associated with all-natural, cardiovascular, and respiratory mortality on Sumatra Island, where PM2.5 levels exceed the WHO and US-EPA air quality standards.

Keywords: Particulate matter**,** Natural causes**,** cardiovascular causes**,** Respiratory causes**,** Mortality

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The strategies pursued by urban households to cope with food insecurity: Insights from selected towns in Southern Ethiopia

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Abstract

Introduction: Food security has become a major global concern, particularly in urban areas where households are struggling to address the issue of basic necessities mainly food that crucially dictates human health. Overcoming these challenges will require effective management mechanisms to inform policy interventions and enhance resilience at both local and global levels. **Objectives:** This study aimed to explore the coping strategies (CS) pursued by urban households in the Southern Ethiopia. Furthermore, the focus is on how households to cope with food insecurity and how using these strategies varies within households. Methods: A household survey questionnaire was conducted using a cross-sectional design, combining both qualitative and quantitative methods to collect data. A total of 310 household heads were targeted for the required data acquisition with: The coping strategy index (CSI) to capture how people perceive and cope with food insecurity that threatens human health.
Results: The results indicate that households used the top seven CS to address the problem of food insecurity: limiting the size of portions at mealtimes (83.9%), depending on less expensive or seasonal foods (68.1%), reducing adult consumption (66.1%), reducing the amount of food consumed (65.8%), purchasing food on credit (60.3%), renting household assets (54.8%), and migrating household members for wage labor (53.5%).
Conclusion: Moreover, the finding shows that the frequency of CS used by urban households in response to food insecurity is rated differently as never, rarely, sometimes, and more than 4 times per week. Therefore, targeted support programs for vulnerable groups should be implemented to ensure they receive adequate food during times of food insecurity wherein the victims' health status is imperatively to be bettered.

Irrigation and Drainage
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73 (2024)

Livestock–irrigation interaction and its influence on the sustainability of small-scale irrigation schemes in Ethiopia

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Abstract

Small-scale irrigation (SSI) plays a large role in rural livelihoods and the economy in Ethiopia. Despite considerable investment, overall SSI performance is disappointingly poor. The sedimentation of canals and intakes leads to low performance and the abandonment of systems. Livestock roaming in the command area and around riverbanks are an important contributor to sedimentation. Commonly proposed solutions, including technocratic fixes, institutional arrangements between irrigators and livestock farmers, and collective action by irrigators, have not yielded satisfactory results. Based on three case studies from Ethiopia, we illustrate why existing solutions are not effective and why collective action is not straightforward. Using in-depth interviews and focus-group discussions, we examine the complex intertwined relationships between irrigators, livestock farmers and local government. Without understanding the interrelationship and accounting for the links between irrigation and livestock in the design and governance structures of SSI, the proposed technical and organizational fixes are unlikely to be successful. Addressing conflicting interests and building consensus and trust among irrigators and livestock farmers are prerequisites for solving the performance concerns of many Ethiopian SSIs.

Water Practice and Technology
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Evaluation of satellite rainfall products to estimate extreme flow events over the Kulfo watershed in Ethiopia

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Abstract

Satellite rainfall products with high spatial and temporal resolution offer opportunities to monitor extreme climate events intensities and trends on spatial different scales. A critical evaluation of the satellite precipitation data set is very important for both the end users and data developers. Meanwhile, the evaluation may provide a benchmark for the product's continued development and future improvement. The main objective of this study is to evaluate the performance of globally gridded high– resolution satellite rainfall products (TRMM, CMORPH and CHRIPS) under sparse ground-based data and complex topography of Kulfo watershed through semi-distributed hydrological model (SWAT). The model is calibrated for the period of 1991–2008 and validated for the period of 2009–2015. Comparisons of the simulations to the observed stream flow at the outlet of Kulfo Watershed form the basis for the conclusions of this study. The Nash-Sutcliffe Efficiency and Coefficient of Determination were used to benchmark the model performance. The result indicated that all models underestimate the observed rainfall. Accuracy of models is not the same in representing the rainfall of the study area with TRMM performing best (Bias=–5.78) while CMORPH performs worst (Bias=–9.87). Overall, the satellite rainfall products tend to overestimate inter-annual rainfall variability.

Key words: extreme climate events, extremes flow, Kulfo watershed, satellite rainfall products, SWAT model

Scientific Reports
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Prevalence of low back pain and associated factors among medical students in Wachemo University Southern Ethiopia

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Abstract

Low back pain(LBP) is the most common musculoskeletal disorder in adults. According to previous studies medical students were found vulnerable for the development of LBP. We assessed the prevalence of LBP and associated factors among Medical students in Wachemo University, Southern Ethiopia. An institution-based cross-sectional study design and simple random sampling technique was employed to select 370 medical students. A structured pretested interviewer administered questionnaire was used to collect the data. The data were entered into Epi-info version 3.1 and analysed by SPSS version 25. Analytical and descriptive statistics were conducted. Simple and multiple logistic regression analyses were employed to assess factors associated with LBP. Variables at p-value ≤ 0.25 in simple logistic regression analysis were entered into multiple logistic regression. Statistical significance was declared at P-value, < 0.05 in multiple logistic analysis. The prevalence of low back pain among medical students was found to be 40.1%with 95% CI (38.5–41.8). Being male students [AOR (95% CI): 1.83 (1.09–3.08)], design of study sitting chairs without back support [adjusted odds ratio(AOR) (95% C.I): 2.81 (1.74–4.55)], stress during class [AOR (95% C.I): 2.60 (1.56–4.35)], and daily study hours greater than 6 h and above [AOR: 4.33, 95% CI (2.30–8.12)] had a significant association with LBP. The prevalence of LBP in this study is high. Better ergonomic facilities and psychosocial supports to medical students are recommended to reduce the effects of predisposing factors on LBP.

Keywords: Low back pain**,** Medical students**,** musculoskeletal disorder**,** Southern Ethiopia

Global Challenges
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8 (2024)

Evaluation of Groundwater Potential Zones Using GIS-Based Machine Learning Ensemble Models in the Gidabo Watershed, Ethiopia

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Abstract

The main objective of this study is to map and evaluate groundwater potential zones (GWPZs) using advanced ensemble machine learning (ML) models, notably Random Forest (RF) and Support Vector Machine (SVM). GWPZs are identified by considering essential factors such as geology, drainage density, slope, land use/land cover (LULC), rainfall, soil, and lineament density. This is combined with datasets used for training and validating the RF and SVM models, which consisted of 75 potential sites (boreholes and springs), 22 non-potential sites (bare lands and settlement areas), and 20 potential sites (water bodies). Each dataset is randomly partitioned into two sets: training (70%) and validation (30%). The model's performance is evaluated using the area under the receiver operating characteristic curve (AUC-ROC). The AUC of the RF model is 0.91, compared to 0.88 for the SVM model. Both models classified GWPZs effectively, but the RF model performed slightly better. The classified GWPZ map shows that high GWPZs are typically located within water bodies, natural springs, low-lying regions, and forested areas. In contrast, low GWPZs are primarily found in shrubland and grassland areas. This study is vital for decision-makers as it promotes sustainable groundwater use and ensures water security in the studied area.

Keywords: geographic information systems, gidabo watershed, groundwater potential zones, random forest, support vector machine

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Exploring preferences to accessing sexual and reproductive health services: A qualitative study of adolescents' and service provider perspectives

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Abstract

Background: Understanding what adolescents want and how preferences are likely to vary among different groups is important to make the healthcare system responsive to the needs of adolescents and to maximize service utilization. Despite this, evidence is scarce in this aspect. Therefore, this study aimed to explore preferences for accessing Sexual and Reproductive Health (SRH) services from the perspective of adolescents and health care providers in the South Ethiopia Regional State.

Methods: A phenomenological qualitative study was conducted from September 04 to October 15, 2023. Seven Focus Group Discussions (FGDs) and ten Key Informant Interviews (KIIs) were conducted with purposively selected seventy-five adolescents and ten healthcare providers respectively. A semi-structured interview guide was used to explore their lived experiences. All interviews and discussions were audio-recorded. The research team transcribed the collected data verbatim and translated it into English. The data was analyzed using a thematic analysis approach. **Results**: In this study, five main themes were identified. The identified main themes were preferred SRH services provider, preferred SRH services venue, preferred SRH services provision time, preferred SRH services information sources, and preferred strategies to improve access to SRH services. Regarding preferred SRH service providers, adolescents prefer males by sex, younger health care providers by age, and not neighborhood health providers by residence. Concerning preferred SRH services venue, adolescents prefer pharmacies as a venue to access condoms and emergency pills, while they prefer traditional medical centers as a source of abortion services. Besides this, schools are a preferred venue for adolescents to access SRH information. Moreover, sexual partners, close friends, and peers who experienced similar problems are the preferred sources of SRH information for adolescents. Furthermore, engagement of private health facilities, strengthening engagement of faith-based organization, and strengthening community-based SRH services provision were identified as preferred strategies to improve access to SRH services.

Conclusion: Improving access to sexual and reproductive health services necessitates the implementation of innovative and responsive strategies that address the diverse preferences and needs of adolescents. Prioritizing adolescent engagement in healthcare is vital, as it fosters a better understanding of their unique perspectives and ultimately enhances the accessibility and utilization of these essential services.

Quaternary Science Advances
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Fatal landslides in Kencho, Shacha & Gozdi villages, Gofa zone, Ethiopia: A detailed investigation (Geological, Geotechnical, geophysical & geospatial) of the July 22, 2024 catastrophe and its socioeconomic repercussions

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Abstract

A landslide is one of the geological hazards that cause the most disaster in densely populated areas. The landslide that occurred in Gezie Gofa woreda, Gofa Zone, Kencho Shacha Gozdi village, killed more than 250 people. Two landslides occurred on July 22, 2024, at 8:30 and 10:40 AM The first landslide killed six people and demolished three houses. The second landslide killed more than 245 people, including those who came to the site to excavate the buried bodies during the first landslide. The primary objective of this research is to evaluate the landslide causative factors, model the landslide susceptibility, and characterize the landslide disaster on socioeconomic effects that occurred on July 22, 2024. The landslide inventory data, field surveys, laboratory analyses, and various geophysical surveys characterized the current and past landslides of the area. The landslide susceptibility model was modeled using a statistical approach in the GIS. environment. The socioeconomic effects were assessed using field surveys and systematic interviews with the victims. The conditioning factors selected for landslide susceptibility modeling are lithology, geological structures, groundwater, slope, land use or land cover, aspect, curvature, and elevation. The major triggering factor of the landslide in the area was heavy rainfall, which occurred on July 21–22, 2024, between 3:00 a.m.-8:30 a.m. The results reveal that the significant conditioning factors of the landslide in the study area are geological structures (both visible and inferred), groundwater, slopes, and human activities. The characterized socioeconomic effects include the destruction of agricultural land, the demolishing of houses, and the loss of human lives, as well as several people evacuated and sheltered under tents and churches. However, the most momentous disaster in the area is the loss of human life. Based on the research results, it would be better to relocate those people living in the high landslide susceptible zones, and all high landslide-prone areas and mountainous terrain in southern Ethiopia should be mapped, and the people should be aware of the landslide risk areas.

Keywords: Landslide susceptibility**,** Gezie gofa**,** Ethiopia**,** Socioeconomic effects**,** Heavy rainfall trigger**,** GIS modeling

Malaria Journal
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Placental malaria and adverse pregnancy outcomes in Majang Zone of Gambella Region, Southwest Ethiopia: a histopathological and molecular study

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Abstract

Background: Placental malaria (PM) is characterized by Plasmodium parasite sequestration in the placenta. It is responsible for various adverse pregnancy outcomes, including maternal anaemia and low birth weight (LBW). This study aimed to assess prevalence and risk factors of PM, and gestational malaria (GM), together with the prevalence of congenital malaria (CM), maternal anaemia, and LBW among parturient women attending delivery ward of Metti Health Centre (Metti HC) in Majang Zone of Gambella Region, Southwest Ethiopia.

Methods: A cross-sectional study involving 180 parturient women attending delivery ward of Metti HC was conducted from November 2022-March 2023. Sociodemographic, obstetric, and anti-malarial intervention data were collected. Capillary, placental and cord blood, and placental biopsy were collected to diagnose malaria using rapid diagnostic test (RDT), microscopy, quantitative polymerase chain reaction (qPCR), and histopathology. Haemoglobin concentration and blood group of the mother and weight of the newborn were determined. Statistical analyses were done by SPSS Version 26.0. Multivariable logistic regression analysis and Chi-square test were done to identify risk factors. Results were presented in text, tables and graphs.

Results: The prevalence of GM, PM, CM, maternal anaemia, and LBW was 24.4% (95% CI 18.1–30.1), 34.4% (95% CI 27.4–41.4), 5.0% (95% CI 2.4–8.8), 41.7% (95% CI 34.6–49.0) and 27.8% (95% CI 21.6–34.6), respectively. Risk factors of GM were: presence of malaria history within the previous year (AOR: 5.10; 95% CI 1.64–15.83), lack of indoor residual spray (IRS) within the previous year (AOR: 2.98; 95% CI 1.05–8.45), and lack of antenatal care (ANC) contact during the index pregnancy (AOR: 3.96; 95% CI 1.44–10.87). Risk factors of PM were: presence of malaria history within the previous year (AOR: 2.98; 95% CI 1.05–8.45), and lack of ANC contact during the index pregnancy (AOR: 4.83; 95% CI 1.91–12.18). The risk of CM ($p < 0.001$), maternal anaemia ($p < 0.001$) and LBW ($p < 0.001$) increased with GM and PM.

Conclusion: There is high prevalence of GM, PM, maternal anaemia, and LBW in the study area. The presence of GM and PM increased the risk of maternal anaemia, CM, and LBW. The identified risk factors should be considered to mitigate malaria among parturient women and its adverse outcomes.

Keywords: Malaria in pregnancy**,** Gestational malaria**,** Placental malaria**,** Congenital malaria, Plasmodium**,** Histopathology**,** Prevalence**,** Risk factors**,** qPCR**,** Anaemia**,** Low birth weight**,** Majang Zone**,** Gambella**,** Southwest Ethiopia

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Determinants of Tax Compliance Behavior: A Case Study in Ethiopia

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Abstract

Policymakers and tax authorities in developing countries face challenges in comprehending the determinants of tax-compliance behavior. This study employs empirical investigation to explore the factors that influence taxpayers' voluntary and enforced tax compliance behaviors. Data were collected through a survey questionnaire distributed to 400 taxpayers using simple random sampling and analyzed using an ordered logit model. The results validate the assumptions of the slippery slope framework, showing that trust significantly impacts voluntary tax compliance and that a strong tax authority's power contributes to more enforced tax compliance in Ethiopia. Additionally, the interaction between trust and power has a more significant effect on enforced tax compliance. This study also emphasizes the importance of improving trust in increasing tax compliance. Moreover, factors such as equity, fairness, tax knowledge, effective tax usage, and taxpayer morale contribute to tax compliance. By identifying factors that contribute to tax compliance, the findings of this research provide valuable insights for tax authorities in Ethiopia and other developing countries in devising strategies to combat tax evasion. This includes implementing a fair tax regime, enhancing the perceived value of public services financed by tax payments, increasing tax knowledge activities to help people understand the importance of paying taxes, and fortifying frameworks to minimize extravagant spending for maintaining public trust and ensuring effective and efficient use of taxpayers' money.

Keywords: tax compliance, slippery slope framework, deterrence, service paradigm, developing country

Environmental Advances
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Unveiling seasonal nitrate contamination dynamics in cropland sub watersheds: A geo-morphological analysis of the bilate agricultural watershed

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Abstract

Cropland sub-watershed surface and groundwater contamination are pressing issues for water management. This study examines the impact of sediment transport indices (STI) on nitrate concentration in downstream water bodies. The research highlights rainfall's significant role in predicting seasonal nitrate levels. Employing GIS-SWPT tools and hydro-geomorphologic analysis, cropland sub-watersheds, particularly sub-watersheds one and three, are prioritized for their high contribution to downstream surface and groundwater nitrate contamination, with prioritization values of 105.58 and 180.63, respectively. Statistical analysis, conducted using Python's scikit-learn library, validated the findings of the study, with the model's F-statistic of 79.63 and a corresponding p-value of 0.0147 underscoring its overall significance. However, while STI alone showed a prioritization parametric correlation coefficient of 0.5077, suggesting other external factors also contribute to nitrate loading, a strong relationship between STI and nitrate concentration was revealed (R^2 of 0.993). This integrated approach enhances understanding of how geomorphologic parameters of cropland sub-watersheds influence water quality downstream. By clarifying the complex interactions between sediment transport and nitrate concentration, evidence-based strategies can be developed to mitigate surface and groundwater nitrate pollution. This research provides valuable insights into cropland sub-watershed pollution dynamics and informs targeted management interventions.

Keywords: Cropland sub-watersheds, GIS-SWPT, Hydro-geomorphologic analysis, Nitrate concentration, Scikit-learn, Sediment transport indices

Malaria Journal
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The effect of single low-dose primaquine treatment for uncomplicated Plasmodium falciparum malaria on haemoglobin levels in Ethiopia: a longitudinal cohort study

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Abstract

Background: To interrupt residual malaria transmission and achieve successful elimination of Plasmodium falciparum in low-transmission settings, the World Health Organization (WHO) recommends the administration of a single dose of 0.25 mg/kg (or 15 mg/kg for adults) primaquine (PQ) combined with artemisinin-based combination therapy (ACT), without glucose-6-phosphate dehydrogenase (G6PD) testing. However, due to the risk of haemolysis in patients with G6PD deficiency (G6PDd), PQ use is uncommon. Thus, this study aimed to assess the safety of a single low dose of PQ administered to patients with G6PD deficiency.

Methods: An observational cohort study was conducted with patients treated for uncomplicated P. falciparum malaria with either single-dose PQ (0.25 mg/kg) (SLD PQ) + ACT or ACT alone. Microscopy-confirmed uncomplicated P. falciparum malaria patients visiting public health facilities in Arjo Didessa, Southwest Ethiopia, were enrolled in the study from September 2019 to November 2022. Patients with uncomplicated P. falciparum malaria were followed up for 28 days through clinical and laboratory diagnosis, such as measurements of G6PD levels and haemoglobin (Hb) concentrations. G6PD levels were measured by a quantiative CareSTART™ POCT S1 biosensor machine. Patient interviews were also conducted, and the type and frequency of clinical complaints were recorded. Hb data were taken on days (D) 7, 14, 21, and 28 following treatment with SLD-PQ + ACT or ACT alone.

Results: A total of 249 patients with uncomplicated P. falciparum malaria were enrolled in this study. Of these, 83 (33.3%) patients received ACT alone, and 166 (66.7%) received ACT combined with SLD-PQ treatment. The median age of the patients was 20 (IQR 28–15) years. G6PD deficiency was found in 17 (6.8%) patients, 14 males and 3 females. There were 6 (7.2%) and 11 (6.6%) phenotypic G6PD-deficient patients in the ACT alone and ACT + SLD-PQ arms, respectively. The mean Hb levels in patients treated with ACT + SLD-PQ were reduced by an average of 0.45 g/dl (95% CI = 0.39 to 0.52) in the posttreatment phase (D7) compared to a reduction of 0.30 g/dl (95% CI = 0.14 to − 0.47) in patients treated with ACT alone (P = 0.157). A greater mean Hb reduction was observed on day 7 in the G6PDd ACT + SLD-PQ group (− 0.60 g/dL) than in the G6PDd ACT alone group (− 0.48 g/dL); however, there was no statistically significant difference (P = 0.465). Overall, D14 losses were 0.10 g/dl (95% CI = − 0.00 to 0.20) and 0.05 g/dl (95% CI = − 0.123 to 0.22) in patients with and without SLD-PQ, respectively (P = 0.412).

Conclusions: This study's findings indicate that using SLD-PQ in combination with ACT is safe for uncomplicated P. falciparum malaria regardless of the patient's G6PD status in Ethiopian settings. Caution should be taken in extrapolating this finding in other settings with diverse G6DP phenotypes.

Keywords: Plasmodium falciparum**,** Malaria elimination**,** Primaquine**,** Artemisinin-based combination therapies**,** Haemoglobin**,** G6PD deficiency**,** Ethiopia

Advances in Atmospheric Sciences
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41 (2024)

Assessment of Seasonal Rainfall Prediction in Ethiopia: Evaluating a Dynamic Recurrent Neural Network to Downscale ECMWF-SEAS5 Rainfall

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Abstract

Seasonal rainfall plays a vital role in both environmental dynamics and decision-making for rainfed agriculture in Ethiopia, a country often impacted by extreme climate events such as drought and flooding. Predicting the onset of the rainy season and providing localized rainfall forecasts for Ethiopia is challenging due to the changing spatiotemporal patterns and the country's rugged topography. The Climate Hazards Group InfraRed Precipitation with Station Data (CHIRPS), ERA5-Land total precipitation and temperature data are used from 1981–2022 to predict spatial rainfall by applying an artificial neural network (ANN). The recurrent neural network (RNN) is a nonlinear autoregressive network with exogenous input (NARX), which includes feed-forward connections and multiple network layers, employing the Levenberg Marquait algorithm. This method is applied to downscale data from the European Centre for Medium-range Weather Forecasts fifth-generation seasonal forecast system (ECMWF-SEAS5) and the Euro-Mediterranean Centre for Climate Change (CMCC) to the specific locations of rainfall stations in Ethiopia for the period 1980–2020. Across the stations, the results of NARX exhibit strong associations and reduced errors. The statistical results indicate that, except for the southwestern Ethiopian highlands, the downscaled monthly precipitation data exhibits high skill scores compared to the station records, demonstrating the effectiveness of the NARX approach for predicting local seasonal rainfall in Ethiopia's complex terrain. In addition to this spatial ANN of the summer season precipitation, temperature, as well as the combination of these two variables, show promising results.

Key words: station**,** prediction**,** downscaling**,** artificial neural networks**,** rainfall

Arabian Journal of Medicinal and Aromatic Plants
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10 (2024)

Knowledge, Attitude and Practice towards Traditional Medicinal Plants utilization along socio-cultural and agroecological-gradient in Southwest Ethiopia

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Abstract

The study of knowledge, attitude, and practice of medicinal plants is vital in understanding how societies utilize botanical resources for health purposes. This study explores intricate relationship between knowledge, attitudes, and practices concerning medicinal plants across diverse socio-cultural and agro-ecological contexts in Southwest Ethiopia. The analysis encompassed 366 respondents, predominantly rural dwellers, in three distinct regions: Chencha, Dherashe, and Zeyse-Elgo. Quantitative and qualitative surveys were conducted. Chi square tests was used to examine the relationship between demographic factors. Notably, traditional medicine remains a basis of healthcare, with knowledge significantly influencing practice. Demographic factors such as age, education, marital status, and occupation play crucial roles. Statistical analyses reveal strong associations between knowledge and demographic variables ($p < 0.05$). Trust in medicinal plants remains high, particularly for treating dermatological and respiratory ailments. Elder and less educated individuals held a better knowledge and are dependent on traditional remedies than the rest of the community. Each region exhibits unique characteristics: Chencha combines local knowledge with non-native species, Dherashe boasts diverse medicinal plants from the surrounding Gardula forest, and Zeyse-Elgo showcases rich cultural diversity in medicinal plant practices. All stakeholders should deliberate integration of the traditional system to modern health care system and documentation of traditional medicine should be encouraged to preserve knowledge of traditional medicine.

Key-words: Medicinal Plants, Socio-cultural dynamics, Southwest Ethiopia, Traditional knowledge

Discover Sustainability
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Integrated assessment of groundwater quality for sustainable irrigation in drought-prone central districts of Odisha, India

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Abstract

Crop productivity relies on the quantity and quality of irrigation water, with groundwater quality playing a major role. Exploitation of groundwater for irrigation is slowly increasing in central districts of Odisha. A study was carried out in these areas to assess the groundwater quality for irrigation for sustainable use of the groundwater resources. This was done by developing a Water Quality Index (WQI) for eight parameters. The groundwater quality was assessed using a framework that utilised the entropy weight approach and Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS). This framework was employed to determine the relative proximity of each solution to the ideal solution. The TOPSIS range is divided into three categories: low quality (less than 0.1), medium quality (0.1–0.5), and good quality (0.5–0.9). The low-quality category has a percentage of 6.45%, categorized as poor quality and unfit for drinking and irrigation uses; the medium-quality category has 52.07%, and the good quality category has 41.47% of the area falls under the very good category. These parameters are essential when considering water usage for agriculture, especially in regions where farmers use fertilizers and pesticides extensively to enhance crop production.

Keywords: Physio-chemical parameters**,** Correlation matrix**,** WQI**,** Shannon entropy**,** TOPSIS

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Immediate Outcomes of Transcatheter Closure versus Surgical Ligation of Patent Ductus Arteriosus in Children at the Cardiac Center of Ethiopia (2012-2022): A Comparative Cross-Sectional Study

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Abstract

Background: Transcatheter closure and surgical ligation of patent ductus arteriosus (PDA) are management options for PDA that have not spontaneously closed. However, studies reported the presence of complications and residual shunts in both Transcatheter closure and surgical ligation of PDA by themselves. In this study, the immediate outcomes of transcatheter closure of PDA versus surgical ligation of PDA were compared.

Methods: Comparative cross-sectional study conducted on children under 18 years of age who underwent transcatheter closure and surgical ligation of PDA at a cardiac center in Ethiopia from January 1, 2012, to January 1, 2022, by retrospectively reviewing the records from October 1, 2023, to November 1, 2023. 664 patients who underwent PDA closure, (n = 316) in the transcatheter closure group and (n = 348) patients in the surgical ligation group were included in this study.

Result: The surgical ligation group patients were younger, and more proportion of patients had severe pulmonary hypertension. Overall complications were significantly higher with surgical ligation compared with transcatheter closure ((112 (35.4% vs 286 (71.9%)), p-value = 0.001)). Total mechanical ventilation time, intensive care unit (ICU) stay, and hospital stay were higher in the surgical ligation group with a p-value of 0.001 each.

Conclusion: Transcatheter closure of PDA has lower overall complications and shorter mechanical ventilation time, lower ICU stay, and lower hospital stay. Given the lower number of overall complications, transcatheter closure of PDA has to be considered for selected patients.

KEYWORDS: PDA, surgical ligation of PDA, Transcatheter closure of PDA, comparative study

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Evaluation of regionalization parameters for stream flow prediction in ungauged catchments of Rift Valley Lakes Basin, Ethiopia

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Abstract

Estimation of streamflow in ungauged catchments is receiving broad research attention for water resources planning and management. Therefore, regionalization of model parameters and spot streamflow measurements have their importance in filling such data gaps. In this study, a regionalization model was established for the estimation of streamflow in ungauged catchments of the Rift Valley Lakes basin in Ethiopia. The Hydrologiska Byråns Vattenbalansavdelning-Integrated Hydrological Modeling System (HBV-IHMS) was calibrated for 14 gauged catchments using bias-corrected satellite rainfall data as model input. Out of which, 8 catchments were selected to develop a regional model due to a similar cluster with spot flow measured catchments and was found that the model performance was acceptable. In these catchments, the calibrated model reproduced the overall pattern and base flow of the observed hydrograph. To establish the regional model, 9 Model Parameters and 32 Physical Catchment Characteristics were used in multiple regression. Daily streamflow data were recorded for three spot measurement rivers sites (Kulfo, Hare, and Hamessa) to serve as validation data for the regionalization model. The validation result showed that the regional model can be applied for ungauged flow estimation in the basin since the Nash–Sutcliffe Coefficient (NSE) is greater than 0.50 and the Relative Volume Error (RVE) is within − 10 to 10%. The combined use of regionalization and spot streamflow measurements is a feasible approach for overcoming data gaps. This study is vital to the Rift Valley Lakes basin authority, scientific community, and decision-makers to undertake spot streamflow measurement in ungauged catchments for water resources management.

Keywords: Regionalization**,** Spot stream flow measurements**,** HBV**,** Ungauged catchments

Eye (Basingstoke)
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Global estimates on the number of people blind or visually impaired by glaucoma: A meta-analysis from 2000 to 2020

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Abstract

Objectives: To estimate global and regional trends from 2000 to 2020 of the number of persons visually impaired by glaucoma and their proportion of the total number of vision-impaired individuals.

Methods: A systematic review and meta-analysis of published population studies and grey literature from 2000 to 2020 was carried out to estimate global and regional trends in number of people with vision loss due to glaucoma. Moderate or severe vision loss (MSVI) was defined as visual acuity of 6/60 or better but <6/18 (moderate) and visual acuity of 3/60 or better but <6/60 (severe vision loss). Blindness was defined as presenting visual acuity <3/60.

Results: Globally, in 2020, 3.61 million people were blind and nearly 4.14 million were visually impaired by glaucoma. Glaucoma accounted for 8.39% (95% uncertainty intervals [UIs]: 6.54, 10.29) of all blindness and 1.41% (95% UI: 1.10, 1.75) of all MSVI. Regionally, the highest proportion of blindness relating to glaucoma was found in high-income countries (26.12% [95% UI: 20.72, 32.09]), while the region with the highest age-standardized prevalence of glaucoma-related blindness and MSVI was Sub-Saharan Africa. Between 2000 and 2020, global age-standardized prevalence of glaucoma-related blindness among adults ≥50 years decreased by 26.06% among males (95% UI: 25.87, 26.24), and by 21.75% among females (95% UI: 21.54, 21.96), while MSVI due to glaucoma increased by 3.7% among males (95% UI: 3.42, 3.98), and by 7.3% in females (95% UI: 7.01, 7.59).

Conclusions: Within the last two decades, glaucoma has remained a major cause of blindness globally and regionally.

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Effects of Altitude training on Ethiopian endurance athletes' recovery heart rate and hematological variables

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Abstract

Background and Study Aim. A recent study indicates that Ethiopian middle-and long-distance athletes originate from diverse geographical regions, including areas of varying elevation. This study aimed to analyze the impact of altitude training on hematological parameters and recovery heart rates among young male endurance trainees training at sites located at different altitude levels.
Material and Methods: The study employed a quasi-experimental, counterbalanced approach involving 15 male trainees. Five individuals from each training center experienced the standard training program across three distinct geographical locations and elevations. Pre-and post-test data were collected on red blood cells, hemoglobin, hematocrit, platelet count, and recovery heart rate before and after six months, from 6:00–8:00 AM. ANCOVA was utilized to analyze the data. **Results** Following the intervention, the mean Red Blood Cell (RBC) count was observed to be higher in trainees from low altitude (5.18±0.33) compared to those from moderate altitude (4.48±0.14 and 5.21±0.22), with a significance level of $p<0.05$. The mean Hemoglobin (HGB) count was found to be higher in moderate altitude trainees (17.00±0.70 and 16.31±0.65) than in low altitude trainees (15.82±1.37), although this difference was not statistically significant ($p>0.05$). Similarly, the mean Hematocrit (HCT) count was low for both low altitude (46.04±3.49) and moderate altitude trainees (46.46±3.9 and 45.42±1.54), with no significant difference noted ($p>0.05$). The mean Platelet (PLT) count was 226.8±75.88 for low altitude trainees and 265.8±23.18, 276±53.96 for moderate altitude trainees, with no significant difference between the groups ($p>0.05$). As for the recovery heart rate, mean values showed no significant difference between the pre-and post-test groups. In the pretest, the mean recovery heart rate was 30.00±14.70 for low-altitude trainees and 43.20±8.90, 43.20±13.68 for moderate-altitude trainees ($p>0.05$). In the post-test, the mean recovery heart rate was 25.20±7.82 for low-altitude trainees and 32.40±10.04, 36.00±7.35 for moderate-altitude trainees ($p>0.05$).
Conclusions The findings indicate that training at different altitudes impacts the hematological and cardiovascular systems of endurance athletes in varied ways. This underscores the importance of developing tailored training programs to optimize performance and recovery. These results are particularly relevant for coaches and athletes seeking to enhance endurance training outcomes through altitude training strategies.

Keywords: altitude training, red blood cell, Hemoglobin, hematocrit, recovery heart rate

Journal of Water and Climate Change
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Assessing the effect of rating curve uncertainty in streamflow simulation on Kulfo watershed, Southern Ethiopia

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Abstract

Accurate streamflow simulation and comprehending its associated uncertainty are crucial for effective water resource management. How-ever, the uncertainty of rating curves from which streamflow data is derived remains poorly understood. This study aims to simulate streamflow under rating curve uncertainty conditions. The bootstrap resampling technique (BSRT) was used to establish the rating curve and estimate associated uncertainty. Furthermore, it integrated with standalone and hybrid models (GRU, Bi-LSTM, and Conv1D-LSTM), to assess the effect of this uncertainty on streamflow simulation. Different lag times of rainfall and discharge are used as input for DL stream-flow simulation models. Despite the complexity, the Conv1D-LSTM model did not outperform the Bi-LSTM model. However, it slightly outperforms the GRU model. Moreover, the rating curve uncertainty significantly propagates to streamflow simulation, particularly in high-flow regions. Consequently, the uncertainties related to rating curves on the Kulfo River led to a streamflow uncertainty of about 17.8 m3 s_1, representing 22% at peak discharge. The performance of the DL models was evaluated using different metrics (RMSE, MAE, NSE, and R2). The findings underscore the importance of considering rating curve uncertainty in streamflow simulation to enhance water resource management practices and support informed decision-making in the study area.

Key words: BSRT, DL models, high-flow regions, Kulfo watershed, rating curve uncertainty, streamflow simulation

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32 (2024)

FUZZY LATTICE ORDERED GROUP BASED ON FUZZY PARTIAL ORDERING RELATION

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Abstract

In this paper, we introduce the concept of a fuzzy lattice ordered group, which is based on a fuzzy lattice that Chon developed in his paper" Fuzzy Partial Order Relations and Fuzzy Lattice". We will also discuss fuzzy lattice-ordered groups in detail, provide several results that are analogous to the classical theory of lattice-ordered groups, and characterize the relationship between a fuzzy lattice-ordered group using its level set and support. Moreover, we define the concepts of fl-subgroups, quotients, and cosets of fl-groups and obtain some fundamental results for these fuzzy algebraic structures.

Keywords: fuzzy lattice; fuzzy lattice ordered group (fl-group); fuzzy convex fl-subgroups; quotient of fl-groups

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133 (2024)

Analysis of temperature and rainfall trends in Beni City, Democratic Republic of Congo

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Abstract

Understanding local-scale climate change is vital to developing adaptive strategies in the face of the century-old river of global warming posing a threat to humanity. This study focuses on assessing temperature and rainfall trends in Beni City, using monthly and yearly (1990–2020) weather station data. Climate variability was analysed using the standardised variable index, and rainfall concentration patterns were highlighted using the precipitation concentration index (PCI). The climate trends were analysed by using the Mann–Kendall test and Sen's slope estimator. The findings indicated that the Tmin is 18.82±0.62°C, and Tmax is 28.22±0.75°C, resulting in a mean temperature of 23.52±0.57°C. The annual and seasonal temperature trend analysis indicated that a significant warming trend was observed in both Tmin and Tmax. Beni City's precipitation trends also showed a mean annual rainfall of 1988.38±416.59 mm, with significant year-to-year variations. Annual rainfall analysis exhibited a slight upward trend; meanwhile, the seasonal trend analysis revealed an increase in rainfall during Mar–Apr–May (MAM) and Aug–Sep–Oct–Nov (ASON) seasons with roughly no discernible trend during Dec–Jan–Feb (DJF), and Jun–Jul (JJ) seasons. Overall, annual and seasonal analyses of specific temperature and rainfall patterns have shown pronounced warming and increased rainfall in the study area. Research highlights: The study reveals significant trends in temperature and rainfall in Beni city, Democratic Republic of Congo, over a 31-year period (1990–2020). Both minimum and maximum temperatures show significant warming trends, with the most recent decade witnessing substantial increases in maximum temperatures. Rainfall patterns exhibit variations, with a slight upward trend in annual rainfall, although the 1990s experienced a notable decrease in precipitation. Monthly analyses highlight specific temperature and rainfall patterns with some months experiencing pronounced warming and increased rainfall.

Keywords: Beni City**,** climate trend**,** climate change**,** temperature**,** rainfall**,** tropical climate

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Power flow control and reliability improvement through adaptive PSO based network reconfiguration

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Abstract

Ensuring stable power flow and reliable supply could maintain system security, improve system efficiency, minimize power loss, and reduce the risk of supply outage. Power flow management can be employed to enhance bus voltage and decrease power losses. The reliability of the system is critical for both the customers and the utility to ensure supply continuity and improved revenue. With the growing demand for reliable power supplies, it is crucial that utilities devote efforts to ensure a consistent power supply to meet customer needs. However, the frequent occurrence of power interruptions and the prolonged duration of interruption pose significant challenges to power distribution systems in the town of Wolaita Sodo. This study aims to explore power flow and reliability control through the utilization of optimal distribution network reconfiguration (DNR). The optimal placement of tie-switches (TS) to address the power flow and reliability issues is done through the adaptive particle swarm optimization (APSO) algorithm. With the help of APSO, five TS units achieved the reliability indices within the national standard boundary. The backward/forward sweep (BFS) and Markov chain-based Monte Carlo simulation (MCMCS) methods are used for load flow and reliability analysis. Through simulation, with integration of five TS, SAIFI decreases from a value of 557 to about 34, SAIDI decreases from 573.59h to about 43.87h and EENS decreases from 1835.5 MWh to about 140.38 MWh annually, active power loss decreases from 1631.15 kW to about 559.35 kW, the minimum bus voltage increases from 0.7537pu to 0.9502pu. Finally, the evaluation of the suggested algorithm variants is conducted by taking into account the duration it takes to respond, the level of convergence achieved, and the extent to which power loss is minimized.

Keywords: Adaptive PSO**,** BFS load flow**,** Distribution network reconfiguration**,** Markov chain MCS**,** Reliability analysis

World Water Policy
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Revisiting the global weights of the integrated watershed health assessment framework and Weyib watershed health analysis: Ethiopia's policy prospects

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Abstract

Watershed health study has been considered as a global issue embodied in the United Nations' 2030 agenda toward sustainable water resources development, paving the way for integrated water resources management (IWRM) application, and visualizing intervention techniques to comprehend existing challenges. The watershed faces tremendous pressure due to erratic rainfall patterns, drastic water demand increase, hydrological extremes, and natural-anthropogenic activities. This study aims to re-evaluate the recently developed Integrated Watershed Health Assessment Framework (IWHF) global weights, Weyib watershed health assessment, and Ethiopia's policy implications using the integration of numerous data and multiple tools. The analytic hierarchy process (AHP) was used to estimate aggregate results from experts' survey responses, which depicted 50.89% priority for ecological conditions, followed by economic 23.30%, policy 13.82%, and 12% for socio-cultural attributes. A slight discrepancy was exhibited when global weights were re-evaluated, and the variables with substantial effects on IWHF in developing countries like Ethiopia were integrated. The majority of Weyib watershed health index (WWHI) indicators unveiled promising results except for stakeholders' collaboration and social obligation to restoration activities, information and educational campaigns, hydrology, wetland, and natural land-cover. The water-quality parameters laboratory findings were depicted as suitable for irrigation purposes. In general, the WWHI was in good health status, and a medium-level priority was required for intervention activities to address deteriorated variables. Moreover, enhancing IWRM's application will contribute to tackling bottlenecks such as boost community awareness and stakeholder collaboration, legal and administrative gaps, overlapped mandates, and unpermitted water use resulting in undermining downstream demands and environmental low-flow.

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Publisher Correction: Global estimates on the number of people blind or visually impaired by cataract: a meta-analysis from 2000 to 2020

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Abstract

Background: To estimate global and regional trends from 2000 to 2020 of the number of persons visually impaired by cataract and their proportion of the total number of vision-impaired individuals.

Methods: A systematic review and meta-analysis of published population studies and gray literature from 2000 to 2020 was carried out to estimate global and regional trends. We developed prevalence estimates based on modeled distance visual impairment and blindness due to cataract, producing location-, year-, age-, and sex-specific estimates of moderate to severe vision impairment (MSVI presenting visual acuity <6/18, ≥3/60) and blindness (presenting visual acuity <3/60). Estimates are age-standardized using the GBD standard population.

Results: In 2020, among overall (all ages) 43.3 million blind and 295 million with MSVI, 17.0 million (39.6%) people were blind and 83.5 million (28.3%) had MSVI due to cataract blind 60% female, MSVI 59% female. From 1990 to 2020, the count of persons blind (MSVI) due to cataract increased by 29.7%(93.1%) whereas the age-standardized global prevalence of cataract-related blindness improved by −27.5% and MSVI increased by 7.2%. The contribution of cataract to the age-standardized prevalence of blindness exceeded the global figure only in South Asia (62.9%) and Southeast Asia and Oceania (47.9%).

Conclusions: The number of people blind and with MSVI due to cataract has risen over the past 30 years, despite a decrease in the age-standardized prevalence of cataract. This indicates that cataract treatment programs have been beneficial, but population growth and aging have outpaced their impact. Growing numbers of cataract blind indicate that more, better-directed, resources are needed to increase global capacity for cataract surgery.

Eye (Basingstoke)
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38 (2024)

Global estimates on the number of people blind or visually impaired by age-related macular degeneration: a meta-analysis from 2000 to 2020

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Abstract

Background: We aimed to update estimates of global vision loss due to age-related macular degeneration (AMD).
Methods: We did a systematic review and meta-analysis of population-based surveys of eye diseases from January, 1980, to October, 2018. We fitted hierarchical models to estimate the prevalence of moderate and severe vision impairment (MSVI; presenting visual acuity from <6/18 to 3/60) and blindness (< 3/60) caused by AMD, stratified by age, region, and year.
Results: In 2020, 1.85 million (95%UI: 1.35 to 2.43 million) people were estimated to be blind due to AMD, and another 6.23 million (95%UI: 5.04 to 7.58) with MSVI globally. High-income countries had the highest number of individuals with AMD-related blindness (0.60 million people; 0.46 to 0.77). The crude prevalence of AMD-related blindness in 2020 (among those aged ≥ 50 years) was 0.10% (0.07 to 0.12) globally, and the region with the highest prevalence of AMD-related blindness was North Africa/Middle East (0.22%; 0.16 to 0.30). Age-standardized prevalence (using the GBD 2019 data) of AMD-related MSVI in people aged ≥ 50 years in 2020 was 0.34% (0.27 to 0.41) globally, and the region with the highest prevalence of AMD-related MSVI was also North Africa/Middle East (0.55%; 0.44 to 0.68). From 2000 to 2020, the estimated crude prevalence of AMD-related blindness decreased globally by 19.29%, while the prevalence of MSVI increased by 10.08%.
Conclusions: The estimated increase in the number of individuals with AMD-related blindness and MSVI globally urges the creation of novel treatment modalities and the expansion of rehabilitation services.

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Intervention fidelity and factors affecting the process of implementing a mobile phone text messaging intervention among adolescents living with HIV: A convergent mixed-methods study in southern Ethiopia

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Abstract

Objective: To assess the intervention fidelity and explore contextual factors affecting the process of implementing a mobile phone text messaging intervention in improving adherence to and retention in care among adolescents living with HIV, their families and their healthcare providers in southern Ethiopia.
Design: A convergent mixed-methods design guided by the process evaluation theoretical framework and the Reach, Effectiveness, Adoption, Implementation and Maintenance framework was used alongside a randomised controlled trial to examine the fidelity and explore the experiences of participants in the intervention.
Setting: Six hospitals and five health centres provide HIV treatment and care to adolescents in five zones in southern Ethiopia.
Participants: Adolescents (aged 10-19), their families and their healthcare providers.
Intervention: Mobile phone text messages daily for 6 months or standard care (control).
Results: 153 participants were enrolled in the process evaluation. Among the 153 enrolled in the intervention arm, 78 (49.02%) were male and 75 (43.8%) were female, respectively. The mean and SD age of the participants is 15 (0.21). The overall experiences of implementing the text messages reminder intervention were described as helpful in terms of treatment support for adherence but had room for improvement. During the study, 30 700 text messages were sent, and fidelity was high, with 99.4% successfully delivered text messages during the intervention. Barriers such as failed text messages delivery, limitations in phone ownership and technical limitations affected fidelity. Technical challenges can hinder maintenance, but a belief in the future of digital communication permeates the experiences of the text message reminders. **Conclusions**: Overall fidelity was high, and participants' overall experiences of mobile phone text messages were expressed as helpful. Contextual factors, such as local telecommunications networks and local electric power, as well as technical and individual factors must be considered when planning future interventions.
Trial registration number PACTR202107638293593.

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41 (2024)

Generation of stationary entanglement and quantum discord in an optomechanical system through three-level atoms

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Abstract

In this paper, we investigate the stationary entanglement and quantum discord between the cavity and mechanical oscillator mode of an optomechanical system whose cavity contains three-level atoms. We examine how sharing entanglement and correlations would be affected by increasing the level of atoms injected into the cavity. In particular, using the appropriate preference of injected atoms to the cavity and optical cavity detuning, we found the impact of atoms and couplings on the degree of steady-state entanglement and quantum discord. Consequently, the stationary entanglement and quantum discord together rise to a certain range of normalized detuning and atom injection levels. Furthermore, both entanglement and Gaussian quantum discord are enhanced when three-level atoms are present, and the maximum entanglement manifests closest to the ringing case. Moreover, we are aware that the system's physical parameters affect the generation of stationary entanglement and quantum correlation. Therefore, these results may provide a platform for a valuable asset in the practical realization of continuous variable entanglement and quantum information processing.

Environmental Research, Engineering and Management
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80 (2024)

Challenge of Rainfall Uncertainty in the Study of Deficit Irrigation

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Abstract

One of the alternative methods for managing irrigation water is deficit irrigation, particularly alternate furrow irrigation (AFI). This deficit in irrigation is affected by uncontrolled rainfall. In line with this, rainfall uncertainty causes a variation between the measured actual crop evapotranspiration and the theoretical crop evapotranspiration. Let us imagine that rain falls during the deficit irrigation research, and the soil moisture under the deficit experiment is then raised to the soil field capacity. It is incorrect to report the result as a deficit. Thus, there is a research gap on the effect of rainfall uncertainty on the quantity of theoretical and actual crop evapotranspiration under deficit irrigation. This study was carried out at the Arba Minch University demonstration site on onion crops. Using CROPWAT 8.0 software, the reference evapotranspiration (ETo) was calculated using the Penman-Monteith formula. The crop coefficient and ETo were used to calculate the theoretical crop evapotranspiration. In contrast, actual crop evapotranspiration was calculated using soil moisture measurements before and after each irrigation event after applying theoretical crop evapotranspiration. As a result, there is a significant difference between the calculated theoretical crop evapotranspiration and actual crop evapotranspiration from a deficit study. Thus, the calculated seasonal theoretical crop evapotranspiration was 201.72 mm. On the other hand, the actual crop evapotranspiration was 275.82 mm. This revealed that the actual crop evapotranspiration was greater than the calculated theoretical crop evapotranspiration by 36.7%. Uncontrolled rainfall was identified as the output's cause. This has an evident effect on the deficit in experimental research. Hence, conducting the deficit experiment in a greenhouse is more reasonable. In addition, it is possible to assess actual crop evapotranspiration based on daily soil moisture measurements and report the deficit level based on the measured amount.

Keywords: actual crop evapotranspiration, deficit irrigation, rainfall, soil moisture, theoretical crop evapotranspiration.

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4 (2024)

Observation of non-recommended (harmful) intrapartum practices among obstetric care providers in public hospitals in southern Ethiopia, 2023

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Abstract

The majority of developing countries do not follow the WHO's emphasis on replacing harmful and ineffective traditional practices with evidence-based clinical treatment. In these countries, harmful or ineffective practices are routinely used as part of routine care during labor and delivery, while beneficial procedures are not used for the majority of laboring mothers. However, it is critical to use evidence-based practices while giving therapy since they improve care quality, save costs, increase patient and family happiness, and promote professional progress. To assess the magnitude of non-recommended (harmful) intrapartum practices among obstetric care providers in public hospitals in southern Ethiopia, 2023. An institution-based cross-sectional study was conducted from January 30, 2023, to February 30, 2023, in public hospitals in the Gamo and Gofa zones. An observational checklist and a self-administered questionnaire were used to gather data. Using odds ratio of 95% C, bivariate and multivariable logistic regression was used to discover factors related with the outcome variable during data analysis using SPSS version 27. A P-value of less than 0.05 and I were regarded as statistically significant. The magnitude of harmful intrapartum practice was 60.6% (95% CI: 53.25–68.5). Lack of internet access (AOR = 10.1, 95% CI: 4.93–21.1), a few years of work experience (AOR = 6.21, 95% CI: 3.1–12.5), and not being trained on evidence-based intrapartum practices (AOR = 4.01, 95% CI: 1.94–7.95) were statistically significant with harmful intrapartum practices. Evidence-based practice can be improved by promptly providing obstetric care providers with ongoing training and standards for intrapartum care.
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133 (2024)

Performance evaluation of multi-satellite rainfall products for analyzing rainfall variability in Abaya–Chamo basin: Southern Ethiopia

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Abstract

Understanding the rainfall variability is crucial for managing water resources and mitigating agricultural hazards, particularly in poorly gauged regions like the Abaya–Chamo basin. This study compares various satellite-derived rainfall products, including Climate Hazards Group Infrared Precipitation with Stations (CHIRPS), Tropical Applications of Meteorology using Satellite data and ground-based observations (TAMSAT), Precipitation Estimation from Remotely Sensed Information using Artificial Neural Networks-Climate Data Record (PERSIANN-CDR), and Climate Hazards Group Infrared Precipitation (CHIRP), with observed rainfall data from 1990 to 2019. Accordingly, this study evaluates the performance of these satellite rainfall products using multiple metrics at daily and monthly scales. The correlation coefficient (CC), mean square error (MSE), Nash-Sutcliffe efficiency (NSE), percent of bias (PBIAS), mean absolute error (MAE), and categorical analysis metrics such as probability of detection (POD), false alarm ratio (FAR) and critical success index (CSI) indicators were applied to evaluate the accuracy of these products. Among them, the CHIRPS satellite product demonstrates superior agreement with observed data, with CC = 0.871 and NSE = 0.925, warranting its selection for further analysis of seasonal and annual rainfall variability. The coefficient of variation (CV) and precipitation concentration index (PCI) were applied to investigate rainfall variability. The study indicates that precipitation patterns in the Abaya–Chamo basin exhibit moderate to high variability throughout the year, with a CV ranging from 20–30%. This suggests substantial variability in annual rainfall within the region, in some instances where the variability exceeds 30%. Moreover, the southern and northern regions of the basin experience a consistent moderate to high variation in precipitation throughout the entire season, while the lowest variability was observed in the central part of the basin. These findings underscore the importance of satellite-derived rainfall data, particularly the CHIRPS product, in understanding spatiotemporal rainfall patterns and making informed decisions in water resource management. This research contributes in advancing our knowledge of rainfall variability in the Abaya–Chamo basin and underscores the utility of satellite data in regions lacking adequate ground-based monitoring.

Keywords: Rainfall variability**,** multi-satellite rainfall products**,** Abaya–Chamo basin

Tropical and Subtropical Agroecosystems
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SOIL MICRONUTRIENT CONTENT ANALYSIS AND MAPPING OF AGRICULTURAL SALT-AFFECTED SOILS AROUND ABAYA AND CHAMO LAKES, SOUTH ETHIOPIA RIFT VALLEY; [ANÁLISIS DEL CONTENIDO DE MICRONUTRIENTES DEL SUELO Y MAPEO DE SUELOS AGRÍCOLAS AFECTADOS POR LA SAL ALREDEDOR DE LOS LAGOS ABAYA Y CHAMO, EN EL VALLE DEL RIFT DEL SUR DE ETIOPÍA]

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Abstract

Background. Salt-affected soils cause a significant portion of land to become unproductive yearly; its impact is severe in sub-Saharan African nations, especially the arid and semiarid lowlands, and the Rift Valley regions of Ethiopia are typically host to naturally salt-affected areas. **Objective**. To analyze the micronutrient content and map the micronutrient fertility status of agricultural salt-affected soils around Abaya and Chamo Lakes South Ethiopia Rift Valley. **Methodology.** A systematic sampling technique was employed to obtain 300 soil samples for the investigation from two depths (0-20 and 20-40cm), with a 600m sampling interval, of which 30 were used. The research data was analyzed using the application of standardized analytical procedures for soil data and descriptive and geostatistical techniques.
Results. According to the study, there is low zinc available in the soil but an ample amount of iron, manganese, and copper. In addition, the study's findings revealed that, whereas the remaining micronutrient regional variability is found at long distances, available iron exhibited a regional variation in soil quality at small distances.
Implications. The study suggests applying organic matter for better soil structure, water retention, and nutrient availability. Moreover, the results recommend that soils affected by salt might recover using various materials.
Conclusions. In the study areas, zinc fertilizer may still be needed for an optimal yield even though the research area has low amounts of zinc fertilizer. The study concluded with management recommendations to minimize the adverse effects of very high micronutrient content on human health and plant growth.

Key words: Kriging, nutrient variability; salt-affected soils; soil micronutrient; special dependency.

Tuberculosis
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148 (2024)

Detection of Mycobacterium tuberculosis complex in saliva by quantitative PCR: A potential alternative specimen for pulmonary tuberculosis diagnosis

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Abstract

Background: Current tuberculosis (TB) diagnostic tests primarily rely on sputum samples, yet many TB patients cannot produce sputum. This study explored whether saliva could be used instead of sputum to diagnose pulmonary TB (PTB).

Method: The study included 32 patients with confirmed PTB and 30 patients with other respiratory diseases (ORD). Saliva from all study participants was subjected to quantitative (qPCR) assays targeting the IS1081 gene for detection of M. tuberculosis complex DNA.

Results: The sensitivity of saliva IS1081 qPCR was 65.6 % (95 % CI 48.4–80.2 %) with positive results for 21/32 PTB cases, while the specificity was 96.7 % (95 % CI 85.9–99.6 %) with negative results for 29/30 participants with ORD. Sensitivity improved to 72.4 % (95 % CI 54.6–86.0 %) when sputum-Xpert was used as the reference standard, while remaining similar at 65.5 % (95 % CI 47.4–80.7 %) when culture was used as the reference standard. In receiver operating characteristic (ROC) curve analysis, the area under the curve (AUC) for saliva IS1081 qPCR was 82.5 % (95 % CI 71.7–93.3 %).

Conclusion: Saliva testing offers a promising alternative to sputum for TB diagnosis among confirmed PTB cases. Larger multicenter studies, encompassing diverse clinical TB characteristics, are needed to provide improved estimates of diagnostic sensitivity and specificity.

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Determinants of cervical cancer screening intention among reproductive age women in Ethiopia: A systematic review and meta-analysis

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Abstract

Introduction Cervical cancer is a leading cause of cancer-related mortality in Ethiopia, despite being preventable. Screening programs remain underutilized despite multiple initiatives. This systematic review and meta-analysis aimed to assess the pooled prevalence of intention to undergo cervical cancer screening and its associated factors among Ethiopian women, addressing a significant gap in national data.

Methods and materials This systematic review and meta-analysis followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Databases such as PubMed, EMBASE, CINAHL, Web of Science, Cochrane Library, HINARI, Google Scholar, and African Journals online were searched using specific keywords and Medical Subject Headings (MeSH). Studies were assessed using a standardized appraisal format adapted from the Newcastle-Ottawa Scale (NOS). Data extraction and analysis were performed using Microsoft Excel-10 and STATA 17 software, respectively. Heterogeneity was evaluated with the I2 statistic and publication bias was examined using Egger's test. Meta-analysis employed a random-effects model.

Result Out of the 750 articles retrieved, nine were included in this systematic review and meta-analysis. The pooled prevalence of intention to screen for cervical cancer in Ethiopia was 33% (95% CI: 9%-56%). Factors significantly associated with intention to undergo cervical cancer screening included favorable attitude (POR = 2.15, 95% CI: 1.29, 4.26), good knowledge about cervical cancer screening (POR: 3.49; 95% CI: 2.04, 6.93), and direct subjective norm (POR: 1.54; 95% CI: 1.32, 3.54).

Conclusion Based on the findings of this meta-analysis, it was observed that women's intention toward cervical cancer screening was low. Determinants identified included favorable attitude, direct subjective norm, and good knowledge of cervical cancer screening. To enhance women's intention for cervical cancer screening, strategies, and activities should be developed to positively influence perceptions among women and those who influence their decisions. Additionally, efforts to enhance public awareness about cervical cancer and its prevention are crucial. © 2024 Lahole et al. This is an open access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Quaternary Science Advances
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15 (2024)

Assessing foundation characteristics at the war dam site, lake tana basin, Ethiopia: A geophysical and geotechnical perspective

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Abstract

An integrated geophysical and geotechnical study evaluated the foundation conditions at the War dam site in northwest Ethiopia. This investigation included the classification of rock quality, shallow seismic refraction, and magnetic approaches. The dam's location comprises quaternary soil deposits and rhyolite rock units that have undergone varied weathering and fracturing. The shallow seismic refraction method distinguishes three layers of p-wave velocities that are less than 1.5 km per second with a depth range of 2–6 m, 1.5–2.5 km per second at a depth range of 15–20 m, and 2.5–3.5 km per second ranging from 20 to 40 m, respectively. Magnetic data were used to identify lineaments, and the RQD value acquired from boreholes ranged from extremely poor to excellent. Lineaments were recognized using the tilt angle approach. The results of the permeability tests demonstrated that the rock mass that serves as the dam's foundation had characteristics that are resistant to low permeability. The maximum and minimum lugeon values obtained from the testing were 9Lu and 0.81Lu, respectively. There are weak zones at and below the surface of the dam site, according to the overall findings acquired from seismic refraction, magnetic, and discontinuity surveying. These results were obtained from monitoring the dam site. These significant structures are directed towards a SW-NE, NE-SW, NNW-SSE, and SSW-NNE orientation. The study assessed the geological suitability of a proposed dam site using seismic refraction and magnetic survey methods. Significant geological variations were observed, particularly in the right abutment and valley floor, indicating the need for targeted grouting. The findings suggest that while the site is generally suitable for dam construction, specific areas require further ground improvement to ensure stability.

Keywords: P-wave velocity**,** Rock quality designation (RQD)**,** Lugeon test and discontinuity**,** War dam

Environmental Science and Pollution Research
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31 (2024)

Investigation of the impact of municipal solid waste disposal site leachate on surface water resources in Hosanna Town, Ethiopia

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Abstract

Surface water resources are the most precious, yet they are also the most vulnerable to pollution. Consequently, maintaining the sustainability of water supplies is critical for livestock support to achieve SDG goals. Landfill leachate poses a significant threat to water resources in developing countries. This study aims to determine how the Hosanna town landfill site affects the Jewie River by analysing the quality of the Alela and Ajew streams and the landfill leachate in both wet and dry seasons. Furthermore, assess the suitability of the water quality for agricultural purposes. The leachate pollution index (LPI), Canadian Council Member of the Environment Water Quality Index (CCMEWQI), and irrigation water quality indices (IWQI) were computed for both seasons using two composite leachate samples and five flow-pace composite river samples. In the wet season, the leachate pollution indices for L1 and L2 ranged from 20.87 to 22.47, respectively. During the dry season, the leachate pollutant index of L1 and L2 was found to be 24.42 and 27.98. Only the Ajew River stream was affected during the dry season because the landfill site is only 46 m away. Both the Ajew and Alela River streams are infested during the rainy season. Irrigation index concentrations revealed that the river water is suitable for cultivation. The early stages of landfill waste maturation are evident from the LPI results. Relocating the dump site is necessary to safeguard water resources because leachate has entered the river streams.

Keywords: Hosanna landfill site**,** Leachate**,** LPI**,** Water quality indices**,** Jewie River

Heliyon
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Factors influencing aflatoxin B1 levels in the groundnut (Arachis hypogaea L.) germplasm of Ethiopia

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Abstract

As there was no maximum permissible limit prescription for aflatoxin B1 (AFB1) in Ethiopia, this study has been conducted to generate data on AFB1 levels in Ethiopian groundnut accessions/landraces. Besides, an attempt was made to find out if there is any relationship between AFB1 and other parameters such as altitude of cultivation, individual seed weight, kernel colonization by Aspergillus flavus, total carbohydrates, protein and total free amino acids. Out of the 28 accessions studied, merely six accessions registered ≤2 ppb AFB1 and thus, they comply with maximum permissible limit set by European Union. Altitude of cultivation had no relationship with AFB1 levels. Interestingly, total carbohydrates in the seeds as well as kernel colonization by A. flavus showed statistically significant ($p < 0.01$) positive relationships with AFB1 levels. It is suggested to use kernel colonization measurement as an alternative to the expensive ELISA based AFB1 measurement. Besides, suitable pre- and post-harvest aflatoxin management strategies should be developed to alleviate the AFB1 levels in Ethiopian groundnut.

Keywords: Aflatoxin B1, Arachis hypogaea, Aspergillus flavus, Groundnut, Kernel colonization

Environmental Research Communications
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6 (2024)

An extensive qualitative and quantitative multi criteria analysis for a hybrid renewable energy system applied to tribal zone - based primary health centres, and maximizing the societal parameters

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Abstract

Remote electrification enhances the quality of life quality of people in remote areas, with no access to electricity through distributed coverage of electricity. Due to the irregular and unbalanced fuel cost and impracticable expansion of the grid, hybrid integrated renewable energy sources become dependable substitute for remote electrification. The necessity of uninterrupted power dispatch is a prime factor for primary health centres, located in tribal and remote areas. This article proposes an integrated primary analysis like financial, production, quantity and environmental, applied to an optimum sizing of a hybrid standalone renewable energy source, which might be carried out in eight primary health centres, situated in the Gudalur Zone in Nilgiris District, Tamil Nadu, India. Four different criteria were inspected in this study, as standard loading, boost up loading, step down loading and complete renewable loading. In addition, every criterion was assessed with four kinds of PV tracking arrangements. The peak load requirement of power and energy, for eight primary health centres, was around 121.08 kW and 907.96 kWh/day respectively. HOMER Pro Micro-grid Analysis Tool was used, to analyze the different primary parameters of this study. The foremost financial parameters like COE (Cost of Energy) and NPC (Net Present Cost), could range from 0.102 to 0.118 $ per kWh and from 0.4047 to 0.5708 Million $ respectively. Annual energy production of solar PV could vary from 318.5 to 427.65 MWh. The main quantity parameter like percentage of excess electricity was obtained from 13.3 to 21.5% annually. The leading emission parameters like CO2 and CO were reported to range from 1700 to 4502 and from 7.98 to 28.1 kg per year respectively. Generator and fuel parameters, key properties of energy storage and converter, were also analyzed extensively. In addition, sensitivity analysis and social parameters were also discussed in this study. The result of this work gives a conceptual and flexible design of structure, to make possible the continuous power supply to the remote tribal area - based primary health centres, under in all situations.

Keywords: hybrid renewable energy, clearness index, solar irradiation, emission parameters, energy storage, financial parameters

Veterinary and Animal Science
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24 (2024)

Performance and egg quality traits of local chickens across different agroecologies in the Kewot district, North Shewa zone, Northern Ethiopia

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Abstract

This study was conducted to evaluate the performance (productive and reproductive) potential and egg quality traits of local chickens (LCs) across different agroecologies (AEs) in the Kewot district, North Shewa zone, northern Ethiopia. A multistage sampling technique was used to select the study sites and households (HHs). The data were collected through semi-structured questionnaires, monitoring and measurements. A total of 147 HHs were included in this study. Ninety brooding hens were monitored to determine hatchability and survivability percentages. A body weight of 120 LCs was measured at the market centres. Furthermore, the egg quality traits of 120 freshly laid eggs were evaluated. The data were analysed by a statistical package for social sciences (version 20). In the study area, the average flock size of the LC/HH populations was 9.90 ± 0.36. The most common flock type was chicks, followed by pullets, with significantly lower ($p < 0.05$) in the lowland (LL) AE. The mean age at first egg of females and the mean age at sexual maturity of males were 6.05 ± 0.06 and 5.68 ± 0.08 months, respectively. The numbers of eggs per clutch and per year were 14.29 ± 0.40 and 50.02 ± 1.51, respectively. There was no significant difference ($p > 0.05$) in the average number of clutches/hen/year across AEs, while significantly lower ($p < 0.05$) numbers of eggs per clutch and per year were recorded for highland (HL) AEs than for LL agro-ecology. The mean hatchability percentage was 80.94 ± 1.69%. The mean market body weights of the male and female LCs were 0.91 ± 0.05 and 0.82 ± 0.05 kg, respectively. There were significant differences ($p < 0.05$) in egg weight, egg width, shell thickness, shell ratio, albumen height, albumen and yolk weight, yolk colour, and Haugh unit (HU) between the AEs. The results revealed that the performance potential and egg quality traits of the LC in the study district were somewhat poor. Therefore, AE-specific development interventions should be designed and implemented to improve the performance potential and egg quality traits of LC in the study area.

Keywords: Egg quality, Local chicken, Productive and reproductive performance

Iranian Journal of Numerical Analysis and Optimization
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14 (2024)

Uniformly convergent numerical solution for caputo fractional order singularly perturbed delay differential equation using extended cubic B-spline collocation scheme

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Abstract

This article presents a parameter uniform convergence numerical scheme for solving time fractional order singularly perturbed parabolic convection-diffusion differential equations with a delay. We give a priori bounds on the exact solution and its derivatives obtained through the problem's asymptotic analysis. The Euler's method on a uniform mesh in the time direction and the extended cubic B-spline method with a fitted operator on a uniform mesh in the spatial direction is used to discretize the problem. The fitting factor is introduced for the term containing the singular perturbation parameter, and it is obtained from the zeroth-order asymptotic expansion of the exact solution. The ordinary B-splines are extended into the extended B-splines. Utilizing the optimization technique, the value of μ (free parameter, when the free parameter μ tends to zero the extended cubic B-spline reduced to convectional cubic B-spline functions) is determined. It is also demonstrated that this method is better than some existing methods in the literature.

Keywords: Singularly perturbed problem; Fractional derivative; artificial viscosity; Delay differential equation.

ASEE Annual Conference and Exposition, Conference Proceedings
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(2024)

Where are Women Engineering Faculty in Ethiopia? The Stubborn Gender Disparity in Engineering Faculty in Ethiopian Universities

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Abstract

In developing countries, workforce diversity, such as faculty diversity in higher education, is important to drive key social justice and positively impact students' academic experiences. Despite Ethiopia's goal of transitioning to an industry-led economy and implementing a higher education policy emphasizing science fields, including engineering and technology, there is a significant gender gap in faculty representation. This study examines the issue regarding the limited gender diversity among engineering faculty in developing countries, focusing on gender disparities in Ethiopian higher education institutions. In addition, the study explores factors contributing to Ethiopian women's faculty underrepresentation. A mixed-methods approach was employed, including a quantitative analysis of the faculty gender composition of seven years and a qualitative analysis of interviews with faculty members. The findings suggest that key factors such as societal norms, cultural beliefs, gender biases, and work-life balance challenges hinder women's participation and advancement in engineering. The paper discusses research-informed recommendations to promote greater gender diversity and gender equity among engineering faculty and university faculty, hence contributing to the broadening of the participation of women faculty in engineering and Ethiopian higher education.

Keywords: engineering education, faculty, diversity, mixed methods, gender bias, cultural beliefs, Ethiopia

PLoS ONE
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19 (2024)

Determinants of longitudinal changes of CD4 cell count and survival time to death of HIV/ AIDS patients treated at Yabelo General Hospital, the case of pastoralist area: Using joint modelling approach

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Abstract

Introduction: HIV/AIDS is a chronic disease that challenges public health worldwide and causes morbidity and mortality in humans. The main purpose of this study was to investigate the determinants of longitudinal changes in CD4 cell count and survival time to death among HIV/AIDS patients as adults from January 2016 to December 2019 at Yabelo General Hospital. The intellectual gap in this study was focused on the study area, which means that the study related to joint modeling doesn't exist in the pastoralist community of Borena.
Methods: This study involved 293 adult HIV-infected adults that could be collected from the recorded patient chart data, and the study design is a retrospective cohort design. The study used a Cox proportional hazard model, a linear mixed effect model, and a joint model, which is the combination of both model processes.
Results: The joint model showed that longitudinal CD4 cell count is significantly associated with survival time (p-value = 0.0253). Covariates such as visiting time, age, weight, educational status, ART adherence, and functional status were statistically significant factors associated with mean changes in the CD4 cell count of HIV patients. WHO stage, educational status, place of residence, TB, family history, and opportunistic infection disease had a significant effect on the survival time of HIV patients.
Conclusions: The estimated association parameter is a negative value, which indicates both outcomes are negatively associated, and higher values of the CD4 cell count are associated with better survival.

Theoretical and Applied Climatology
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155 (2024)

Correction to: Integrated statistical and graphical non-parametric trend analysis of annual and seasonal rainfall in the Shire River Basin, Malawi (Theoretical and Applied Climatology, (2024),

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Abstract

This study integrates purely statistical methods of Mann–Kendall (MK) and Spearman rho (SMR) with statistical-graphical methods of Onyutha trend (OT) test and innovative trend analysis (ITA) to examine annual and seasonal rainfall variations at 12 stations across the Shire River Basin (SRB) during 1976–2005. The results reveal a general decreasing trend for annual rainfall throughout the basin. At seasonal scale, the following trends were observed: an increase for the December-January–February (DJF) season, especially in the southern portion of the basin; a decrease for the March–April-May (MAM) and June July–August (JJA) seasons; and inconclusive results for the September–October-November (SON) season. Despite nearly all time series indicating consistent trend direction as established by the four tests, the ITA identified the most significant rainfall patterns on both annual and seasonal basis. The performance abilities for the MK, SMR, and OT tests demonstrated the closest agreement at the verified significant level. In addition to the monotonic trend results obtained statistically, sub-trends are visually distinguished using the graphical features of the OT and ITA approaches. For the former, changes are seen as step jumps in the mean of the data, and for the latter, trends regarding high and low rainfall clusters are evaluated, hence offering more details regarding rainfall variability, such as the SRB's sensitivity to both floods and droughts. Thus, the completely different aspects offered by the visually oriented methods complement the purely monotonic trend detection methods.

Applied Soil Ecology
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200 (2024)

Response of carbohydrate-degrading enzymes and microorganisms to land use change in the southeastern Qinghai-Tibetan Plateau, China

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Abstract

Land use change alters the soil carbon (C) cycle, but it is unclear how change in land use modifies the function and composition of the microbial communities involved in soil C cycling. In this research, we examined the impact of land use change on soil C fractions, C-degrading enzymes, carbohydrate-active enzymes (CAZyme) and composition of microbial community in the southeastern Qinghai-Tibet Plateau of China. We collected surface soils (0–20 cm) from seven sites that simultaneously included four land uses: farmland (FL), natural forest (NF), shrubland (SL) and artificial forest (AF). We determined soil physicochemical properties and performed metagenomic analysis to determine the microbial community composition and CAZyme genes. The results showed that soil C fractions were significantly decreased by 19–55 % when NF was converted to AF, SL and FL due to a decline in litter inputs ($p < 0.05$). Similarly, C-degrading enzymes significantly declined after NF converted to other land uses ($p < 0.05$). Moreover, changes in land use significantly affected the soil microbial composition ($p < 0.05$). In NF, the relative abundances of Proteobacteria, Candidatus Rokuobacteria and Verrucomicrobia were higher compared to FL and SL. Conversely, FL and SL had a significantly higher abundance of Actinobacteria, Acidobacteria, Chloroflexi, and Gemmatimonadetes phyla than NF soil. Furthermore, CAZyme genes were mainly derived from three bacterial phyla: Actinobacteria, Acidobacteria and Proteobacteria. The abundance of CAZyme genes such as glycosyl transferases and carbohydrate esterase were significantly higher in NF, while glycoside hydrolases, carbohydrate-binding modules and polysaccharide lyases genes were significantly higher in FL ($p < 0.05$). Changes in relative abundances of microbial marker genes, genes coding C-degrading enzymes and CAZyme genes were mainly linked to changes in soil properties, such as soil C fractions, total nitrogen, moisture content, microbial biomass nitrogen, bulk density and pH. Overall, our study provides an in-depth insight into the responses of C-cycling microorganisms and functional genes to land use changes.

Transnational Corporations Review
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16 (2024)

The role of FDI augmented with governance and human capital on structural transformation: Experiences from SSA and EAP countries

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Abstract

In the last few decades, the majority of least-developed countries have failed to achieve the structural transformation theme. The concern of achieving structural transformation is further aggravated by the lack of technology, low level of literacy, poor institutional qualities, and low development level of the manufacturing sub-sector in these countries. To examine the role of FDI augmented with governance and human capital on structural transformation, the study used panel data for four Sub-Saharan African (SSA) and three East Asian and Pacific (EAP) countries across 31 years. The auto-regressive Distributed Lag with Pooled Mean Group technique was employed for analysis after checking the possible assumptions. The model for the full panels suggests that FDI inflows, especially when supplemented with good governance and better literacy, promote structural transformation. Moreover, across regions, in the short run, the interactive effect of FDI with governance and literacy had a positive effect for EAP and a negative effect for SSA countries. Finally, the government of the least developed countries that endeavors to achieve structural transformation should focus on improving the quality of governance and literacy rate and then engage in attracting massive inflows of FDI, among others.

Keywords: ARDL model, East Asian and the Pacific, Sub-Saharan Africa, Foreign direct investment and structural transformation

Partial Differential Equations in Applied Mathematics
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10 (2024)

Numerical method for second order singularly perturbed delay differential equations with fractional order in time via fitted computational method

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Abstract

The numerical solution of time fractional parabolic differential equations with singular perturbations and delay is the subject of this article. An arbitrarily small perturbation parameter $\varepsilon(0<\varepsilon<<1)$ is multiplied the highest order derivative term. The problem's solution shows an exponential boundary layer on the right side of the spatial domain for small values of ε. The solution and its derivatives are discussed together with their properties and bounds. The Crank–Nicolson approach for time discretization and the fitted operator non-standard finite difference method for space discretization are used to solve the time fractional singularly perturbed time delay problem under consideration. The comparison principle and solution bound are used to examine and analyze the scheme's stability. The scheme's uniform convergence is examined and demonstrated. The proposed scheme has a uniform convergence order of $Mx-1+(\Delta t)2-\gamma$. Two numerical illustrations for various values of ε are taken into consideration to validate the theoretical analysis of the scheme. The constructed scheme provides a better order of convergence and more accurate results than methods found in the literature.

Keywords: Singular perturbed problem, Caputo derivative, Non-standard finite difference scheme, Time fractional, Partial differential equation

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19 (2024)

The effect of workforce diversity on organizational performance with the mediation role of workplace ethics: Empirical evidence from food and beverage industry

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Abstract

This study examines the effect of workforce diversity on organizational performance in the Ethiopian food and beverage sector. It incorporates workplace ethics as a mediator to explain in detail the complex relationship between workforce diversity and organizational performance. The study uses a quantitative design, in which data is collected from a random sample of 359 employees from stratified random firms. A Structural Equation Model (SEM) result verified the viability of three of the four proposed hypotheses. Organizational performance is not directly affected by workforce diversity. But it directly changes in response to the change in workplace ethics. Besides, workplace ethics mediate the relationship between workforce diversity and organizational performance. This implies a more advanced relationship exists between diversity and performance, involving effects transitions via workplace ethics, than what this study initially proposed. Thus, an approach to improving firm performance involves reinforcing good workplace ethics practices. Organizations can mitigate the negative impact of workforce diversity on workplace ethics by creating a more inclusive and ethical workplace. This includes providing training on diversity and inclusion and promoting a culture of respect and understanding.

World Water Policy
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10 (2024)

Analyzing groundwater storage anomalies in data-scarce areas of Ethiopia's Rift Valley Basin using artificial neural network

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Abstract

Groundwater storage anomalies (GWSA) study requires the use of hydro-climatic models coupled with Gravity Recovery and Climate Experiment climate (GRACE) and GRACE Follow-On (GRACE-FO) Terrestrial Water Storage experiments. Understanding groundwater storage anomalies in the research area is difficult due to the restricted hydro-meteorological data availability, especially, groundwater levels, changes in groundwater storage, and budgetary and technical constraints. No such investigation of GWS anomalies prior to this study in this Basin was conducted. The research focuses on GWSA investigations in the basin employing Global Land Data Assimilation Systems and Artificial Neural Networks-Back Propagation Algorithm techniques are required. The ultimate objective of this study was to reduce the GRACE GWS from 1° to 0.25° and close the discontinuity between GRACE/GRACE-FO observations. The results illustrated that GRACE/GRACE-FO GWS throughout the basin were overall declining. The GWS anomaly significantly decreased between 2011 and 2013, with the highest monthly depletion in March 2011 (−158 mm). In contrast, from mid-June to mid-October, the maximum positive value varied from 20.80 mm in the southernmost basin to 39.49 mm in the central-southeastern basin. The basin's eastern, central-southeastern, northern, and southern areas displayed positive monthly GWS trends. The entire dry season has been influenced by negative anomalies. Hence, the identification of GWS variations and a comprehensive understanding of their effects provided valuable scientific insights. Identifying and analyzing anomalies in groundwater storage (GWS) can provide valuable information. This data can be efficiently used to develop appropriate regulatory frameworks, which may contribute to the long-term viability of the availability of groundwater.

Keyword: SANNs, downscaling, GRACE, groundwater storage change, rift valley basin

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19 (2024)

Prevalence of insomnia and associated factors among postpartum mothers in Southern Ethiopia, a community-based cross-sectional study

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Abstract

Insomnia has become a global public health concern, particularly among postpartum women. Minimal sleep interruption related to newborn care is normally expected, insomnia, however has negative impact during the postpartum period. Although its causes and contributing factors are poorly understood, it has a wide-ranging impact on the mother and her infant. So far, studies in Ethiopia have focused on the general community, neglecting mothers in the postpartum period. Thus, this study aimed to assess the prevalence of insomnia and the factors associated with it. A community-based cross-sectional study included 451 study participants who were chosen using a simple random sampling technique. A structured, pretested, and interviewer-administered questionnaire was used to collect data. After entering the data into EpiData version 3.1, it was exported to the Statistical Package for Social Sciences version 26 for analysis. Bivariable and multivariable binary logistic regression analyses were carried out. Variables with a P-value of 0.2 in the bivariable analysis were included in the multivariable analyses. Those with a P-value of 0.05 were declared statistically significant in the final model. The current study included 444 mothers in total. Insomnia was prevalent among 23.2% (95% CI: 19.3%, 27.4%) of mothers who had given birth within the previous 12 months. Insomnia was associated with unplanned index pregnancy [AOR = 4.4, 95% CI (2.2, 8.7)], alcohol consumption [AOR = 3.0, 95% CI (1.4, 6.5), low social support [AOR = 9.7, 95% CI (4.4, 21.1)], medium social support [AOR = 2.2, 95% CI (1.1, 4.3)] and depression [AOR = 10.7, 95% CI (5.7, 20.0). A planned index pregnancy, abstaining from alcohol, and recognizing and treating postpartum depression were all advised.

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230 (2024)

Spliced-Leader RNA as a Dynamic Marker for Monitoring Viable Leishmania Parasites During and After Treatment

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Abstract

Accurate detection of viable Leishmania parasites is critical for evaluating visceral leishmaniasis (VL) treatment response at an early timepoint. We compared the decay of kinetoplast DNA (kDNA) and spliced-leader RNA (SL-RNA) in vitro, in vivo, and in a VL patient cohort. An optimized combination of blood preservation and nucleic acid extraction improved efficiency for both targets. SL-RNA degraded more rapidly during treatment than kDNA, and correlated better with microscopic examination. SL-RNA quantitative polymerase chain reaction emerges as a superior method for dynamic monitoring of viable Leishmania parasites. It enables individualized treatment monitoring for improved prognoses and has potential as an early surrogate endpoint in clinical trials.

Keyword: leishmaniasis, diagnostics, surrogate marker, treatment response, PCR

Journal of Statistical Theory and Applications
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23 (2024)

Modeling the Progression of Haematocrit Level over Time

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Abstract

Haematocrit Levels is defined as the proportion, by volume, of the blood that consists of red blood cells. This study was conducted to model the progress of haematocrit levels over time in kidney patients after their transplant and to determine how the progress depends on the age and gender of the patient and other factors. This is a longitudinal study, and haematocrit level was considered as a response while the covariates were time, gender, age, cardio-vascular problem during the years preceding the transplantation, and rejection symptoms during the first three months after the transplantation took place of the patients. Different statistical methods such as, multivariate regression model, two stage analysis and linear mixed effects model were employed to explore the progress of haematocrit over time. Models revealed that haematocrit levels in kidney transplant patients evolve over time. Gender and Age of the patient have significant effect on the evolution of haematocrit levels. Males tend to have a high increase in haematocrit levels over time than females. With regards to age, haematocrit levels tend to increase with increasing age. Moreover, it was observed that experience of cardio-vascular problems before trandplant and rejection symptoms did not have a significant effect on the progress of haematicrit levels. The growth of Haematocrit levels evolve over time follows a quartic time effect. Change in haematocrit levels varies according to gender and age of the patient. Patients starting with low haematocrit levels tend to have a larger increase over time.

Keywords: Kidney transplant**,** longitudinal data**,** Multivariate regression**,** two stage analysis

Clean Technologies and Environmental Policy
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26 (2024)

Assessment of air pollution emitted during cooking using biomass and cleaner fuels in the Shiselweni region of Eswatini (Swaziland)

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Abstract

In Eswatini, 62.3% of households still rely on solid fuel for cooking, especially wood (61.8%). Smoke emissions during biomass burning remain the primary source of indoor air pollution, comprising pollutants detrimental to health. This study provides a quantitative exposure assessment of fuels used in the Shiselweni region with the objectives of monitoring the carbon monoxide (CO) and carbon dioxide (CO2) concentrations during cooking events and evaluating cancer and noncancer risks due to exposure to particulate-bound polycyclic aromatic hydrocarbons (PAHs) during cooking events among cooking personnel in households that cook indoors by burning biomass. Real-time CO, CO2, and particulate matter (PM) monitoring was performed in seventeen kitchens during cooking events across the Shiselweni region using different cooking methods: biomass in open fires and stoves, liquefied petroleum gas (LPG), and electric stoves. PM2.5, PM10, and CO exceeded indoor exposure guidelines for biomass fuel-related homesteads. Particulate PAH intake concentrations were evaluated, and biomass fuel users exhibited high cancer risks and low embryo survival chances due to particulate PAH exposure. The average total cost of reducing the incremental lifetime cancer risk (ILCR) and hazard quotient (HQ) to acceptable levels was lower when shifting from biomass to LPG stoves than when shifting to electric stoves.

Keywords: Biomass fuel**,** Indoor air pollution**,** Particulate matter**,** polycyclic aromatic hydrocarbons**,** Carbon monoxide**,** Carbon dioxide

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DOI:

102 (2024)

Automated wheat rust disease classification using deep learning to support sdg 1: enhancing agricultural productivity and poverty alleviation

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Abstract

Agricultural production is pivotal for alleviating extreme poverty and boosting economic stability in line with Sustainable Development Goal 1 (SDG 1) of eradicating poverty in all its forms everywhere. India's agricultural sector is essential to feed its growing population, projected to reach 1.6 billion by 2050. Crop diseases, particularly wheat rusts—yellow rust, leaf rust, and stem rust—are significant obstacles to agricultural productivity, causing substantial yield losses and affecting the livelihoods of millions of farmers. Therefore, developing an automated system for recognizing and classifying wheat rust diseases is crucial for ensuring food security and economic stability. This study aims to design an automated system for identifying and categorizing wheat rust diseases using advanced image processing and machine learning techniques. We collected a dataset of wheat leaf images from agricultural fields in Punjab and Haryana and applied noise filtering and segmentation methods to enhance image quality. Transfer learning and deep convolutional neural networks (CNNs) were used to develop a classifier model. The ResNet50 model achieved an accuracy of 98.5% in classifying wheat rust diseases. By addressing wheat rust diseases effectively, this system supports SDG 1 by enhancing agricultural productivity, improving food security, and contributing to the economic well-being of farmers.

Keywords: Deep learning, wheat rust, transfer learning, convolutional neural networks, agricultural, productivity, SDG 1, poverty alleviation.

Applied Soft Computing

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Fuzzy-based predictive deep reinforcement learning for robust and constrained optimal control of industrial solar thermal plants

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Abstract

Integrating distributed solar fields (DSFs) into conventional heat and power plants (CHPs) of industries is mostly constrained by the availability of a real-time capable control scheme. Safe and efficient operation of industrial DSF requires the supply of a fluctuating and periodically available energy at the required temperature while reducing losses and ensuring operational constraint. Reinforcement learning (RL), specifically Q-learning methods, are being recently applied for such control tasks. However, existing RL approaches cannot be directly applied to continuous domain control tasks or tasks with operation constraints. While using deep learning in model-free RL can remove these limitations, tractability and scalability boundaries on performing the deep learning are becoming significant, with scarce data and multi-objective concerns. In contrast, model-based deep RL schemes can be applied for sample efficiency and satisfying operational constraints, but their modeling framework is not general and accurate. To address these challenges, the work here develops a hybrid fuzzy convolution model (HFCM) that takes full advantages of data, models (dynamic and steady-state), and prior knowledge on industrial DSF. The HFCM is then extended for use in deep deterministic policy gradient (DDPG) algorithm to learn the DSF control task. This is done so by solving a multi-objective optimization problem, which is formulated as a constrained Markov decision process (CMDP) with continuous state and actions. Some practical and relevant findings were made with this HFCM. Firstly, it allowed the DDPG agent to learn independently a temperature state and a disturbance state, using only temperature measurement and single realizations of state vector. It also permitted the testing of an operational state violation strategy on a DDPG actions, and at the same time, the correction of the effects at a safety layer, if needed. Furthermore, the proposed control strategy simultaneously reduced mean temperature tracking error by 24%–51% and energy gain by 13.9%–17.35% when compared respectively to model-free DDPG and MPC baselines.

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Capability of logistic regression in identifying flood-susceptible areas in a small watershed

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Abstract

The Earth is currently experiencing severe economic and social consequences as a result of frequent floods. This study is crucial for effective risk management and mitigation, protecting lives and property from potential flood damage in the Deme watershed. This study endeavors to assess the efficacy of a logistic regression model in generating a flood susceptibility map for the Deme watershed in Ethiopia. Fourteen factors contributing to flooding were considered, including digital elevation model, slope, aspect, profile curvature, plane curvature, Topographic Position Index (TPI), Topographic Roughness Index (TRI), flow direction, Topographic Wetness Index (TWI), distance to the river, rainfall, land use/land cover (LULC), Normalized Difference Vegetation Index (NDVI), and soil type. The receiver operating characteristic (ROC) curve method was employed to validate the model. The area under the curve (AUC) values for the model were determined to be 81% for the training dataset and 82% for the validation dataset, indicating its effectiveness in delineating flood-prone areas. The findings revealed that 18% of the watershed is very highly susceptible to flooding, 19% exhibits high susceptibility, 18% shows moderate susceptibility, while 20 and 24% have low and very low susceptibility, respectively. This research provides insights into comprehensive flood prevention and urban development strategies.

Keyword: Deme watershed, flood susceptibility, geospatial data, household survey, logistic regression

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64 (2024)

Corrigendum to "Optical and luminescence properties of pure, iron-doped, and glucose capped ZnO nanoparticles"

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Abstract

Pure, iron-doped, and glucose capped ZnO nanoparticles (NPs) have been synthesized by a chemical precipitation method. The structural, optical, and photoluminescence properties of all the prepared samples are examined systematically. X-ray diffraction patterns of all the samples exhibited a single hexagonal wurtzite structure with an average crystallite size ranging from 1.01 to 1.78 nm. Transmission electron microscope images showed the spherical shaped NPs in the range of between 17 and 19 nm. Fourier transform of infrared spectroscopy (FTIR) studies confirmed the presence of octahedral sites around 470–489 cm−1 and tetrahedral sites at 616 cm−1 in pristine and doped samples. The calculated optical bandgap energy for pure, Fe doped and glucose capped ZnO NPs are found to be 3.82, 3.80, and 3.63 eV, respectively, and the variations in the bandgap is ascribed to the Fermi level, which is in the conduction band resulting in the absorption edge shifting towards the higher/ lower energy. It is observed that Fe doped and glucose capped ZnO NPs showed a strong photoluminescence signal than the pure ZnO NPs. The green emission is quenched. The blue emission is enhanced due to the deactivation of oxygen vacancies on the surfaces due to the smaller particle sizes as a result of the quantum confinement effect.

Keywords: ZnO nanoparticle, Precipitation method, hexagonal wurtzite structure, Optical bandgap, Photoluminescence

Mathematical Modelling of Engineering Problems
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11 (2024)

Optimization of a Fuzzy-Based MPPT Controller for a PV Water Pumping System through a PSO-Based Approach

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Abstract

Water is essential for many agricultural and human needs. The use of fossil fuels in water pumping systems has an effect on the environment. A new energy paradigm is being adopted as part of the sustainable development goals, and carbon-free technologies are being widely used to generate renewable energy. This paper presents a fuzzy-based maximum power point tracking (MPPT) approach for a photovoltaic (PV) water pumping system that employs particle swarm optimization (PSO). Additionally, the fuzzy logic control (FLC) scheme for power converters was used in SIMULINK/MATLAB to design and simulate the MPPT of the PV system. The FLC inputs and output scaling gains were adjusted using the PSO algorithm. In addition, a comparative evaluation of the performance of different MPPT controllers was carried out. It made use of fuzzy logic, a PSO-based fuzzy controller, and the perturb and observe technique. According to the simulation results, the simulated photovoltaic water pumping application has high efficiency levels of a normal fuzzy logic, a PSO-based fuzzy controller, and the perturb and observe technique are 95.65%, 96.5%, 84.99%, respectively. The results further indicate that the overall efficiency of the PV water pumping system can be significantly increased by using the recommended PSO-based fuzzy controller technique.

Keywords: particle swarm optimization, fuzzy logic controller, perturb and observe, maximum power point tracking, photovoltaic

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38 (2024)

Global estimates on the number of people blind or visually impaired by Uncorrected Refractive Error: a meta-analysis from 2000 to 2020

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Abstract

Background: Uncorrected refractive error (URE) is a readily treatable cause of visual impairment (VI). This study provides updated estimates of global and regional vision loss due to URE, presenting temporal change for VISION 2020 Methods: Data from population-based eye disease surveys from 1980–2018 were collected. Hierarchical models estimated prevalence (95% uncertainty intervals [UI]) of blindness (presenting visual acuity (VA) < 3/60) and moderate-to-severe vision impairment (MSVI; 3/60 ≤ presenting VA < 6/18) caused by URE, stratified by age, sex, region, and year. Near VI prevalence from uncorrected presbyopia was defined as presenting near VA < N6/N8 at 40 cm when best-corrected distance (VA ≥ 6/12). Results: In 2020, 3.7 million people (95%UI 3.10–4.29) were blind and 157 million (140–176) had MSVI due to URE, a 21.8% increase in blindness and 72.0% increase in MSVI since 2000. Age-standardised prevalence of URE blindness and MSVI decreased by 30.5% (30.7–30.3) and 2.4% (2.6–2.2) respectively during this time. In 2020, South Asia GBD super-region had the highest 50+ years age-standardised URE blindness (0.33% (0.26–0.40%)) and MSVI (10.3% (8.82–12.10%)) rates. The age-standardized ratio of women to men for URE blindness was 1.05:1.00 in 2020 and 1.03:1.00 in 2000. An estimated 419 million (295–562) people 50+ had near VI from uncorrected presbyopia, a +75.3% (74.6–76.0) increase from 2000 Conclusions: The number of cases of VI from URE substantively grew, even as age-standardised prevalence fell, since 2000, with a continued disproportionate burden by region and sex. Global population ageing will increase this burden, highlighting urgent need for novel approaches to refractive service delivery.

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Evaluation of drinking water quality and associated health risks in Adama City, Ethiopia

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Abstract

Drinking water deterioration causes to risk of public health which is essential to supply safe water to the public. This study assessed groundwater quality and health risks in Adama City by analyzing groundwater and chlorine samples. Ion photometry techniques detected anions and cations, ensuring accuracy with quality control protocols. Water Quality Index (WQI) and chlorine decay modeling via WaterGEMs assessed water quality. Hazard index (HI) calculations evaluated exposure risks; Pearson correlation analyzed physicochemical relationships. Findings highlighted water quality and hazards. Aquachem software analyzed Adama's groundwater, revealing high total alkalinity and potassium exceeding WHO limits. Other parameters (nitrate, nitrite, chloride, fluoride, and sulfate) met WHO standards. Sodium, calcium, magnesium, iron, manganese, and boron also complied. Multivariate analysis showed significant parameter associations. Water types included Ca–Na–HCO3 (27.27 %), Na–Ca–HCO3 (36.36 %), Na–Ca–Mg–HCO3, Na–HCO3 (9.09 % each), and Na–Mg–HCO3 (18.18 %). Drinking Water Quality Index rated boreholes as “Good.” Health risk assessments found no significant fluoride, iron, or manganese risks across ages. Chlorine residual analysis indicated 74 % had levels below WHO recommendations, prompting chlorine dosing adjustments. Findings inform groundwater management in Adama City.

Keywords: Aquachem**,** Chlorine decay**,** Water quality index**,** Hazardous index**,** Hydro-geochemistry, WaterGEMS

Heliyon
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Acclimatize experimental approach to adjudicate hydraulic coefficients under different bed material configurations and slopes with and without weir

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Abstract

The primary purpose of this study was to evaluate the hydraulic coefficient of coarse aggregate grain size beds and hydraulic parameters under random and perpendicular bed configurations, as well as to explore the discharge coefficient for rectangular weirs. The research objectives were to compare flow resistance coefficients, evaluate the discharge coefficient for rectangular weirs, investigate the relationship between roughness coefficient and hydraulic parameters, and validate the theoretical hydraulic equation for the rectangular weir. This was achieved by analysing different bed configurations, bed slopes, and 20 and 30-mm bed materials. Sieve analysis was conducted on bed materials using American-standard sieves to determine their particle size distribution. The experiment was performed in a rectangular flume measuring 12 m in length, 0.31 m in width, and 0.45 m in depth. In a laboratory experiment, water was pumped into a flume using centrifugal pumps, and a rectangular weir was attached downstream for discharge measurement. The experiment investigated factors such as Manning roughness coefficient, bed material geometry, bed slope, and weir shapes. Approximately 1680 tests were conducted to analysed the impact of these factors on discharge and the coefficient of discharge. The average Manning's roughness coefficients for a grain size of 20 mm were 0.019 (with weir) and 0.019 (without weir) in a random bed configuration, and 0.028 (with weir) and 0.027 (without weir) in a perpendicular flow bed configuration. For a grain size of 30 mm, the coefficients were 0.023 (with weir) and 0.022 (without weir) in a random bed configuration, and 0.033 (with weir) and 0.026 (without weir) in a perpendicular flow bed configuration. The presence of a weir has affected Manning's roughness coefficients and discharge coefficients. With a weir, the roughness coefficients have generally been higher compared to without a weir, indicating increased roughness in the channel. The discharge coefficient for a rectangular weir with a grain size of 20 mm ranged from 0.39 to 0.84 (random bed) and 0.27 to 0.68 (perpendicular flow bed), while for a grain size of 30 mm it ranged from 0.31 to 0.81 (random bed) and 0.23 to 0.48 (perpendicular flow bed). The discharge coefficients have varied depending on the grain size and bed configuration, reflecting different flow efficiencies over the weir. Rough particles influenced flow and Manning's roughness coefficient value, then reduced discharge and velocity values. Under two bed configurations and slopes, beds with a grain size of 30 mm have higher roughness coefficients compared to those with a grain size of 20 mm. The models have shown that the roughness coefficient is inversely proportional to the discharge and directly proportional to the tailgate water levels. The coefficient of roughness and discharge coefficient are mainly influenced by the channel slopes, bed roughness, bed grain size, and bed configuration. A randomly configured bed with a 20 mm grain size gravel bed is preferred over a perpendicular bed configuration to handle high discharges. Using a 20 mm grain-size gravel bed in open-channel flow is more suitable than a 30 mm grain-size bed. Relying on the constant friction factor, Manning's n, is not recommended as it may result in design errors. These findings have the potential to improve hydraulic engineering design practices, enhancing the accuracy and efficiency of open-channel flow systems.

Keywords: Manning's and discharge coefficient**,** Bed roughness**,** rectangular weir bed, distribution**,** Froude number**,** Reynolds number**,** Open channel flow

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369 (2024)

Nutrient and sediment retention by riparian vegetated buffer strips: Impacts of buffer length, vegetation type, and season

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Abstract

Farming activities in watersheds can significantly increase sediment and nutrient loads, threatening aquatic ecosystems. Riparian vegetated buffer strips (RVBS) have emerged as a promising strategy to capture and sequester these pollutants. While previous research highlights the effectiveness of woody vegetation in reducing nutrient loads, an essential knowledge gap exists regarding the comparative efficiency of different vegetation types (woody, shrubs and grasses) in trapping nutrients and reducing transport from watersheds to waterbodies. To address this knowledge gap, a multi-year field investigation was carried out with the following objectives: (a) to evaluate the influences of RVBS length (2, 5, 10, 14 and 18 m) and vegetation type (woody, grass, shrub, and no buffer) on reducing nutrient and sediment concentrations in surface runoff across different seasons, and (b) to compare soil microbiological characteristics among the different buffer treatments. The findings reveal significant insights into the effectiveness of different RVBS configurations in mitigating nutrient and sediment concentrations. Woody RVBS demonstrated exceptional resilience, particularly during snowmelt periods, significantly outperforming non-woody vegetation types. In contrast, RVBS with grasses often showed limited effectiveness in reducing nutrient levels in overland flow. Importantly, the results highlight the remarkable capacity of woody vegetation within 18-metre RVBS, exhibiting 100% sediment trapping efficiency (STE), 89.8% total nitrogen (TN) removal, and 92.82% total phosphorus (TP) removal. Comparatively, grass treatments displayed lower efficiencies (STE:86%, TN:72.3%, TP: 77.8%), followed by shrubs (STE: 62%, 43.9% and 48.8%), and the control with no buffer (STE: 27%, TN: 20.6%, TP: 23.17%). The superior efficacy of woody vegetation can be attributed to its deep rooting systems and higher organic matter content in the soil compared to grass and shrub areas. Additionally, woody treatments exhibited higher levels of organic carbon, nutrients, and microbial activities in the soil, indicating greater potential for nutrient cycling. High-throughput sequencing revealed shifts in bacterial community diversity and biomass in vegetation treatments compared to the control bare soil. These findings underscore the potential of RVBS incorporating woody vegetation or grass to mitigate nutrient and sediment concentrations by enhancing infiltration and plant uptake processes. Nevertheless, RVBS effectiveness may vary, particularly during snowmelt periods. Future studies should explore RVBS design and management approaches in natural systems, with a specific focus on optimizing the effectiveness of grass treatments during snowmelt.

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Role of laser power and scan speed combination on the surface quality of additive manufactured nickel-based superalloy

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Abstract

In laser-based powder bed fusion (L-PBF), the volumetric energy density (VED) controlled by laser power (LP) and scan speed (SS) significantly affects the desired surface quality. Any variations in the LP and SS on the VED notably affect the surface quality due to changes in laser powder interactions. Therefore, the present study concentrated on the effect of various combinations of LP and SS, i.e. low LP (160 W) with high SS (1250 mm/s), high LP (320 W) with low SS (410 mm/s), low LP (160 W) with low SS (550 mm/s) and high LP (320 W) with high SS (1100 mm/s). The wide range of varying VEDs was chosen between 29 and 177 J/mm3. The results showed the VED range between 66 and 90 J/mm3 exhibited minimum surface roughness parameters of 0.51 < Ra < 0.52 µm, 0.63 < Rq < 0.64 µm, and 2.53 < Rz < 2.79 µm. The specific impact of LP and SS combination between 160 and 320 W with 400–1250 mm/s by maintaining a constant VED of 66 J/mm3 was also investigated. At a constant VED of 66 J/mm3, the combination of 280 W and 960 mm/s shows minimum roughness parameters of Ra = 0.527 µm, Rq = 0.645 µm, and Rz = 2.446 µm. The results showed that the combination of low LP with low SS, high LP with high SS, low LP with high SS, and high LP with low SS, increases surface roughness.

Keywords: Inconel 718**,** additive manufacturing**,** laser-based powder bed fusion**,** process Parameter**,** volumetric energy density**,** surface roughness

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Integration of geospatial analysis, frequency ratio, and analytical hierarchy process for landslide susceptibility assessment in the maze catchment, omo valley, southern Ethiopia

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Abstract

This investigation was conducted in southern Ethiopia's Maze watershed in the Omo River Valley. Frequency ratio (FR) and analytic hierarchy process (AHP) techniques were used to assess landslide susceptibility in the region. Identifying causative components and landslide inventory data achieved the goal. Remote sensing and on-site investigations found 793 landslide polygons. To assess vulnerability, the landslide inventory information is categorized into two groups: the training dataset (70%) and the validation dataset (30%). This study examined "slope, aspect, curvature, lithology, land use and cover, normalized vegetation index, and proximity to fault lines, rivers, and distance to road as landslide controlling factors". The spatial analysis capabilities in Arc GIS were used to overlay the weights of all landslide-causing components to create the susceptibility map. A final landslide susceptibility map is produced using FR and AHP methods and categorized as "very low," "low," "moderate," "high," and "very high." The frequency ratio method divides the region into susceptibility classes by frequency. The very low, low, medium, high, and very high susceptibility groups cover 25%, 20%, 18%, and 19% of the territory. The analytical hierarchical process technique shows that 3%, 7%, 26%, 36%, and 28% of the area are very low, low, medium, moderate, and very high landslide susceptibility. The receiver operating characteristic curve was employed to validate the area-underlayer susceptibility maps. The success rates were determined using the FR and AHP approaches, resulting in AUC numbers of 0.873 and 0.87. Similarly, the prediction rates were determined to be 0.81 and 0.80. The landslide susceptibility maps will significantly influence land resource allocation.

Keywords: Analytical hierarchy process, Ethiopia, Frequency ratio, Geospatial analysis, Landslide susceptibility assessment, Omo valley

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14 (2024)

Exploring the Effects of Written Corrective Feedback Types on Grammatical Accuracy in L2 Writing: Evidence from Ethiopian High School Students

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Abstract

Although, written corrective feedback (hereafter referred to as CF) is applauded in many writing courses for fostering students' quality writing, its impact on grammatical accuracy in L2 students' writing remains a debated topic. Thus, this study looked into the effect of CF types on L2 students' grammatical accuracy in writing. To achieve this objective, the design of this study was quasi-experiment. During the intervention of the study three groups: two experimental groups and one control group were participated with a total of 150 students. Over the intervention of 8 weeks, the students received pretest, immediate post-test and a delayed post-test was given. The data collected through the writing tests was analyzed using one-way ANOVA and Scheffe post hoc tests. The findings indicated that although CF types have positive effects during the immediate posttest scores, they did not have any positive effect on L2 students' grammatical accuracy in writing context in the delayed posttest scores. This implies that CF alone is not sufficient for improving the grammatical accuracy of high school students in Ethiopia. Although the CF literature discussed its importance in the language acquisition, teachers are advised to focus on students' additional exposures in writing accuracy rather than grammatical correction in their writing classes and use longer treatment to allow language learners' engagement with the CF types provided.

Keywords: feedback types, grammatical accuracy, high school students, L2 writing, written corrective feedback

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Adolescent maternal health services utilization and associated barriers in Sub-Saharan Africa: A comprehensive systematic review and meta-analysis before and during the sustainable development goals

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Abstract

Introduction: Effective and adequate maternal health service utilization is critical for improving maternal and newborn health, reducing maternal and perinatal mortality, and important to achieve global sustainable development goals (SDGs). The purpose of this systematic review was to assess adolescent maternal health service utilization and its barriers before and during SDG era in Sub-Saharan Africa (SSA).

Methods: Systematic review of published articles, sourced from multiple electronic databases such as Medline, PubMed, Scopus, Embase, CINAHL, PsycINFO, Web of Science, African Journal Online (AJOL) and Google Scholar were conducted up to January 2024. Assessment of risk of bias in the individual studies were undertaken using the Johanna Briggs Institute (JBI) quality assessment tool. The maternal health service utilization of adolescent women was compared before and after adoption of SDGs. Barriers of maternal health service utilization was synthesized using Andersen's health-seeking model. Meta-analysis was carried out using the STATA version 17 software.

Results: Thirty-eight studies from 15 SSA countries were included in the review. Before adoption of SDGs, 38.2 % (95 % CI: 28.5 %, 47.9 %) adolescents utilized full antenatal care (ANC) and 44.9 % (95%CI: 26.2, 63.6 %) were attended by skilled birth attendants (SBA). During SDGs, 42.6 % (95 % CI: 32.4 %, 52.8 %) of adolescents utilized full ANC and 53.0 % (95 % CI: 40.6 %, 65.5 %) were attended by SBAs. Furthermore, this review found that adolescent women's utilization of maternal health services is influenced by various barriers, including predisposing, enabling, need, and contextual factors.

Conclusions: There was a modest rise in the utilization of ANC services and SBA from the pre-SDG era to the SDG era. However, the level of maternal health service utilization by adolescent women remains low, with significant disparities across SSA regions and multiple barriers to access services. These findings indicate the importance of developing context-specific interventions that target adolescent women to achieve SDG3 by the year 2030.

Keywords: Adolescent**,** Adolescent girls**,** Teenagers**,** Maternal health**,** Antenatal care**,** Prenata care**,** Skilled birth attendant**,** Skilled delivery**,** Postnatal care**,** Pregnancy**,** Meta-analysis**,** Systematic review**,** SS

Pan African Medical Journal
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49 (2024)

Evaluation of the antihyperglycemic and antihyperlipidemic effects of Trigonella foenum-graecum L and Coffea arabica L seeds in STZ induced diabetic mice: impact on kidney and liver functions

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Abstract

Introduction: diabetes mellitus is a metabolic disease of the endocrine system characterized by elevated blood sugar levels due to disorders in insulin action, and secretion. This study aims to evaluate the antihyperglycemic and antihyperlipidemic effects of Trigonella foenum-graecum L and Coffea arabica L seeds in STZ (streptozotocin) induced diabetic mice: impact on kidney and liver functions.

Methods: twenty-six male mice aged 2 weeks, were divided into five groups: normal control, diabetic control (DC), positive control (PC), galactomannan-treated (GM), and chlorogenic acid-treated (CGA). Trigonella foenum-graecum L (TFL) seeds were bought from the local market. Similarly, Coffea arabica L (CAL) seeds were collected from the Ethiopian Commodity Exchange. After a 28-day treatment period TFL and CAL, fasting blood glucose diabetic control (FBG], oral glucose tolerance (OGT), lipid profile, and kidney and liver function tests were conducted. Statistical analysis was performed using R software, with the significance level set at a P-value < 0.05.

Results: galactomannan-treated and CGA significantly reduced FBG by-176.8 and-252.4 ($p<0.01$), respectively, and improved OGT (AUC of CGA-7449 and GM-14754) in comparison to DC (52452] ($p<0.05$). Similarly, liver and kidney function tests showed a statistically significant difference against the non-treated group 1 ($p<0.01$). In the lipid profile test, galactomannan reduced triglyceride and cholesterol levels, while chlorogenic acid improved low-density lipoprotein and cholesterol.

Conclusion: according to this research, TFL and CAL seeds decreased fasting blood glucose levels and improved glucose tolerance, lipid profiles, liver and kidney function tests, and glucose tolerance.

Keywords: Diabetes mellitus, galactomannan-treated, chlorogenic acid-treated, hyperglycemia, hyperlipidemia, Streptozotocin

Partial Differential Equations in Applied Mathematics
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Nonstandard hybrid numerical scheme for singularly perturbed parabolic differential equations with large delay

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Abstract

In this paper, a numerical scheme for a class of singularly perturbed delay parabolic convection–diffusion problems having Dirichlet boundary conditions is proposed. When the perturbation parameter tends to zero, the solution to these problems exhibits a boundary layer at the right side of the domain. The classical methods fail to provide good accuracy for these problems. To overcome this drawback, we proposed the Crank–Nicolson finite difference scheme to discretize in temporal direction on a uniform mesh and a nonstandard midpoint upwind scheme in spatial direction on a piecewise uniform Shishkin mesh. The resulting scheme has been shown to be uniformly stable and convergent with respect to perturbation parameter and mesh size. The scheme converges uniformly with the order of convergence $O\Delta t^2+N^{-1}\ln N^2$, where Δt is mesh size in temporal discretization and N is number of mesh elements in spatial discretization. To validate theoretical results, numerical experiments have been carried out and presented in the form of tables and graphs.

Keywords: Midpoint upwind, Crank–Nicolson, Nonstandard hybrid, Singular perturbation, Boundary layer, Shishkin mesh

European Physical Journal Plus
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139 (2024)

Generation of quantum correlations through optical parametric amplification in a hybrid optomechanical system

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Abstract

In this paper, we theoretically investigate the generation of quantum correlations between the cavity–mirror, cavity–cavity, and mirror–mirror interactions through optical parametric amplification (OPA) in two coupled optomechanical systems. Utilizing the linearization approximation, we assess the system's quantum correlations using logarithmic negativity, quantum steering, and Gaussian quantum discord. Our findings demonstrate that under OPA, higher nonlinear gain enhances quantum correlations, resulting in stronger entanglement. However, the decay rates significantly impact the sustainability of these correlations. Additionally, we show that Gaussian quantum discord contributes to broader quantum correlations beyond entanglement. We also characterize quantum steering by examining the steerability between subsystems, revealing that strong coupling under OPA boosts quantum steering between cavity modes. Our results may have potential applications in constructing long-distance quantum communication networks and facilitating the manipulation of quantum state transfer.

Journal of Water and Climate Change
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15 (2024)

Representative concentration pathways (RCPs) used as a tool to evaluate climate change impact on maize crop production in the Woybo catchment of Ethiopia

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Abstract

The research was conducted to assess the climate change impact on crop water requirements (CWRs) in the Woybo catchment of southern Ethiopia. The impact of climate change was assessed through climate models under RCP4.5 and RCP8.5 emission scenarios for the 2050s compared to 1971–2005. During the 2050s, the annual mean minimum temperature increased by 1.9–2.3 °C, while the maximum temperature over the catchment increased by 1.4–2.0 °C. The projected rainfall is expected to increase in autumn, summer, and annually by 3.7–16.8 and 8.7–12.2% in the 2050s under RCP4.5 and 8.5, respectively. But it is likely to decrease in winter and spring by 1.5–10.2% and 8.7–2.8%, respectively. The average annual potential evapotranspiration will rise by 0.1–6.8%. Under both RCPs, CWRs may increase from 6.2 to 17.2% during the growing season, while irrigation water requirements (IWRs) may rise from 4.6 to 16.4%. Future period projection results show that potential evapotranspiration and IWRs will increase for maize crops compared to the baseline period. The study will help water managers, users, and agricultural developers in preparing new water-saving strategies and achieving agricultural sustainability.

Key words: climate change, crop water requirement, CROPWAT, evapotranspiration, trend analysis, Woybo catchment

Journal of the Knowledge Economy
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15 (2024)

Multivariate Generalized Autoregressive Conditional Heteroscedasticity Modeling of the Relationship between Major Economic Indicators in Ethiopia

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Abstract

We model the relationship between major economic indicators in Ethiopia. We obtained 28 years of data from the National Bank of Ethiopia (NBE) for the period between 1991 and 2018, these data have been transformed into quarterly data. It was seen that there are upward trend and volatility clustering in the data. Multivariate Generalized Autoregressive Conditional Heteroscedasticity (MGARCH) models were employed for volatility modelling with the specific interest in identifying the trend and the impact of macroeconomic variables on economic growth. Results from Dynamic Conditional Correlations (DCC (1,1))-GARCH model showed the sum of ARCH and GARCH effect was 0.672. This implied volatility is neither permanent nor explosive, that is a shock to volatility in one period will not lead to greater volatility in the next period. It was also found that the estimated association parameter between consumer price index which is proxy for inflation and real gross domestic product was -0.557, this shows negative association between inflation and real gross domestic product. Furthermore; volatility on exchange rate and money supply has a significant positive association with volatility on real gross domestic product and inflation. NBE should be cautious in controlling the money supply to control the problem of inflation, since the increase in money supply increases inflation, and inflation affects economic growth.

Keywords: Major economic indicators**,** Gross domestic product**,** Economic growth**,** Multivariate GARCH model

Environment, Development and Sustainability
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26 (2024)

Do rural women realized land tenure security rights? South Wollo, Ethiopia

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Abstract

Land is a valuable resource, with economic, political, and cultural significance for the rural poor. Land rights are fundamental to eradicate poverty. Strengthening women's land rights is increasingly on national and international agendas. The previous studies fail to investigate the status of rural women in realizing their tenure security rights in the frame work of the revised proclamation no. 133/2006. This study analyzed the current status of rural women in realizing land tenure rights in the South Wollo Zone, Ethiopia. Data were collected from 198 sample households and 83 key informants selected following a multistage sampling technique. The data were analyzed using qualitative and quantitative techniques. The qualitative data were analyzed thematically. The results of the study reveal that 39% of rural women in the study area practiced the experience of transferring land tenure rights according to proclamation no. 133/2006. The study shows that 37.66% of respondents undertook different land right transfers in written form according to proclamation no. 133/2006 article 17(5–6) at land administration offices. Understanding the rights and obligations of transferring tenure rights is an important aspect of reducing land disputes among landholders. In the presence of land disputes, rural women use both formal and informal dispute resolution mechanisms. Therefore, the study concludes that large numbers of rural women realized their landholding and using rights. To better improve the tenure security of rural women, further awareness creation activities and counseling of women are imperative by the local government and other non-governmental organizations working of tenure security, sustainable land management, and women's land right.

Keywords: Land dispute**,** Landholding**,** Land transfer**,** rural women**,** Tenure rights

Journal of Low Frequency Noise Vibration and Active Control
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43 (2024)

Effect of metallic substrate and rubber elastic materials over passive constrained layer damping on tool vibration during boring process

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Abstract

Tool vibration is a key factor that affects surface finish, generates noise, and reduces the tool life during conventional boring because of the excessive overhanging length of the tool holder. The interaction between the dynamics of the machine tool and the boring process led to progressive vibration. The creation of appropriate mechanisms in reducing tool vibration will help manufacturing industries to become more productive. In this research, in order to control vibration in the overhanging boring bar, a passive vibration control method was employed. Constrained layer dampers consist of boring bar, substrate, and elastic materials and it is used to minimize tool vibration produced during boring operation. The investigation utilized computational analysis through the ANSYS Workbench platform, employing key parameters such as the overhanging length of the tool holder (100, 150, and 200 mm), substrate material (aluminum, brass, and copper), and elastic material (Nitrile rubber, Natural rubber, and polyurethane). A comprehensive series of 27-run boring experiments were conducted to assess the impact of the constrained layer damper on tool vibration and cutting properties. The results of the study revealed remarkable improvements in various performance metrics. The constrained layer damper demonstrated an impressive 98% reduction in tool vibration, signifying its efficacy in dampening vibrational forces during the boring operation. Furthermore, a substantial 83% decrease in surface roughness was observed, indicating enhanced machining precision and surface finish. The constrained layer damper also exhibited a noteworthy 97.5% reduction in tool wear, highlighting its ability to significantly prolong tool life under challenging machining conditions.

Keywords: Constrained layer damper**,** tool vibration**,** boring process**,** surface roughness**,** tool wear

Theoretical and Applied Climatology
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155 (2024)

Rainfall variability and its teleconnection with atmospheric circulation anomalies over southern and southeastern region, Ethiopia

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Abstract

Factors related to rainfall variabilities in southern and southeastern Ethiopia have not yet been addressed. The extreme wet and dry events caused by atmospheric circulation patterns during the March-April-May periods were studied using 1991–2022 data from Climate Hazard Group InfraRed Precipitation with Stations (CHIRPS) and atmospheric circulation anomalies datasets. Empirical orthogonal function (EOF), precipitation concentration index (PCI), and coefficient of variation (CV) are used to determine the interannual variation. The study revealed that both PCI and CV exhibit rainfall variability with increasing magnitude from west to east of the region, while the first mode of EOF showed a dominantly uniform pattern and accounted for 48.8% of the observed variance. Eight extreme dry and four extreme wet years were also observed. Composite analyses suggested that the study area during wet years were characterized by convergence or divergence of velocity potential, and decrease or increase of vertical velocity at lower or upper troposphere which favorable conditions to vertical motion, while opposite phenomena observed during dry periods. Westerly winds from the southern Atlantic Ocean were associating with wet, while easterly winds from the Indian Ocean with dry. The study found a negative correlation between rainfall and Azores SLP, a positive correlation with Indian Ocean SST, and 62.5% of the driest periods coexisted with La Niña events. In summary, Indian Ocean SST, Nino Index 3.4, Azores SLP, South Atlantic 850-hPa westerly winds, and vertical velocity are predictive factors that should be considered in the rainfall forecasting process in the study area.

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Determinants of land management technology adoptions by rural households in the Goyrie watershed of southern Ethiopia: Multivariate probit modeling estimation

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Abstract

Land management technology (LMT) adoption is one of Ethiopia's crucial strategies to combat soil depletion and promote agricultural production. However, there is scant information concerning the intensity, interdependent nature, and households' decision to adopt multiple LMTs. Thus, the purpose of this study is to identify factors influencing households' decisions to adopt multiple LMTs and the intensity and interdependency of the technologies in the Goyrie watershed of southern Ethiopia. The data was collected from 291 randomly selected household heads, focus group discussion participants, and key informant interview respondents. The quantitative data was analyzed using descriptive statistics and econometric methods like multivariate probit and ordered probit modeling, while the qualitative data was presented through content analysis. The result indicated that more than half of respondents (67 %) applied one or two LMTs. The highest complementary effects were observed in mixed soil bunds with desho grasses and manure applications. However, soil bunds and fanya-juu, manure application and agroforestry showed interchangeability with one another. Sex, education, family size, landholding size, access to development agents and credit institutions, training, and village membership increased the probability of adopting multiple LMTs, whereas age, land rent, and crop sharing discouraged the likelihood of households' decisions to adopt LMT. The results of the ordered probit model revealed that village membership and contact with extension agents highly encouraged the intensity of LMT adoptions. Thus, policymakers and planners should consider social, institutional, human asset, and technological related factors to increase adoption rates and intensity of land management technologies.

Keywords: Land management technology**,** Determinant**,** Adoption**,** Rural household**,** MVP model

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19 (2024)

Typical pneumonia among human immunodeficiency virus-infected patients in public hospitals in southern Ethiopia

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Abstract

Background Typical pneumonia is a pressing issue in the treatment of human immunodeficiency virus (HIV) patients, especially in Sub-Saharan Africa, where it remains a significant menace. Addressing this problem is crucial in improving health outcomes and the reduction of the burden of diseases in this vulnerable category of patients.

Objective To determine the prevalence of community-acquired typical pneumonia among HIV patients in Public Hospitals in southern Ethiopia.

Methods A cross-sectional study was done among 386 HIV patients clinically suspected of typical pneumonia attending the anti-retroviral therapy (ART) clinics of two hospitals from March to September 2022. A pretested structured questionnaire was employed to collect the demographic, clinical, and behavioral data. Sputum samples were collected and inspected for bacteria following standard procedures, and antimicrobial susceptibility testing was performed employing the Kirby-Bauer disk diffusion method. Besides, extended-spectrum β-lactamase (ESβL) and carbapenemase-producing Gram-negative bacteria were inspected by the double disk synergy test and modified carbapenem inactivation method. Descriptive and inferential statistical analyses were also done.

Results Overall, 39.1% (151/386) of sputum cultures (95% Confidence Interval: 32.4–44) were bacteriologically positive. A total of 151 bacteria were identified, comprising 72.8% (n = 110) of Gram-negative bacteria. The predominant isolate was Klebsiella pneumoniae (25.8%, n = 39), followed by Staphylococcus aureus (17.9%, n = 27); 59.6% (n = 90) of the entire isolates were multidrug-resistant (MDR). Forty percent (11/27) of S. aureus were methicillin-resistant S. aureus (MRSA), and 28.1% (n = 31) and 20.9% (n = 23) of Gram-negative bacteria were extended-spectrum beta-lactamases (ESBL) and carbapenemase producers, respectively. Occupational status, alcohol consumption, cluster of differentiation4 (CD4) Thymocyte cell count < 350, interruption of trimethoprim-sulfamethoxazole prophylaxis and antiretroviral treatment, and recent viral load ≥ 150 were found statistically significant.

Conclusion The higher rates of MDR, MRSA, ESBL, and carbapenem-resistant Enterobacterales (CRE) indicate that bacterial pneumonia is a vexing problem among HIV patients and therefore it is advisable to implement an antimicrobial stewardship program in the study area.

Asian Journal of Dairy and Food Research
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Effects of Season, Productive State, Age and Agro-ecology on Blood Biochemical Characteristics of Dromedary Camels (Camelus dromedarius) in Natural Browsing Environment

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Abstract

Background: Blood biochemistry and reference intervals assist in distinguishing between healthy and productive camels as well as providing information for nutritional conditions, evaluation and monitoring when they are allowed to browse naturally; nevertheless, these intervals are frequently collected from animals of varying ages. The nutritional condition and biochemical markers of dromedary camels in pastoral systems in southern Ethiopia were investigated in this study, which took season, animal status, age and environmental variables into consideration.

Methods: A total of 36 camels were divided into three groups based on their age (> 8 years, 5-8 years, or less than 5 years) and productive state (milking, pregnant and young) in two environments (two herds in arid and semi-arid areas). Blood samples were collected from animals' neck jugular veins, centrifuged and frozen for analysis. The samples were centrifuged (3000 rpm for 10 min) immediately after their arrival at the laboratory. Serum concentrations of glucose, protein, urea, creatinine, triglycerides and cholesterol were measured using spectrophotometry. **Result**: This study shows that glucose (91.33+7.30 mg/dl), total protein (7.17+0.15 mg/dl) and triglyceride (75.28+5.38 mg/dl) concentrations were significantly higher ($P<0.05$) during the rainy season, whereas urea (32.06+1.18 mg/l) and creatinine levels were significantly higher during the dry season. The study reveals increased glucose, total protein and triglyceride concentrations in camels during the rainy season, while urea and creatinine levels were higher during the dry season. Arid camels had lower serum concentrations of total protein and urea. Milking and pregnant camels had lower total serum protein, triglyceride and cholesterol levels.

Key words: Blood biochemistry, Borana, Camelus dromedarius, Productive state, Protein

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19 (2024)

Investigating the association between household exposure to Anopheles stephensi and malaria in Sudan and Ethiopia: A case-control study protocol

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Abstract

Background Endemic African malaria vectors are poorly adapted to typical urban ecologies. However, Anopheles stephensi, an urban malaria vector formerly confined to South Asia and the Persian Gulf, was recently detected in Africa and may change the epidemiology of malaria across the continent. Little is known about the public health implications of An. stephensi in Africa. This study is designed to assess the relative importance of household exposure to An. stephensi and endemic malaria vectors for malaria risk in urban Sudan and Ethiopia.

Methods Case-control studies will be conducted in 3 urban settings (2 in Sudan, 1 in Ethiopia) to assess the association between presence of An. stephensi in and around households and malaria. Cases, defined as individuals positive for Plasmodium falciparum and/or P. vivax by microscopy/rapid diagnostic test (RDT), and controls, defined as age-matched individuals negative for P. falciparum and/or P. vivax by microscopy/RDT, will be recruited from public health facilities. Both household surveys and entomological surveillance for adult and immature mosquitoes will be conducted at participant homes within 48 hours of enrolment. Adult and immature mosquitoes will be identified by polymerase chain reaction (PCR). Conditional logistic regression will be used to estimate the association between presence of An. stephensi and malaria status, adjusted for co-occurrence of other malaria vectors and participant gender.

Conclusions Findings from this study will provide evidence of the relative importance of An. stephensi for malaria burden in urban African settings, shedding light on the need for future intervention planning and policy development.

ACS Nano
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18 (2024)

Discrimination of Xylene Isomers by Precisely Tuning the Interlayer Spacing of Reduced Graphene Oxide Membrane

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Abstract

Separating xylene isomers is a challenging task due to their similar physical and chemical properties. In this study, we developed a molecular sieve incorporating a reduced graphene oxide (rGO) membrane for the precise differentiation of xylene isomers. We fabricated GO membranes using a vacuum filtration technique followed by thermal-induced reduction to produce rGO membranes with precisely controllable interlayer spacing. Notably, we could finely tune the interlayer spacing of the rGO membrane from 8.0 to 5.0 Å by simply varying the thermal reduction temperature. We investigated the reverse osmosis separation ability of the rGO membranes for xylene isomers and found that the rGO membrane with an interlayer spacing of 6.1 Å showed a high single component permeance of 0.17 and 0.04 L m-2 h-1 bar-1 for para- and ortho-xylene, respectively, exhibiting clear permselectivity. The separation factor reached 3.4 and 2.8 when 90:10 and 50:50 feed mixtures were used, respectively, with permeance 1 order of magnitude higher than that of current state-of-the-art reverse osmosis membranes. Additionally, the membrane showed negligible permeance and selectivity decay even after continuous operation for more than 5 days, suggesting commendable membrane resistance to solvent swelling and operating pressure.

Keywords: what are keywords**,** Xylene Isomers**,** Graphene Oxide**,** Membrane Separation**,** Interlayer Spacing**,** Reverse Osmosis

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Diverse interactions between bacteria and microalgae: A review for enhancing harmful algal bloom mitigation and biomass processing efficiency

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Abstract

The interactions between bacteria and microalgae play pivotal roles in resource allocation, biomass accumulation, nutrient recycling, and species succession in aquatic systems, offering ample opportunities to solve several social problems. The escalating threat of harmful algal blooms (HABs) in the aquatic environment and the lack of cheap and eco-friendly algal-biomass processing methods have been among the main problems, demanding efficient and sustainable solutions. In light of this, the application of algicidal bacteria to control HABs and enhance algal biomass processing has been promoted in the past few decades as potentially suitable mechanisms to solve those problems. Hence, this comprehensive review aims to explore the diverse interaction modes between bacteria and microalgae, ranging from synergistic to antagonistic, and presents up-to-date information and in-depth analysis of their potential biotechnological applications, particularly in controlling HABs and enhancing microalgal biomass processing. For instance, several studies revealed that algicidal bacteria can effectively inhibit the growth of Microcystis aeruginosa, a notorious freshwater HAB species, with an antialgal efficiency of 24.87 %–98.8 %. The review begins with an overview of the mechanisms behind algae-bacteria interactions, including the environmental factors influencing these dynamics and their broader implications for aquatic ecosystems. It then provides a detailed analysis of the role of algicidal bacteria in controlling harmful algal blooms, as well as their role in bioflocculation and the pretreatment of microalgal biomass. Additionally, the review identifies and discusses the constraints and challenges in the biotechnological application of these interactions. By exploring the strategic use of algicidal bacteria, this review not only underscores their importance in maintaining aquatic environmental health but also in enhancing biomass processing efficiency. It offers valuable insights into future research avenues and the potential scalability of these applications, both in situ and at an industrial level.

Keywords: Algicidal bacteria**,** biological pretreatment**,** Cell wall**,** Environmental factors**,** Flocculation**,** Harmful algal blooms**,** Interaction

International Journal of Rural Management
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20 (2024)

Rural Out-migration and Its Impact on Crop Production Efficiency of Producers in Southern Ethiopia

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Abstract

The research delt with the effect of labour out-migration on output per hectare and efficiency of wheat and teff producers in Kembata-Tembaro and Hadiya zones of Ethiopia based on primary data gathered from 415 random sample of rural households. The multinomial endogenous switching model was used as an analytical model. According to the stochastic frontier model, the mean efficiency of wheat and teff are 82.98 and 66.43 per cent, respectively. According to the econometric results, rural–urban and international migration reduces wheat productivity by 110.94 and 179.11 kg, respectively. The average treatment effect on treated (ATT) also revealed that participation in international migration reduces Teff producers' technical efficiency by 5.51 per cent. However, teff productivity is reduced by 382.94 and 747.49 kg due to rural urban and international migration, respectively. The lost labour channel of the modern theory of migration is maintained by the result of the study. So as to minimise the negative impact of out-migration in the study area, policymakers must focus more on promoting access to credit, irrigation, land, off-farm employment and public services for rural households.

Keywords, Migration**,** stochastic frontier model**,** switching regression**,** technical efficiency

Agroforestry Systems
DOI: https://doi.org/10.1007/s10457-024-00982-z
98 (2024)

Scattered trees in smallholder farms improve soil properties and litter decomposition in humid-agroecosystems in Ethiopia

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Abstract

Low agricultural productivity associated with poor soil fertility management characterizes the sub-Sahara African agriculture. Trees in farmlands are believed to improve soil properties and agricultural productivity, yet smallholders are limited in their choice of agroforestry tree species. Here, we assessed the effect of Cordia africana and Croton macrostachyus trees on soil properties and leaf litter decomposition in parkland agroforestry in Bullen District, Benshangul Gumuz, northwestern Ethiopia. We used a randomized complete block design with a distance from a tree trunk setup to draw soil samples and conduct a litter burial experiment across five farmlands. In each farmland, three mature trees per species were identified, separately, and under each tree, three transects containing three concentric radial distances measured from a tree trunk were established. Using this setup, a total of 45 composite soil samples per the study species were drawn and analyzed for soil pH, total nitrogen, available phosphorus, organic carbon, and cation exchange capacity. Additionally, leaf litter mass losses of the study species were quantified with the litterbags method. The results revealed that all the measured soil variables and litter decomposition were significantly different between distances for both C. africana and C. macrostachyus. A significantly higher nutrient contents and litter decomposition were observed under the tree canopies than outside, and for C. macrostachyus than C. africana. We conclude that trees in farmlands might improve soil properties through litter addition and decomposition. Future studies should disentangle the role of litter addition and microclimate effects of trees in farmlands on soil properties.

Keywords: Benshangul Gumuz**,** Bullen District**,** Cordia africana**,** Croton macrostachyus**,** Litter mass loss**,** Parkland agroforestry

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Trends and levels of the global, regional, and national burden of appendicitis between 1990 and 2021: findings from the Global Burden of Disease Study 2021

GBD 2021 Appendicitis Collaborator Group

Abstract

Background: Appendicitis is a common surgical emergency that poses a large clinical and economic burden. Understanding the global burden of appendicitis is crucial for evaluating unmet needs and implementing and scaling up intervention services to reduce adverse health outcomes. This study aims to provide a comprehensive assessment of the global, regional, and national burden of appendicitis, by age and sex, from 1990 to 2021. Methods: Vital registration and verbal autopsy data, the Cause of Death Ensemble model (CODEm), and demographic estimates from the Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) were used to estimate cause-specific mortality rates (CSMRs) for appendicitis. Incidence data were extracted from insurance claims and inpatient discharge sources and analysed with disease modelling meta-regression, version 2.1 (DisMod-MR 2.1). Years of life lost (YLLs) were estimated by combining death counts with standard life expectancy at the age of death. Years lived with disability (YLDs) were estimated by multiplying incidence estimates by an average disease duration of 2 weeks and a disability weight for abdominal pain. YLLs and YLDs were summed to estimate disability-adjusted life-years (DALYs). Findings: In 2021, the global age-standardised mortality rate of appendicitis was 0·358 (95% uncertainty interval [UI] 0·311–0·414) per 100 000. Mortality rates ranged from 1·01 (0·895–1·13) per 100 000 in central Latin America to 0·054 (0·0464–0·0617) per 100 000 in high-income Asia Pacific. The global age-standardised incidence rate of appendicitis in 2021 was 214 (174–274) per 100 000, corresponding to 17 million (13·8–21·6) new cases. The incidence rate was the highest in high-income Asia Pacific, at 364 (286–475) per 100 000 and the lowest in western sub-Saharan Africa, at 81·4 (63·9–109) per 100 000. The global age-standardised rates of mortality, incidence, YLLs, YLDs, and DALYs due to appendicitis decreased steadily between 1990 and 2021, with the largest reduction in mortality and YLL rates. The global annualised rate of decline in the DALY rate was greatest in children younger than the age of 10 years. Although mortality rates due to appendicitis decreased in all regions, there were large regional variations in the temporal trend in incidence. Although the global age-standardised incidence rate of appendicitis has steadily decreased between 1990 and 2021, almost half of GBD regions saw an increase of greater than 10% in their age-standardised incidence rates. Interpretation: Slow but promising progress has been observed in reducing the overall burden of appendicitis in all regions. However, there are important geographical variations in appendicitis incidence and mortality, and the relationship between these measures suggests that many people still do not have access to quality health care. As the incidence of appendicitis is rising in many parts of the world, countries should prepare their health-care infrastructure for timely, high-quality diagnosis and treatment. Given the risk that improved diagnosis may counterintuitively drive apparent rising trends in incidence, these efforts should be coupled with improved data collection, which will also be crucial for understanding trends and developing targeted interventions. Funding: Bill and Melinda Gates Foundation.

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Landslide susceptibility assessment in Addi Arkay, Ethiopia using GIS, remote sensing, and AHP

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Abstract

Landslides account for the breakdown of natural topographies, impacting many mountainous areas and leading to loss of lives and damaged infrastructure. This research aims to generate a reliable landslide susceptibility zonation map employing geospatial and Analytical Hierarchy Processes (AHP) in Addi Arkay Woreda, North Gondar Zone, Amhara Regional State, northern Ethiopia. The present study uses remote sensing data, geographic information system (GIS) tools, AHP, and weighted linear combination (WLC) models to analyze multiple environmental variables, including slope, aspect, curvature, lithology, soil texture, topographic wetness index (TWI), and rainfall. As per the results, around 186.12 km2 (13.26%) of the total study area is under very high landslide susceptibility and 140.85 km2 (10.05%) under very low susceptibility. Using Google Earth images for inaccessible areas, 121 landslide inventories were identified through fieldwork. Of these inventories, 85 were used to train the model and 36 for testing. The performance of the AHP model was validated by the Receiver Operating Characteristics (ROC) curve (0.75), which indicates good predictive accuracy for identifying landslide-prone areas. These findings are essential to regional land use planning, hazard mitigation, and landslide prevention efforts. Additionally, this study contributes to the scientific understanding of landslide dynamics in the Northwestern highlands of Ethiopia and offers a methodological framework that can be applied to other regions with similar geological and climatic conditions.

Keywords: Landslide susceptibility, AHP, GIS, Remote sensing, Addi arkay woreda, Ethiopia

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Groundwater modeling and estimation of the safe pumping rate for the sustainable use of groundwater resources in Kombolcha town, upper Borkena watershed, Ethiopia

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Abstract

The rate of groundwater extraction is increasing due to population growth. Balancing pumping rates with natural recharge is necessary for sustainable use. The safe groundwater pumping rate was determined using the groundwater model ModelMuse. To determine the safe pumping rate, 39 borehole data points were gathered and adjusted for 4, 8, and 12 h of pumping scenarios for 50 years in a steady-state pumping condition. The recharge rates in the study area were calculated using four empirical approaches in addition to the water balance method. Of the four empirical methods, the water balance technique provided the most accurate estimates of groundwater recharge, with an estimated average recharge rate of 176.75 mm per year. The ModelMuse model water balance report demonstrated that there was positive storage for all boreholes to be pumped simultaneously under 4- and 8-h pumping rate scenarios, but that there would be a significant drawdown under 12-h pumping from the stress period of 2039–2065, and the summation of inflow and outflow would become negative, indicating that the withdrawal rate is greater than the recharge rate. Thus, the safe pumping rate for Borkena groundwater was calculated to be 975 L/s in 8-h pumping rate scenarios.

Keyword: Borkena watershed, ModelMuse, recharge

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Global, regional, and national incidence and mortality burden of non-COVID-19 lower respiratory infections and aetiologies, 1990–2021: a systematic analysis from the Global Burden of Disease Study 2021

GBD 2021 Lower Respiratory Infections and Antimicrobial Resistance Collaborators

Abstract

Background: Lower respiratory infections (LRIs) are a major global contributor to morbidity and mortality. In 2020–21, non-pharmaceutical interventions associated with the COVID-19 pandemic reduced not only the transmission of SARS-CoV-2, but also the transmission of other LRI pathogens. Tracking LRI incidence and mortality, as well as the pathogens responsible, can guide health-system responses and funding priorities to reduce future burden. We present estimates from the Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) 2021 of the burden of non-COVID-19 LRIs and corresponding aetiologies from 1990 to 2021, inclusive of pandemic effects on the incidence and mortality of select respiratory viruses, globally, regionally, and for 204 countries and territories.

Methods: We estimated mortality, incidence, and aetiology attribution for LRI, defined by the GBD as pneumonia or bronchiolitis, not inclusive of COVID-19. We analysed 26 259 site-years of mortality data using the Cause of Death Ensemble model to estimate LRI mortality rates. We analysed all available age-specific and sex-specific data sources, including published literature identified by a systematic review, as well as household surveys, hospital admissions, health insurance claims, and LRI mortality estimates, to generate internally consistent estimates of incidence and prevalence using DisMod-MR 2.1. For aetiology estimation, we analysed multiple causes of death, vital registration, hospital discharge, microbial laboratory, and literature data using a network analysis model to produce the proportion of LRI deaths and episodes attributable to the following pathogens: Acinetobacter baumannii, Chlamydia spp, Enterobacter spp, Escherichia coli, fungi, group B streptococcus, Haemophilus influenzae, influenza viruses, Klebsiella pneumoniae, Legionella spp, Mycoplasma spp, polymicrobial infections, Pseudomonas aeruginosa, respiratory syncytial virus (RSV), Staphylococcus aureus, Streptococcus pneumoniae, and other viruses (ie, the aggregate of all viruses studied except influenza and RSV), as well as a residual category of other bacterial pathogens.

Findings: Globally, in 2021, we estimated 344 million (95% uncertainty interval [UI] 325–364) incident episodes of LRI, or 4350 episodes (4120–4610) per 100 000 population, and 2·18 million deaths (1·98–2·36), or 27·7 deaths (25·1–29·9) per 100 000. 502 000 deaths (406 000–611 000) were in children younger than 5 years, among which 254 000 deaths (197 000–320 000) occurred in countries with a low Socio-demographic Index. Of the 18 modelled

pathogen categories in 2021, S pneumoniae was responsible for the highest proportions of LRI episodes and deaths, with an estimated 97·9 million (92·1–104·0) episodes and 505 000 deaths (454 000–555 000) globally. The pathogens responsible for the second and third highest episode counts globally were other viral aetiologies (46·4 million [43·6–49·3] episodes) and Mycoplasma spp (25·3 million [23·5–27·2]), while those responsible for the second and third highest death counts were S aureus (424 000 [380 000–459 000]) and K pneumoniae (176 000 [158 000–194 000]). From 1990 to 2019, the global all-age non-COVID-19 LRI mortality rate declined by 41·7% (35·9–46·9), from 56·5 deaths (51·3–61·9) to 32·9 deaths (29·9–35·4) per 100 000. From 2019 to 2021, during the COVID-19 pandemic and implementation of associated non-pharmaceutical interventions, we estimated a 16·0% (13·1–18·6) decline in the global all-age non-COVID-19 LRI mortality rate, largely accounted for by a 71·8% (63·8–78·9) decline in the number of influenza deaths and a 66·7% (56·6–75·3) decline in the number of RSV deaths.

Interpretation: Substantial progress has been made in reducing LRI mortality, but the burden remains high, especially in low-income and middle-income countries. During the COVID-19 pandemic, with its associated non-pharmaceutical interventions, global incident LRI cases and mortality attributable to influenza and RSV declined substantially. Expanding access to health-care services and vaccines, including S pneumoniae, H influenzae type B, and novel RSV vaccines, along with new low-cost interventions against S aureus, could mitigate the LRI burden and prevent transmission of LRI-causing pathogens.

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The expansion of an invasive malaria vector: Anopheles stephensi emergence in Arba Minch town in the southern Rift Valley of Ethiopia

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Abstract

Urban areas in malaria-endemic countries in East Africa are experiencing a significant increase in malaria cases, with the establishment of an "exotic" urban malaria vector, Anopheles stephensi, increasing the risk of urban malaria. To this end, the present study aimed to investigate the emergence of this species in Arba Minch, Ethiopia. Following the detection of An. stephensi in other parts of Ethiopia, 76 artificial containers (55 discarded tyres, 18 concrete water storage, and three plastic containers) were sampled in 21 locations in Arba Minch town, for immature Anopheles mosquito stages, using the standard dipping technique. Larvae were reared into adults which were morphologically identified at the species level 2–3 days after emergence. Morphological identification results were confirmed by species-specific polymerase chain reaction. Of the examined containers, 67 (88%) had at least one Anopheles larva. Thirty-two of the adults emerged were morphologically identified as An. stephensi, with 26 (81%) confirmed by molecular analysis. This is the first study to report An. stephensi from Arba Minch, one of South Ethiopia's largest towns, highlighting the need for increased vigilance. The planned and ongoing study in and around Arba Minch will contribute to understanding the bionomics and role of An. stephensi in malaria parasite transmission, helping develop a strategy to address the impending risk of urban malaria in Ethiopia.

Keywords: Anopheles stephensi**,** Arba Minch**,** Entomological surveillance

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Distribution, pollution status of metals and human health risk evaluation in honey: Chemometric approach

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Abstract

Ethiopia is one of the top honey-producing countries in Africa, with a diversity of floral sources for bees supported by different ecosystems. Studying the levels of metals in honey is essential for ensuring the quality and safety of honey and managing environmental contamination, which ultimately contributes to the well-being of both individuals and communities. Thus, this study was designed to determine the concentration of Cr, Mn, Zn, Ni, Fe, Cu, Co, Cd and Pb in bee honey and stingless bee honey using a flame atomic absorption spectrophotometer (FAAS) after being digested with a mixture of 1 mL of HNO3 and 4 mL of HClO4. The contents of trace metals (mg/kg) for Cr, Mn, Fe, Co, Ni, Cu, Zn, and Cd were varied from 0.5 to 1.33, 0.04–0.1, 0.83–1.74, BDL–0.60, 0.35–0.60, 0.020–0.12, 0.35–0.69, and BDL-0.32 in bee honey and 0.5–1.02, 0.03–0.11, 0.59–1.86, 0.17–0.35, 0.35–0.78, 0.038–0.13, and 0.32–0.44 in stingless bee honey, respectively. It was found that Cd and Pb in both bee and stingless bee honey were below the detection limit. For adults, the target hazard quotient (THQ) and hazard index (HI) values were found to be below 1, which indicates a lower level of noncarcinogenic risk due to honey consumption. The carcinogenic risks for all samples were lower than the maximum tolerable range. Multivariate analyses, including principal component and cluster analysis, were applied to assist in the analysis of metallic data, and confirmed the association between metals in samples. Therefore, the consumption of honey in the study areas does not cause any carcinogenic or non-carcinogenic health risks to the local population.

Keywords: Heavy metal, Health risk, Honey, Pearson's correlation, Principal component analysis

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Are Ethiopian health facilities providing diabetes services capable of managing tuberculosis? Policy implications for introducing diabetes and tuberculosis collaborative care

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Abstract

Objective This study aimed to assess the availability and preparedness of health facilities offering diabetes mellitus (DM) to manage tuberculosis (TB) in Ethiopia.
Design Secondary data analysis of institution-based cross-sectional national survey data.
Setting Data were obtained from the 2021-2022 Ethiopian Service Provision Assessment (ESPA) survey which includes all active health facilities in Ethiopia.
Participants This study included all health facilities that provide DM services (both diagnosis and treatment) and recently collected DM data during the 2021-2022 ESPA survey.
Outcome measures The service availability was computed as the percentage of facilities offering DM services to provide TB management. The preparedness of these facilities for managing TB was measured using three service tracer indicators (staff training and guidelines, diagnostics and essential medicines used in TB management) defined by the WHO Service Availability and Readiness Assessment Manual. The extent of preparedness was categorised as low level (<50%), moderate level (≥50% to 75%) and high level (≥75%). A descriptive statistic was employed to present the study findings.
Results Only 170 out of 338 facilities were reported to provide DM services across the country, with 136 (70%) also offering TB management services. Among these facilities, the majority were health centres (n=82; 60.1%), publicly owned (n=98; 72.0%), rural (n=83; 60.7%) and located in the Oromia region (n=53; 39.0%). Regarding preparedness, facilities offering DM services had an overall moderate to high preparedness for managing TB, with 47 (27.5%), 53 (31.1%) and 70 (41.3%) facilities classified as low-level, moderate-level and high-level preparedness, respectively. Specifically, these facilities were less prepared in the domains of 'trained staff and guidelines' and 'diagnostics', but had better preparedness in providing first-line TB drugs, with an overall score of 79.7%.
Conclusions Although the percentage availability of TB services in facilities offering DM services and their preparedness was unsatisfactory compared with WHO standards, Ethiopia has a greater capacity to implement WHO strategies to reduce the burden of TB-DM comorbidity. However, given the high epidemiological risk and the high burden of both diseases in the country, our findings emphasise the urgent necessity to establish and implement a collaborative TB-DM care plan to integrate TB services within facilities providing DM care.

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Green practices and economic performance: Mediating role of green innovation in Ethiopian leather, textile, and garment industries—An integrated PLS-SEM analysis

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Abstract

Incorporating green issues into business operations is indisputable, as this is mandatory in today's environmental era. The purpose of this study was to explore the structural link between green practices such as green manufacturing, green marketing orientation, green human resource management, green investment, and the economic performance of textile and leather firms in Ethiopia through green innovation. This study was carried out utilizing a quantitative method, and 201 surveys were used to gather the data from the top managers and general managers of medium and large textile and leather firms in Ethiopia using stratified random sampling. To test the hypothesis, partial least squares structural equation modeling (PLS-SEM) was used. The results of this study demonstrate that green practices, specifically green manufacturing practices (GMP), green marketing orientation (GMO), and green investment (GIV), have a positive and substantial contribution to firms' economic performance (EP) and green innovation (GIN). However, the advancement of GIN is not significantly affected by the adoption of sustainable human resources management (HRM). Moreover, green innovation facilitates the connection between economic success, GIV, and GMO. Nonetheless, when it comes to the relationship between GHRM, green manufacturing practices, and economic success, green innovation plays no mediating function. According to this research, a company's management ought to strengthen its green practices as lower expenses would boost its economic outcome.

Keywords, Green marketing orientation**,** Green manufacturing**,** Green innovation**,** Green HRM**,** Green investment**,** Structural equation model**,** Economic performance

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Hydrodynamic modelling to develop design and operational options for sedimentation reduction in irrigation schemes, Ethiopia

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Abstract

Study region: The Great Rift Valley Basin of Ethiopia, Arata-Chufa (100 ha) and Ketar (430 ha) irrigation schemes.
Study focus: Sedimentation triggers malfunctioning in irrigated agriculture by decreasing canal discharge capacity and increasing operation and maintenance costs. The current study coupled a hydrodynamic sediment model with the output of an erosion model to analyse sedimentation problems, employing data on discharges, water levels, sediment load, and sediment concentration collected over two years (September 2017 to September 2018). The effects of design (canal lining, building a settling basin, and changing longitudinal bed slope) and operational (sediment flushing) modifications on sediment reduction were simulated with the Hydrologic Engineering Center's (HEC) River Analysis System (HEC-RAS) model.
New hydrological insights for the region: The model simulation indicates that the most promising low-cost option to reduce sedimentation is flushing during the rainy season, reducing deposition by 82% (Arata-Chufa) and 57% (Ketar). The second option is lining the canal, particularly for a scheme mainly experiencing river sediment like Arata-Chufa, where deposition would be reduced by 28%. Construction of a new settling basin with a flushing option would reduce deposition by 63% (Arata-Chufa) and 42% (Ketar). Changing the bed slope of the severely silted canal section has little effect on sediment reduction. Therefore, operational changes are more promising low-cost options than design modification to reduce sediment deposition in SSI schemes.

Keywords: Irrigation, Sediment transport, Design modification, Operational changes, Soil erosion

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Effect of dawri-damaa (Pentas schimperiana) leaf meal supplementation on performances, carcass characteristics, and economic feasibility of sheep fed native grass hay

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Abstract

With a growing export and local market, sheep farming is critical to the economy of smallholder farmers; however, indigenous sheep breeds usually exhibit low carcass output and live weight due to nutritional constraints. The study aimed to investigate the impact of supplementing local sheep with dawri-damaa leaf meal (DDLM) on their performance, carcass characteristics, and profitability when fed native grass hay. The research used a randomized complete block design (RCBD) to administer four feeding treatments (T1, T2, T3, and T4 at 0%, 30%, 50%, and 70% DDLM, respectively) to 20 local uncastrated male lambs having an average 23.72 ± 0.73 kg body weight and average age of 11.72 ± 0.74 months. Greater doses of DDLM in the diet resulted in greater average daily gain (ADG) of 51.4–83.8 g/day and feed conversion efficiency (FCE) of 0.066–0.089 in lambs, compared to 15.0 g/day ADG and 0.025 FCE in lambs under control diet (T1). Additionally, the lambs had increased slaughter body weight (SBW), empty body weight (EBW), and hot carcass weight (HCW) in T4 and T3 compared to other treatments ($p < .05$). There were no significant differences in dressing percentages (DPs) across any treatment group. The study also discussed the economic viability of supplementing with DDLM, suggesting that feeding 70% daily dry matter of DDLM at 2.5% live weight might be beneficial depending on availability, access, and cost factors. In conclusion, feeding DDLM up to 70% has improved the performance of sheep and is economically feasible. Further research might be required to discover whether such levels of inclusion are harmful and apply different processing methods for feeding animals.

Keyword: Scarcass, dawri-damaa, economic feasibility, sheep

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34 (2024)

Magnitude and Risk Factors for Paediatric Congenital Heart Surgery Complication and its association with Patient Outcomes in the Cardiac Center of Ethiopia

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Abstract

Background: Congenital heart disease surgery is related to significant postoperative complications which have been associated with poor patient outcomes. However, the prevalence, predictors, and effect of complications on outcomes have only been evaluated in a few numbers of studies. This study aimed to assess the magnitude of postoperative complications after congenital heart surgery, their predictors, and the associations between complications and patient outcomes.

Methods: A retrospective, single-center cross-sectional study was done at the Cardiac Center of Ethiopia (CCE) on children who had undergone cardiac surgery between 2009 and 2022. All 919 pediatric patients aged below 18 years who had undergone congenital heart surgery were included in the study.

Result: Of the 919 patients who underwent surgery in the cardiac center of Ethiopia, Ventricular septal defect (VSD) was the most common diagnosis (41%) and VSD patch closure (39.4%) was the most common surgical procedure. The presence of at least one complication was identified in 39.5% of patients. Of all patients, 11.3% had cardiac, 23.1% had extra-cardiac complications, and 5.3%% had major complications. Higher age at diagnosis, lower weight at admission, cyanotic congenital heart disease, higher Risk adjustment for congenital heart surgery score (RACH-1 score), higher vasoactive inotropic score, Cardiopulmonary bypass use during surgery, higher cardiopulmonary bypass time, higher aortic cross-clamp time, higher duration of surgery, and the higher number of surgeries were associated with complications. The duration of mechanical ventilation, length of intensive care unit stays, and length of hospital stay was significantly prolonged in patients with complications.

Conclusion: Congenital heart disease surgeries pose a high risk of complications, and these complications are associated with poor patient outcomes in Ethiopia. Therefore, predicting complications based on risk factors and early detection and treatment is crucial to improve the patient's outcome.

KEYWORDS: Congenital heart diseases, surgery, complications, Outcome

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Bioaccumulation of heavy metals, assessment of carcinogenic and non-carcinogenic health risk in various spices

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Abstract

Spices consumption is the main pathway for human exposure to certain environmental pollutants. This study was aimed to evaluate the concentration of heavy metals such as cadmium (Cd), chromium (Cr), copper (Cu), iron (Fe), manganes (Mn), lead (Pb) and zinc (Zn) in different parts of various spices samples in Arba Minch Ethiopia. The average levels of metals in white cumin, fenugreek, black cumin, turmeric, basil, cardamom, and coriander were varied in the range 0.35–1.8, 1.02–11.96, 1.69–32.19, 20.74–38.98, 7.38–26.01, 2.96–9.57 and 5.38–44.63 mg/kg for Cd, Cr, Cu, Fe, Mn, Pb and Zn, respectively. Principal component analysis (PCA) showed that the robust linkage between Zn, Cr, and Mn in PC1, Cu and Pb in PC2, and Cd and Fe in PC3 comprising 39.10 %, 25.72 % and 18.57 % of the total variance, respectively. The average daily intake values were calculated in the range 5.22 × 10–5–2.69 × 10–4, 1.52 × 10–4–1.78 × 10–3, 2.53 × 10–4–4.81 × 10–3, 3.09 × 10–3–5.82 × 10–3, 1.1 × 10–3–3.88 × 10–3, 4.42 × 10–4–1.43 × 10–3, and 8.18 × 10–4–6.66 × 10–3, for Cd, Cr, Cu, Fe, Mn, Pb and Zn, respectively. The target hazard quotient (THQ) and hazard index (except in white cumin and fenugreek) for heavy metals in various spices were lower than the acceptable limit of unity (THQ and HI <1). The carcinogenic risk values were in the acceptable threshold limit (1 × 10–6–1 × 10–4), indicating that consuming different spices in the studied area will not pose a potential health risk to human health.

Keywords: Heavy metal Various spices Health risk Multivariate analysis Daily intake

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The trends and spatiotemporal variability of temperature and rainfall in Hulbarag district, Silte Zone, Ethiopia

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Abstract

Ethiopia gets its agricultural water primarily from rainfall. This study was intended to investigate current climate variability and trends across space and time. Daily gridded temperature and rainfall data from 1993 to 2022 in the Hulbarag district, Silte Zone of Ethiopia was obtained from

The Ethiopian National Metrological Institute and the Climate Hazard Group Infrared Precipitation with Station. The trends and variability of temperature and rainfall were analyzed using the Mann-Kendall trend test, Sen's slope, coefficient of variation, precipitation concentration index, and rainfall anomaly index. The results indicated that annual, spring, and summer rainfall revealed statistically significant decreasing trends at Hulbarag and Sankura stations, with the magnitude of −13.4, −11.6, and −10.6 mm per year and −6.8, −3.6 and −10.9 mm per year respectively. Conversely, autumn and winter season rainfall showed statistically significant increasing trends at Hulbarag and Sankura stations, with the magnitude of 5.1 and 5.5mm per year and 3.4 and 1.84mm per year consecutively. Between 43 % and 47 % of the observation periods had negative anomalies. The average yearly temperature, average yearly minimum temperature, and average yearly maximum temperatures at Sankura and Fonko stations all displayed statistically significant increasing trends, with a magnitude of 0.091 °C, 0.009 °C and 0.051 °C per year and 0.03 °C,0.01 °C and 0.0022 °C per year successively. It is advisable to develop a farming system that is climate-resilient by improving the adaptive capacity of wheat and maize-growing farmers by expanding the availability of early maturing seeds, changing crop calendars, and enhancing proactive and credible climate information services.

Keywords: Ethiopia**,** Hulbarag district**,** Rainfall**,** Temperatures**,** Trends

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Soil moisture-based irrigation interval and irrigation performance evaluation: In the case of lower kulfo catchment, Ethiopia

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Abstract

The lack of soil moisture-based irrigation intervals, poor distribution of irrigation water among users, and the time-based and spatial variability of water supply have been challenges for the productivity of irrigation schemes in the Lower Kulfo catchment, Southern Ethiopia. This study was conducted to develop soil moisture-based irrigation intervals and to evaluate irrigation water delivery and field level irrigation efficiencies. Soil water content, and flow along the canal and in the field were measured directly, and irrigation duty was estimated by using CropWat 8 model. To minimize water stress or excess problems, irrigation needs to be applied when soil water content drops to 35.7 % for onion and pepper, 34.4 %% for watermelon, and 32.5 % for wheat and maize from field capacity. However, irrigation was applied at 36.2 % for onion, 35.4 % for watermelon, 36.4 % for pepper, 36.2 % for maize, and 35 % for wheat in the existing irrigation scheme that increased irrigation amount in the field. The average percentage of soil moisture depletion (p) at time of irrigation was 27.4 %, which was below the recommended value. The average adopted irrigation and design irrigation interval were 4 & 6 days for onion and pepper, 5 & 7 days for watermelon and wheat, and 6 & 7 days for maize, respectively. The mean irrigation adequacy and dependability of the irrigation scheme in the lower Kulfo catchment were 1 & 0 for Arba Minch irrigation scheme, 0.5 & 0.2 for Arba Minch University farmland, 0.4 & 0.25 for private farmland and 0.1 & 0.43 for Kollashara farmland, respectively. The value of irrigation equity was 0.7 in January, 0.6 in February, and 0.8 in March which indicates the highly temporary variation of irrigation adequacy. The mean value of canal conveyance was 82.7 % and the average on-farm irrigation efficiency also was 56.6 %. The average value crop yield in the present study were 0.5ton/ha for wheat, 4.9ton/ha for onion, 6.2ton/ha for pepper, 0.6ton/ha for watermelon, 4.2ton/ha for maize that was very low compared with other control irrigation in the study area. Inadequate soil moisture-based intervals, inequitable water distribution, and variable supply hinder irrigation in the Lower Kulfo catchment; adopting optimized practices and robust management can enhance efficiency, equity, and crop productivity.

Keywords: Crop productivity**,** Irrigation adequacy**,** Irrigation equity**,** Irrigation interval**,** Moisture depletion

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Nurses' knowledge, Practice, and Associated Factors Towards Adult Palliative Care: A Cross-sectional Study

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Abstract

The demand for palliative care is increasing rapidly, but inadequate knowledge and practice remain a significant issue. This study aimed to assess nurses' knowledge, practice, and associated factors toward adult palliative care. A cross-sectional study was conducted including 277 randomly selected nurses from May through September 2021. The data related to knowledge were gathered using the Palliative Care Quiz for Nursing, and an observational checklist to assess the practice was used. EpiData and SPSS software were used for data entry and analysis, respectively. Descriptive statistics and bivariable and multivariable analyses were also applied. Depending on the value of the adjusted odds ratio with a 95% confidence level, statistical significance was declared at a P value of.05. Findings showed that 43.2% and 47% of nurses had good knowledge and practice in palliative care, respectively. The odds of trained nurses having good knowledge were 9.65 times higher than those who did not. There were 2.7 times more odds of practicing palliative care among nurses with good knowledge than those with poor knowledge. Overall, over half of the nurses have poor knowledge and practice in palliative care. To enhance their knowledge and practice, formal palliative care education and training will be beneficial.

Tropical Animal Health and Production
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56 (2024)

Hemoglobin polymorphism and its association with morphometric and egg production traits in Ethiopian indigenous and Sasso chicken breeds

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Abstract

The present study investigated the biochemical polymorphism of hemoglobin (Hb) and its relationship with performance traits of Ethiopian indigenous and Sasso chicken breeds. A total of 284 chickens reared in three agro-ecologies were examined for genetic diversity and associations with productive traits at Hb locus using agarose gel electrophoresis. The results showed that the HbA allele was dominant in both breeds, and a higher proportion of male chickens were HbAA genotypes, while females were predominantly HbBB types. In the highland agro-ecology, chickens with the HbAA genotype were the most dominant, whereas in mid- and low-land agro-ecologies, chickens with HbBB and HbAB genotypes were found to be more frequent. A moderate level of expected heterozygosity was obtained with 0.47 and 0.445 for indigenous and Sasso chickens, respectively, with an average effective number of alleles per locus of 1.89 and 1.80. Moreover, chickens with HbAA genotypes showed significantly ($p \leq 0.05$) higher body weight and linear body measurements than those of HbAB and HbBB genotypes. However, for appendage body structures (comb and wattle dimensions), chickens with the HbAB and HbBB genotypes had higher mean values. Additionally, clutch size (14.2 ± 0.4), clutch length (21.8 ± 0.7), and eight-month egg production (84.1 ± 1.2) were significantly ($p \leq 0.05$) higher for hens with HbBB genotypes, followed by those with HbAB-types. Therefore, the considerable hemoglobin variability and significant associations of Hb variants with the performance traits can be sought as guiding information for further genetic improvement interventions in the chicken breeds under investigation. Further microsatellite marker-based genotyping is recommended to validate the higher morphometric values for HbAA genotypes and the better egg production for HbBB and HbAB genotypes.

Keywords: Hemoglobin**,** Morphometric traits**,** Egg production**,** Chicken diversity**,** Sasso chicken**,** Agro-ecology

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196 (2024)

Groundwater recharge estimation using WetSpass-M and MTBS leveraging from HydroOffice and WHAT tools for baseflow in Weyib watershed, Ethiopia

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Abstract

WetSpass-M model and multi-technique baseflow separation (MTBS) were applied to estimate spatio-temporal groundwater recharge (GWR) to be used to comprehend and enhance sustainable water resource development in the data-scarce region. Identification of unit Hydrographs and Component flows from Rainfall, Evaporation, and Streamflow (IHACRES) techniques outperform the existing 13 MTBS techniques to separate baseflow depending on the correlation matrix; mean baseflow was 5.128 m3/s. The WetSpass-M model performance evaluated by Nash-Sutcliff Efficiency (NSE) was 0.95 and 0.89; R2 was 0.90 and 0.85 in comparison to observed and simulated mean monthly baseflow and runoff (m3/s), respectively. The estimated mean annual water balance was 608.2 mm for actual evapotranspiration, 221.42 mm for the surface runoff, 87.42 mm for interception rate, and 177.66 mm for GWR, with an error of − 3.29 mm/year. The highest annual actual evapotranspiration was depicted in areas covered by vegetation, whereas lower in the settlement. The peak annual interception rates have been noticed in areas covered with forests and shrublands, whereas the lowest in settlement and bare land. The maximum annual runoff was depicted in settlement and bare land, while the lowest was in forest-covered areas. The annual recharge rates were low in bare land due to high runoff and maximum in forest-covered areas due to low surface runoff. The watershed's downstream areas receive scanty annual rainfall, which causes low recharge and drought. The findings point the way ahead in terms of selecting the best approach across multi-technique base flow separations.

Keywords: Actual evapotranspiration**,** Surface runoff**,** Water balance**,** WetSpass-M, Weyi watershed**,** Ethiopia

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Global, regional, and national age-specific progress towards the 2020 milestones of the WHO End TB Strategy: a systematic analysis for the Global Burden of Disease Study 2021

GBD 2021 Tuberculosis Collaborators

Abstract

Background: Global evaluations of the progress towards the WHO End TB Strategy 2020 interim milestones on mortality (35% reduction) and incidence (20% reduction) have not been age specific. We aimed to assess global, regional, and national-level burdens of and trends in tuberculosis and its risk factors across five separate age groups, from 1990 to 2021, and to report on age-specific progress between 2015 and 2020.

Methods: We used the Global Burden of Diseases, Injuries, and Risk Factors Study 2021 (GBD 2021) analytical framework to compute age-specific tuberculosis mortality and incidence estimates for 204 countries and territories (1990–2021 inclusive). We quantified tuberculosis mortality among individuals without HIV co-infection using 22 603 site-years of vital registration data, 1718 site-years of verbal autopsy data, 825 site-years of sample-based vital registration data, 680 site-years of mortality surveillance data, and 9 site-years of minimally invasive tissue sample (MITS) diagnoses data as inputs into the Cause of Death Ensemble modelling platform. Age-specific HIV and tuberculosis deaths were established with a population attributable fraction approach. We analysed all available population-based data sources, including prevalence surveys, annual case notifications, tuberculin surveys, and tuberculosis mortality, in DisMod-MR 2.1 to produce internally consistent age-specific estimates of tuberculosis incidence, prevalence, and mortality. We also estimated age-specific tuberculosis mortality without HIV co-infection that is attributable to the independent and combined effects of three risk factors (smoking, alcohol use, and diabetes). As a secondary analysis, we examined the potential impact of the COVID-19 pandemic on tuberculosis mortality without HIV co-infection by comparing expected tuberculosis deaths, modelled with trends in tuberculosis deaths from 2015 to 2019 in vital registration data, with observed tuberculosis deaths in 2020 and 2021 for countries with available cause-specific mortality data.

Findings: We estimated 9·40 million (95% uncertainty interval [UI] 8·36 to 10·5) tuberculosis incident cases and 1·35 million (1·23 to 1·52) deaths due to tuberculosis in 2021. At the global level, the all-age tuberculosis incidence rate declined by 6·26% (5·27 to 7·25) between 2015 and 2020 (the WHO End TB strategy evaluation period). 15 of 204 countries achieved a 20% decrease in all-age tuberculosis incidence between 2015 and 2020, eight of which were in

western sub-Saharan Africa. When stratified by age, global tuberculosis incidence rates decreased by 16·5% (14·8 to 18·4) in children younger than 5 years, 16·2% (14·2 to 17·9) in those aged 5–14 years, 6·29% (5·05 to 7·70) in those aged 15–49 years, 5·72% (4·02 to 7·39) in those aged 50–69 years, and 8·48% (6·74 to 10·4) in those aged 70 years and older, from 2015 to 2020. Global tuberculosis deaths decreased by 11·9% (5·77 to 17·0) from 2015 to 2020. 17 countries attained a 35% reduction in deaths due to tuberculosis between 2015 and 2020, most of which were in eastern Europe (six countries) and central Europe (four countries). There was variable progress by age: a 35·3% (26·7 to 41·7) decrease in tuberculosis deaths in children younger than 5 years, a 29·5% (25·5 to 34·1) decrease in those aged 5–14 years, a 15·2% (10·0 to 20·2) decrease in those aged 15–49 years, a 7·97% (0·472 to 14·1) decrease in those aged 50–69 years, and a 3·29% (–5·56 to 9·07) decrease in those aged 70 years and older. Removing the combined effects of the three attributable risk factors would have reduced the number of all-age tuberculosis deaths from 1·39 million (1·28 to 1·54) to 1·00 million (0·703 to 1·23) in 2020, representing a 36·5% (21·5 to 54·8) reduction in tuberculosis deaths compared to those observed in 2015. 41 countries were included in our analysis of the impact of the COVID-19 pandemic on tuberculosis deaths without HIV co-infection in 2020, and 20 countries were included in the analysis for 2021. In 2020, 50 900 (95% CI 49 700 to 52 400) deaths were expected across all ages, compared to an observed 45 500 deaths, corresponding to 5340 (4070 to 6920) fewer deaths; in 2021, 39 600 (38 300 to 41 100) deaths were expected across all ages compared to an observed 39 000 deaths, corresponding to 657 (–713 to 2180) fewer deaths.

Interpretation: Despite accelerated progress in reducing the global burden of tuberculosis in the past decade, the world did not attain the first interim milestones of the WHO End TB Strategy in 2020. The pace of decline has been unequal with respect to age, with older adults (ie, those aged >50 years) having the slowest progress. As countries refine their national tuberculosis programmes and recalibrate for achieving the 2035 targets, they could consider learning from the strategies of countries that achieved the 2020 milestones, as well as consider targeted interventions to improve outcomes in older age groups. **Funding:** Bill & Melinda Gates Foundation.

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Modeling streamflow responses to land use and land cover change using MIKE SHE models in the upper Omo Gibe catchment of Ethiopia

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Abstract

The land use and land cover (LULC) changes in the upper Gibe catchment were studied intricately using the MIKE SHE model and analyzed through statistical tests. The Mann–Kendall test was used to identify potential trends, while the Pettit test was used to detect abrupt changes in rainfall, temperature, and streamflow. A set of three maps of LULC change (1990, 2003, and 2018) was developed to observe how they affect the hydrological pattern of the catchment. Statistical analyses were conducted at mean annual time scales to establish relationships among the anomalies. It has been noted that certain temperature gauges showed statistically significant increases in temperature. Change points in the 1980s and 1990s were identified during the study period. The annual streamflow trends displayed an increasing trend that was not that significant. LULC changes contributed to increased surface runoff, attributed to agricultural, settlement, and water body expansion, as well as reductions in bare land, forest, shrubland, and grassland. The MIKE SHE model performed well during both the calibration and validation periods on the monthly time scale. The alterations in LULC had a noticeable impact on stream flows during both wet and dry seasons, resulting in increased mean monthly stream flows during the wet season and decreased flows during the dry season. The MIKE SHE study and related statistical analysis is quite a different method to perceive the results.

Keywords, LULC, MIKE SHE, surface runoff, trend analysis, upper Omo Gibe catchment, 土地利用和土地覆盖，MIKE SHE，地表径流，趋势分析，奥莫吉贝上游流域，LULC, MIKE ELLA, Escorrentía superficial, Análisis de tendencia, Cuenca del Alto Omo Gibe,

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Determinants of urban households in the diversification of livelihood activities: The case of Wolaita zone in southern Ethiopia

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Abstract

Diversification of Livelihood Activities (DLA) is indeed crucial for populous countries like Ethiopia, where it serves as a strategy to mitigate food insecurity. Despite its significance, empirical studies focusing on DLA among urban households in Ethiopia are relatively scarce. Therefore, this study examines factors affecting urban households' participation in the DLA in selected towns of the Wolaita zone. The study used both primary and secondary data. A total of 310 sample respondents from three town administrations in the Wolaita zone: Areka, Boditi, and Sodo, were selected using a multi-phase sampling technique. The study used a survey questionnaire, Key Informant Interviews, Focus Group Discussions, and observations as methods for primary data collection. The collected data was analyzed using descriptive and inferential statistics. The results revealed that among the sampled respondents, 23.9 %, 28.4 %, and 33.2 % depend on on-farm, on-farm + non-farm, non-farm + off-farm activities, respectively, while the remaining 14.5 % diversify their livelihood activities through combinations of on-farm + non-farm + off-farm Livelihood Diversification Activities (LDA). The Multinomial Logot (MNL) model result shows that the participation of LDA in the study areas was positively and negatively determined by cooperative membership, development agent training, gender, education, home ownership, rural connections, household income, and technical skills that were found to be statistically significant at 1 %, 5 %, and 10 %. Therefore, the government should prioritize empowering the diversification of livelihood activities and develop policies and programs that support urban households' livelihoods, with a specific focus on promoting off-farm and non-farm endeavors.

Keywords: Diversification, Livelihood activity, Multinomial logit model, Urban households, Wolaita zone

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23 (2024)

A comprehensive review of current approaches on food waste reduction strategies

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Abstract

Food waste is a serious worldwide issue that has an impact on the environment, society, and economy. This comprehensive review provides a detailed description of methods and approaches for reducing food waste, emphasizing the necessity of comprehensive strategies to tackle its intricate relationship with environmental sustainability, social equity, and economic prosperity. By scrutinizing the extent and impact of food waste, from initial production stages to final disposal, this comprehensive review underlines the urgent need for integrated solutions that include technological advancements, behavioral interventions, regulatory frameworks, and collaborative endeavors. Environmental assessments highlight the significant contribution of food waste to greenhouse gas emissions, land degradation, water scarcity, and energy inefficiency, thereby emphasizing the importance of curtailing its environmental impact. Concurrently, the social and economic consequences of food waste, such as food insecurity, economic losses, and disparities in food access, underscore the imperative for coordinated action across multiple sectors. Food waste can also be effectively reduced by various innovative approaches, such as technological waste reduction solutions, supply chain optimization strategies, consumer behavior-focused initiatives, and waste recovery and recycling techniques. Furthermore, in order to foster an environment that encourages the reduction of food waste and facilitates the transition to a circular economy, legislative changes and regulatory actions are essential. By embracing these multifaceted strategies and approaches, stakeholders can unite to confront the global food waste crisis, thereby fostering resilience, sustainability, and social equity within our food systems.

Keyword: blockchain technology, food waste, supply chain optimization, waste recycling methods

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38 (2024)

Global estimates on the number of people blind or visually impaired by cataract: a meta-analysis from 2000 to 2020

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Abstract

Background: To estimate global and regional trends from 2000 to 2020 of the number of persons visually impaired by cataract and their proportion of the total number of vision-impaired individuals.

Methods: A systematic review and meta-analysis of published population studies and gray literature from 2000 to 2020 was carried out to estimate global and regional trends. We developed prevalence estimates based on modeled distance visual impairment and blindness due to cataract, producing location-, year-, age-, and sex-specific estimates of moderate to severe vision impairment (MSVI presenting visual acuity <6/18, ≥3/60) and blindness (presenting visual acuity <3/60). Estimates are age-standardized using the GBD standard population.

Results: In 2020, among overall (all ages) 43.3 million blind and 295 million with MSVI, 17.0 million (39.6%) people were blind and 83.5 million (28.3%) had MSVI due to cataract blind 60% female, MSVI 59% female. From 1990 to 2020, the count of persons blind (MSVI) due to cataract increased by 29.7%(93.1%) whereas the age-standardized global prevalence of cataract-related blindness improved by −27.5% and MSVI increased by 7.2%. The contribution of cataract to the age-standardized prevalence of blindness exceeded the global figure only in South Asia (62.9%) and Southeast Asia and Oceania (47.9%).

Conclusions: The number of people blind and with MSVI due to cataract has risen over the past 30 years, despite a decrease in the age-standardized prevalence of cataract. This indicates that cataract treatment programs have been beneficial, but population growth and aging have outpaced their impact. Growing numbers of cataract blind indicate that more, better-directed, resources are needed to increase global capacity for cataract surgery.

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Underweight associated with water, sanitation, and hygiene among women of reproductive age in Arba Minch Health and Demographic Surveillance Site, Southern Ethiopia

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Abstract

Ethiopia is one of the sub-Saharan African countries where underweight among women of reproductive age is high, and it is predisposing to low birth weight, preterm birth, and reduced resistance to infections. Poor water, sanitation, and hygiene (WASH) and drinking water polluted with disease-causing microorganisms lead to undernutrition. Therefore, this study aimed to assess the association between WASH and underweight among women of reproductive age at Arba Minch Health and Demographic Surveillance Site (HDSS), Southern Ethiopia. A community-based cross-sectional study was conducted at Arba Minch HDSS, South Ethiopia, from April to May 2022. Women of reproductive age were included in the study. Data were collected using a pre-tested questionnaire and checklist. Multivariate analysis was conducted to assess the association separately for WASH indicators with underweight status of the women by adjusting for sociodemographic characteristics. Adjusted Odds Ratio (AOR) with a 95% confidence interval was used to assess the association. The prevalence of underweight and overweight/obesity among women of reproductive age was 7.82% (95% CI: 5.60, 10.81) and 12.32% (95% CI: 9.50, 15.83), respectively. Latrine hygiene and use were significantly associated with being underweight. The odds of being underweight among those who use clean latrine were 0.43 (95% CI: 0.20, 0.92) compared to those who use unclean latrine or do not have toilet facilities. The utilization of clean latrine facilities is negatively associated with being underweight among women of reproductive age. From WASH components, latrine utilization and keeping the latrine clean to use need to get focused on reducing the risk of being underweight among women of reproductive age.

Keywords: body mass index, hygiene, latrine, sanitation, underweight, water

Modeling Earth Systems and Environment
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10 (2024)

Assessment of meteorological drought and its association with global climate drivers in Genale Dawa River Basin, South-East of Ethiopia

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Abstract

The Genale Dawa River Basin (GDRB) frequently experiences drought, making it important to understand how drought conditions have changed over time in the region. To assess the evolution of drought characteristics, we analyzed the patterns of drought in the GDRB from 1990 to 2020 using the Standardized Precipitation Evapotranspiration Index (SPEI). We also examined the relationship between the SPEI drought index and global climatic factors using the Pearson correlation coefficient (r). By applying the run theory, we identified the occurrence, duration, severity, intensity, and peak of droughts in each zone in the basin. Additionally, we used the Modified Mann-Kendall trend test to detect significant trends in the SPEI and drought indicators for each zone using the R software package. Our results indicate that the southern and southeastern regions of the basin experienced varying levels of drought, while the northern half was consistently affected by severe drought. On average, a drought event occurred once every 3–5 years in the basin. Furthermore, we observed that La Nina events were mainly associated with drought in the Belg season, while El Nino events were more linked to drought in the Kiremt season. The Nino3.4 index was found to be a useful indicator of the meteorological drought in the GDRB, suggesting its potential use as a drought predictor for the basin. In the region's northernmost regions, we discovered a statistically significant tendency toward increased dryness, but no such trend was seen in any other regions. Based on the results, it is recommended that conducting a comprehensive analysis using multiple drought indices under changing climate conditions is essential in future studies. The findings from the present study can be valuable for policymakers and stakeholders in developing effective strategies to mitigate the impact of droughts on agriculture and water resources management in GDRB.

Keywords: Meteorological drought**,** Genale Dawa River Basin**,** SPEI**,** Global climate drivers**,** Spatiotemporal variation

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492 (2024)

Assessing bioenergy prospects of algal biomass and yard waste using an integrated hydrothermal carbonization and pyrolysis (HTC–PY): A detailed emission–to–ash characterization via diverse hyphenated analytical techniques and modelling strategies

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Abstract

Hydrothermal carbonization (HTC) presents a promising method for converting carbonaceous waste into renewable fuels, facilitating energy recovery. This study focuses on the HTC pretreatment of microalgae (Chlorella sorokiniana) and yard waste, examining their physicochemical structural changes, component migration, and potential for valorization via integrated HTC and pyrolysis processes. HTC notably enhances the carbon content while reducing oxygen and nitrogen levels in these feedstocks, producing a clean solid fuel with high energy density. The study investigates the pyrolytic behavior of hydrochars and their blends using different analytical techniques, kinetic modeling, and fixed–bed reactor experiments. The blends with 90% and 70% of microalgae hydrochar (CSH) exhibited the most significant synergistic effects during co–pyrolysis, evident in its devolatilization behaviors and reduced activation energies. Integrating artificial neural networks and response surface methodology models facilitated optimization of pyrolysis parameters and accurate prediction of bio–oil, biochar, and gas yields. The analytical techniques enabled characterization of pyrolysis products, revealing notable changes in bio–oil and biochar compositions, suggesting potential enhancements. The study comprehensively evaluates the HTC–pyrolysis approach's potential for converting microalgae and lignocellulosic biomass into eco–friendly biofuels for industrial applications.

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4 (2024)

Level of HIV serodiscordance and associated factors among heterosexual couples in Ethiopia: A systematic review and meta-analysis

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Abstract

HIV-related causes accounted for approximately 770,000 deaths globally in 2018. Globally, there were 1.7 million new infections, and approximately 37.9 million people were living with HIV by the end of 2018. According to the WHO 2018 study, the African Region was the most affected, with 25.7 million people living with HIV in 2018. In Africa, married and cohabiting couples have a high prevalence of HIV discordance, ranging from 3% to 20% in the general population. Therefore, it is crucial to understand the level of HIV serodiscordance among married couples in Ethiopia and the contributing factors. Studies were systematically searched, utilizing international databases such as PubMed, Google Scholar, Cochrane Library, and Embase. The level of quality of the included articles, which employed cross-sectional and cohort study designs, was evaluated using the New Castle Ottawa scale. The systematic review employed a random-effects approach, and statistical analysis was conducted using STATA version 17 software. The presence of statistical heterogeneity within the included studies was assessed using the I-squared statistic. The random-effects meta-analysis model was used to estimate the pooled level of HIV serodiscordance. The results were reported following the Preferred Reporting Item for Systematic Review and Meta-Analyses (PRISMA) guideline. A total of ten (10) observational studies were included in this review. The pooled level of HIV serodiscordance among married heterosexual couples in Ethiopia was found to be 11.4% (95% CI = 7% -15.7%). The results from the meta-analysis indicated a significant positive association between HIV serodiscordance and the variables studied. Specifically, consistently using condoms (OR = 1.82; 95% CI: 1.08–2.56), having a CD4 count of >200 cells/mm3 (OR = 1.45; 95% CI: 1.12–1.77), and having a premarital sexual relationship (OR = 1.93; 95% CI: 1.28–2.57) were strongly linked to couples' serodiscordance. To protect a seronegative partner in a serodiscordant relationship from acquiring HIV infection, it is crucial to implement preventive measures. These measures include providing comprehensive health education on the correct and consistent use of condoms, ensuring regular monitoring and care at an antiretroviral therapy (ART) clinic, and offering voluntary counseling and testing (VCT) services to both sexual partners.

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Spatiotemporal variability and trends in rainfall and temperature extremes using ERA5 reanalysis and CORDEX–Africa model in Southern Ethiopia

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Abstract

Rainfall and temperature are characterized by spatial and temporal variability in Ethiopia. However, less attention was given for the analysis of climate variability using advanced techniques and multiple sets of data. This study was conducted to examine spatiotemporal variability and trends in rainfall and temperature extremes in Ghibe III Dam watershed. Observational, ERA5, and regional simulation model data sets were used. The coefficient of variation (CV) and precipitation concentration index (PCI) were employed. The trends in rainfall and temperature extremes were examined using the modified Mann-Kendall test and the Sen Slope estimator in R-ClimDex in R 4.2.2 software. The warmest days exhibited temperature from 24.6°C to 40°C in Bele, 28.2°C to 35.43°C in Wolaita Sodo, 33.6 °C–44 °C in Areka, 31.64 °C–36.8 °C in Gesuba, and 29.19 °C–36.15 °C in Gena Bosa. The warmest nights showed temperature ranging from 14 °C to 18.74 °C in Bele and Gena Bosa, respectively. Annual warm days (TX90p) ranges from 11.34 to 57.1 days, with higher heating in the southern parts. The cool days (TX10p) range from 2.79 to 8.41, while the cool nights (TN10p) range from 0.04 to 8.26 days. The areal average temperature maximum and minimum range between 26.37 °C and 13.81 °C, respectively, with mean precipitation of 1446.92 mm.The rainfall extremes indices showed increasing and decreasing trends. The extreme temperature indices showed an overall warming trend. Based on ERA estimates, the rainfall in winter showed higher variability (CV = 72.4%–99.3 %) than the annual rainfall (CV = 33%–79.8 %). PCI showed a moderately (12 %) to very erratic (19.4 %) rainfall distribution. The climate model estimate showed high variability (CV = 20.65 %) in Climate Limited Area Modeling Community (CCLM) under representative concentration paths (RCP) 4.5 and 8.5 and extremely high variability (CV = 93.49 %) in the Regional Atmospheric Climate Model (RACMO) under RCP 4.5. Policymakers should design appropriate adaptation strategies applicable to farmers.

Keywords: Climate model**,** Climate variability**,** Cool night**,** Modified mann-kendall test**,** Warmest day

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Effect of irrigation regimes on nutrient uptake and nitrate leaching in maize (Zea mays L.) production at Birr-Farm, Upper Blue Nile, Ethiopia

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Abstract

Sustainably managed irrigation water is essential to agriculture. In order to identify the best irrigation strategies for maximizing agricultural productivity and environmental health, this study examines the effects of various irrigation depths on nutrient uptake, nitrate leaching, and maize yield. The study was carried out at Birfarm, in the Jabitehnan District, Amhara, Ethiopia, throughout the irrigation periods of 2022/23 and 2023/24. The experiment used a (RCBD) with three replications testing five application depths to apply irrigation (50 %, 75 %, 100 %, 125 % and 150 % ETc). ANOVA was performed to determine the influences of irrigation levels on nutrient uptake and nitrate leaching. Irrigation levels significantly impacted N, P and K uptake. Maximum nutrient uptake occurred at 150 % ETc with higher nutrient uptake observed in the second experimental season. Irrigation levels significantly affected nitrate leaching, with the highest leaching at 150 % ETc. Excessive irrigation increased nitrate leaching, aligning with findings from other studies. Maize yield, thousand grain weight (TGW) and above-ground biomass yield (ABY) were significantly influenced by irrigation depth. Optimal irrigation (100 % ETc) produced the maximum yield of 6.08 and 5.83 tha-1, the maximum thousand grain weight of 682.51 g and 685.12 g, and the highest above-ground biomass yield of 31.41 and 32.74 tha-1 in the second and first experiments, respectively, while excessive and deficit irrigation reduced yield. The study highlights the importance of optimizing irrigation depth for nutrient uptake, nitrate leaching and maize yield. While increased irrigation improved nutrient uptake and yield, excessive irrigation led to higher nitrate leaching, emphasizing the need for balanced irrigation practices to enhance productivity and environmental sustainability. Farmers should implement 100%ETc to enhance productivity, ensure efficient nutrient utilization, and protect the environment from the adverse effects of nitrate leaching.

Keywords: Cultivation**,** Irrigation regime**,** Maize**,** Nitrate leaching**,** Nutrient uptake

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Applicability of visual and analytical soil quality indicators in environmentally diverse catchments of the Ethiopian Rift

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Abstract

This research focuses on two science-based soil quality assessments, i.e., visual soil assessment (VSA) and analytical (lab-based) soil quality (SQ) assessment. The VSA, especially when conducted by farmers, offers a cost-effective approach to studying soil in extended study areas. However, little is known about the applicability of VSA in areas subjected to different degradation processes. Our study takes place in the lowland, midland, and highland agro-ecological zones (AEZs) of the Shafe and Sile-Elgo catchments, in the Southern Main Ethiopian Rift Valley. It aims to contribute to the state-of-art knowledge on VSA by evaluating its reproducibility when conducted by farmers and extensionists and its correlation to analytical SQ indicator scores, and to generate insight into SQ of the cropland in the various AEZs of two selected catchments. To that aim, 36 cropland fields were selected, half of these fields receiving soil and water conservation (SWC) practices, while no SWC was applied to the others. In each field, the VSA was conducted by farmers and experts, followed by laboratory analyses and calculation of an SQ index. Our finding reveals that overall VSA scores assigned by both groups were very strongly correlated ($r=0.909–0.975$, $p<0.001$) and reproducible at any level of stratification in the highly diverse, tropical study area covered in this research. However, the VSA indicator soil texture turned out to be non-reproducible. Both VSA and analytical SQ indicator scores are significantly ($p<0.05$) higher in fields receiving SWC practices and integrating both methods provided a clear contrast between fields that have good and poor SQ conditions in different AEZs of the catchments. The VSA method is less capable of capturing problems related to toxicities or low nutrient and water availability as a consequence of acidity, salinity and sodicity. Therefore, when the VSA method is applied to monitor SQ status of fields subjected to diverse degradation processes, it would be better to include specific indicators of pH and EC.

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Genomic diversity of Campylobacter jejuni and Campylobacter coli isolated from the Ethiopian dairy supply chain

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Abstract

Campylobacteriosis outbreaks have previously been linked to dairy foods. While the genetic diversity of Campylobacter is well understood in high-income countries, it is largely unknown in low-income countries, such as Ethiopia. This study therefore aimed to conduct the first genomic characterization of Campylobacter isolates from the Ethiopian dairy supply chain to aid in future epidemiological studies. Fourteen C. jejuni and four C. coli isolates were whole genome sequenced using an Illumina platform. Sequences were analyzed using the bioinformatics tools in the GalaxyTrakr platform to identify MLST types, and single nucleotide polymorphisms, and infer phylogenetic relationships among the studied isolates. Assembled genomes were further screened to detect antimicrobial resistance and virulence gene sequences. Among 14 C. jejuni, ST 2084 and ST 51, which belong to the clonal complexes ST-353 and ST-443, respectively, were identified. Among the 4 sequenced C. coli isolates, two isolates belonged to ST 1628 and two to ST 830 from the clonal complex ST-828. The isolates of C. jejuni ST 2084 and ST 51 carried β-lactam resistance gene blaOXA-605, a fluoroquinolone resistance-associated mutation T86I in the gryA gene, and a macrolide resistance-associated mutation A103V in 50S L22. Only ST 2084 isolates carried the tetracycline resistance gene tetO. Conversely, all four C. coli ST 830 and ST 1628 isolates carried tetO, but only ST 1628 isolates also carried blaOXA-605. Lastly, C. jejuni ST 2084 isolates carried a total of 89 virulence genes, and ST 51 isolates carried up to 88 virulence genes. Among C. coli, ST 830 isolates carried 71 genes involved in virulence, whereas two ST 1628 isolates carried up to 82 genes involved in virulence. Isolates from all identified STs have previously been isolated from human clinical cases, demonstrating a potential food safety concern. This finding warrants further monitoring of Campylobacter in dairy foods in Ethiopia to better understand and manage the risks associated with Campylobacter contamination and transmission.

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Spatial analysis and mapping of intensity and types of agricultural salt-affected soils around Abaya and Chamo Lakes, South Ethiopia Rift Valley

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Abstract

Purpose: Salt-affected soils have significant enough salt concentrations to impact other land and soil resource uses, plant health, soil characteristics, and water quality. Consequently, a study was carried out in the South Ethiopian Rift Valley area around the lakes of Abaya and Chamo to determine the intensity and the types of salt-affected soil and map their spatial distributions. Methods: At 0–20 cm depths, a grid soil sampling scheme was employed to gather data from agricultural soils affected by salt. An adequately spaced grid cell of 200 m*200 m or seven transects, with seven samples collected every 200 m on each sampling site, was generated by the QGIS software's Fishnet tool, and an auger collected 226 soil samples from the proposed 245 soil sampling points. The analysis and interpretation of the data were done using both statistical and geostatistical methods. The un-sampled surface was predicted and mapped from laboratory point data using the standard Kriging algorithm in QGIS. Results: According to the results, the soil in the study area was rated as strongly alkaline and moderately alkaline in the reaction. The coefficient of variation (CV) was the lowest for soil pH. Except for the Ganta Kanchama site, low CV (<10 %) confirmed the similarity of pH values throughout all research areas. The EC values depicted that the study area is slightly saline except for the Ganta Kanchame site, which rated moderately saline to strongly saline. The variability of soil EC rated moderate to strong variation for the studied area. The exchangeable sodium percentage (ESP) values distribution between the study sites demonstrates considerable variability and difference. The area is dominated by low to high-risk rate soil sodicity, as evidenced by the soil ESP CV of the studied area, which was >100 % and showed significant variability among the samples. Out of 2274.65ha of the studied area, the type of salt 62.28 %, 26.09 %, 10.99 %, and 0.63 % were categorized as non-saline non-sodic, saline-sodic, sodic, and saline, respectively. Following saline-sodic, sodic, and saline soils, respectively, non-saline and non-sodic soils comprise most of the investigated areas. Conclusions: The result indicates almost all the salt-affected areas were situated in relatively lower slope areas exhibiting a flat to almost flat slope (0–2%). The study's findings are that the studied area needs specific soil management strategies to boost the salinity and sodicity problems around the study area and recommended reclamation techniques as the extent of the problems.

Keywords: Salt-affected soils**,** Intensity of salt problems**,** Types of salt**,** Geostatistical**,** Salinity and sodicity

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Assessing Nitrate Leaching and Runoff Coefficients in the Dynamic Interplay of Seasonal Crop Biomass: A Study of Surface and Groundwater Nitrate Contamination in the Bilate Cropland Watershed

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Abstract

Effective water resource management and sustainable agricultural practices are contingent upon a thorough understanding of nitrate dynamics. This study investigates the utilization of seasonal average cropland runoff observations to improve the prediction accuracy of nitrate runoff loads to surface water originating from cropping zones. By integrating data from various sources, including seasonal rainfall/runoff observations and cropland parameters, the study explores the complex relationship between crop biomass growth, nitrogen fertilizer application, and seasonal rainfall over cropland. Monthly average observations of cropping zone rainfall/runoff in the cropping zone are analyzed to understand the response of seasonal crop biomass to nitrogen fertilizer application and seasonally calibrated rainfall/runoff in the cropland watershed. The study demonstrates the prototypical runoff observation from cultivated areas and statistically estimates seasonal runoff at downstream stream outlets. This shows a strong correlation with an R^2 of 0.9742 with a p-value less than 0.001 for seasonal rainfall climate parameters. Seasonal cropland runoff observations from EWX lite are presented for model calibration at downstream outlets, based on regional crop calendars, facilitating the estimation of nitrate loading to surface water and nitrate contamination from cropping zones. The findings reveal distinct cropping zones, particularly zones 5, 6, 11, and 13, which significantly contribute, each exceeding 50 mg/l of leaching load to groundwater. Moreover, more than ten zones surpass the threshold of 50mg/l in nitrate loading to surface water. These quantitative insights provide valuable spatial information regarding nitrate runoff relationships within the watershed, enabling the identification of specific zones with heightened nitrate contributions and offering actionable solutions for promoting sustainable agriculture and refining water resource management strategies.

Keywords: Nitrate contamination, Geographically Weighted Regression (GWR) model, Cropland Watershed, Earth observation, Runoff and leaching coefficients, Sustainable agriculture

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Assessing the impacts of precipitation on water yield estimation in arid environments: Case study in the southwestern part of Saudi Arabia

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Abstract

Water yield is a vital ecosystem service in basins, particularly in arid and subarid regions around the world. This study mainly focuses on the impact of precipitation variations on the estimation of annual water yield in the arid and subarid environment of the southwest part of Saudi Arabia. The simulation was performed using the Terrset software, based on the Integrated Valuation of Ecosystem Services and Tradeoff (InVEST) model. Eight input data parameters were considered, including Land Use and Land Cover, average annual potential evapotranspiration (ET), average annual precipitation ranging from 2000 to 2012, soil depth, PAWC (plant available water content), biophysical data, and a seasonality factor. The results show a high correlation, with an R2 value of 0.99, between annual water yield and precipitation during the 2000–2012 period in the region. The highest amount of water yield was obtained in 2010, with values around 266.67 mm, while the lowest was observed in 2006, with a value of 3.51 mm. The average pixel-level water yield in the region ranges from 46.65 to 154.08 mm, with a mean annual water yield of 96.77 mm. The highest amount of water yield is observed in Al Baha, at 1.3 mm per hectare, while the lowest value is observed in the Makkah region, at approximately 1.07 mm per hectare. The estimation of average annual water yield is crucial for understanding the amount of water production annually in the watershed. This information is particularly important in arid and subarid environments where water scarcity is a concern.

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Post-operative site infections among surgical patients at Southern Ethiopia: A prospective cohort study

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Abstract

Objective: The current study was conducted to estimate the magnitude of SSI among surgically treated patients and identify the predictors associated with it. Background: summary: Despite the fact that surgical site infection (SSI) is still a global health care-associated infection related to patients' discomfort, morbidity, and mortality, it is the most preventable nosocomial infection if all necessary measures are taken into account. Methods: An institution-based prospective cohort study was conducted at a large teaching hospital in southern Ethiopia. Patients admitted to the surgical ward with a non-traumatic acute abdomen were participants in the study and were followed prospectively for 30 days. The collected data was entered into Epi-Data 4 and exported to STATA 16 for analysis. A logistic regression (bi-variable and multivariable) model was computed to detect the association between SSI and predictors. In the final model, variables with a p-value <0.05 were declared statistically significant. Results: In this study, a total of 169 patients were enrolled. More than 3/4th (78.9%) of them were male, and the mean ± SD age of participants was 42.14 ± 12.5 years. Eighteen participants (10.5%) suffered from surgical site infection (SSI). Predictors of SSI were ever smoking [AOR = 3.9; 95% CI (1.2–16.5)], American Society of Anesthesiologists score ≥3 [AOR = 8.9; 95% CI (1.7–45.5)], appendectomy [AOR = 7.7; 95% CI (1.3–45.7)], and co-morbid diabetes [AOR = 13.8; 95% CI (2.6–72.1)]. Conclusion: The magnitude of SSI was considerable in the study setting. Predictors of SSI were smoking, ASA score, appendectomy, and co-morbid diabetes. We strongly recommend that health-care professionals provide health education and patient counseling on smoking and health-seeking behaviors. Considering co-morbid conditions before surgery has paramount importance. Moreover, further large-scale studies are suggested.

Keywords: Surgical site infection**,** abdominal surgery, Predictors

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Assessing the impacts of climate change on hydrological processes in the upper Genale River basin, Ethiopia

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Abstract

The aim of this research is to assess the impact of future climate change on hydrological parameters (e.g., precipitation and temperature) in Ethiopia's upper Genale River basin. Future climate scenarios for the 2021–2050 and 2051–2080 periods were developed from four different GCM–RCM combinations of CORDEX-Africa projections using the Representative Concentration Pathways (RCP 4.5 and RCP 8.5). These climate models were bias corrected and used as input to the Soil and Water Assessment Tool (SWAT) model. During the 2030s (2021–2050) and 2060s (2051–2080), under the two RCPs, the projected precipitation in the annual and seasonal periods tends to decrease while temperatures increase. The simulated result revealed a significant change in hydrological components (e.g., During the 2060s), under the RCP4.5 scenario, CNRM-CM5 climate model runoff, ground water flow, and total water yield increased by 24.47%, 27.98%, and 28.56%, respectively. On the contrary, during the 2060s under the MIROC5 climate model, runoff, ground water flow, and total water yield reduced by 20.84%, 34.34%, and 25.8%, respectively. The annual hydrological components of the study area under MPI-ESM-LR, EC-EARTH, and MIROC5 showed a decrease in total water yield, surface runoff, ground waterflow, and lateral flow. However, due to a rise in temperature, evapotranspiration showed an increase up to 8.1% under all climate models (MPI-ESM-LR, EC-EARTH, CNRM-CM5, and MIROC5). The reduction in rainfall, which coincides with rising temperatures, is expected to reduce annual water yield, surface runoff, ground waterflow, and lateral flow by up to 39.8%, 39.3%, 50%, and 40.1%, respectively, across MPI-ESM-LR, EC-EARTH, and MIROC5 scenarios for the entire study basin in future projections. Our study helps to give a better insight into understanding climate change in watershed and can benefit the planning of water resources by strengthening adaptation strategies against the impacts of future climate change.

Keywords: Upper Genale River basin**,** Climate change**,** Regional climate models**,** Hydrological processes**,** SWAT model

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Prevalence of low back pain and associated factors among nurses working in public hospitals of Hawassa city, southern Ethiopia: A cross-sectional study

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Abstract

Background: Low back pain is a prevalent musculoskeletal ailment that affects numerous individuals, particularly those in the workforce. Nurses, in particular, are highly susceptible to this condition. In developing countries, nurses may encounter physically demanding environments requiring them to lift or transfer patients or equipment without access to proper lifting aids. Such circumstances increase their chances of developing low back pain. Hence, it is crucial to determine the prevalence and risk factors of low back pain to assess the effect and suggest preventive measures. Objective: This study aims to assess the prevalence of low back pain and associated factors among nurses working in public hospitals in Hawassa City, Sidama Region, Southern Ethiopia, 2021. Methods: An institutional-based cross-sectional study was conducted from May 15 to Jun 15, 2021, among randomly selected 398 nurses working in public hospitals of Hawassa City, southern Ethiopia. Data were collected using a standard, modified Nordic Musculoskeletal assessment tool. The data was entered into EPI-Data version 4.6.0.2 and exported to STATA version 14.0 for analysis. A multivariable logistic regression model was used to identify factors associated with the prevalence of low back pain. Significance was considered at $p < 0.05$ with a 95 % confidence interval. Results: The study was conducted among 391 nurses, giving a response rate of 98.2 %.The one-year prevalence of low back pain was 242(61.9 %) with (95 % CI: 57%–66 %). Being female [AOR 1.82; 95%CI (1.07–3.08)], body mass index ≥25 kg/m2 [AOR 2.17; 95 %CI (1.24–3.79)], not getting assistance from coworkers [AOR 1.80; 95 % CI (1.07–3.02)] and not using of the assistive device were [AOR 1.77; 95 % CI (1.04–3.01)] were factors significantly associated with low back pain among nurses. Conclusion: Based on the findings of this study, a high proportion of nurses reported having low back pain among nurses in Hawassa public hospitals. The study suggests emphasizing the accessibility of assistive devices for patient care, having a balanced body weight, and working in collaboration among nurses to reduce the risk of low back pain among nurses.

Keywords: Low back pain**,** Nurses**,** Public hospitals**,** Ethiopia

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Finite element analysis on failure-yielding stresses in the wheel bolt of automobile vehicle due to operational loading conditions

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Abstract

In automotive industry, wheel bolts were observed as a common source of failure in service and are unwanted as they get burdensome when subjected to failure. The main objective of this research was to investigate the effect of preload, static, and dynamic operational loading conditions on the mechanical behavior of the wheel bolt of a vehicle to identify the main causes of wheel bolt failure and prevent it from damage. To perform analysis, first the 3D-modeling was developed for the joint by using CATIA-V5, and the finite element analysis was carried out using ANSYS R18.0 software: to determine the stress distribution and its concentration areas on the surfaces of the wheel bolt. In each loading condition, the equivalent and maximum shear stresses were effectively examined. But, for dynamic loading, the comparative effect of axle load and vehicle speed was well-thought-out. The results reveal that the amount of von mises stress varies in the range of 870.7–1667.3 MPa and the shear stress results in a range of 475.5–918.33 MPa, as the axle load increased. When comparing the effect of axle load and vehicle speed, the radial load variation had a greater effect on the advancement of stresses in the wheel bolt. Unlike that, the effect of speed variation was observed to be relatively weak. Therefore, the strong overloading effect investigated during numerical analysis was assessed as the likely probable root cause of failure, and the bolt thread parts were detected as a critical stress concentration area on which the bolt material experiences failure.

Keywords: Wheel bolt**,** Equivalent stress**,** Maximum shear stress**,** Preloading**,** Static loading**,** Dynamic loading

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A comprehensive review and potential guidance on the reliability of landslide evaluation approaches in Central, Northern, and Northwestern Highlands, Ethiopia

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Abstract

The growing popularity of GIS technology in Ethiopia has encouraged multiple scholars to investigate landslide hazards using quantitative approaches, despite its limitations. The present review examined the approach used in the evaluation of landslide hazards by five prior studies that shared catchments. The review results reveal that the controlling factors assumed by the five researchers were inconsistent and resulted in highly divergent frequency ratio (FR) values, even for the same factors. This implies that the contribution of a single instability factor can be inferred sufficiently for landslide hazard assessment and mapping; otherwise, the results are highly subjective and disputable. Since the soil type in the region was alluvial-colluvial in the five studies, and a majority of the failures occurred shortly after rainfall, rainfall data and basic soil properties (classification and shear strength) should not be overlooked. In addition to the nonstandard use of morphometric parameters, the inherent limits of GIS methodologies, the omission of hydrogeotechnical properties, and the observed subjective outcomes make the GIS-based approach imprecise, error-prone, and doubtful. The total effect will result in ineffective early warning systems and unworthy mitigation measures, resulting in significant life costs and damage. As a result, it is recommended that GIS technology should be coupled with software (TRIGRS, Scoops3D, SINMAP, OpenLISEM, GLM, and SLIP) that considers hydrogeotechnical properties to provide more reliable conclusions. In addition to using instability factors consistently, regional statistical correlations of all morphometric parameters can be developed, allowing for less complex and realistic empirical models to be used.

Keywords: GIS technology**,** Instability factors**,** Frequency ratio**,** Hydrogeotechnical parameters**,** Empirical models

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Assessing landslide susceptibility in Lake Abya catchment, Rift Valley, Ethiopia: A GIS-based frequency ratio analysis

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Abstract

Ethiopia's varied landscape, significant rainfall, and diverse geological characteristics pose risks of landslides. The specific research area spans 40 km2 within the Lake Abaya catchment area in the Rift Valley of Ethiopia. This investigation aimed to map landslide susceptibility using remote sensing information, GIS technology, and frequency ratio analysis. It evaluated multiple factors influencing landslide susceptibility. The process involved meticulous mapping of thematic layers, utilizing GIS techniques and diverse data sources, including primary data, satellite imagery, and secondary sources. A combination of Google Earth image analysis and field surveys was used to map landslide susceptibility in inaccessible areas. It was determined that 138 landslide sites existed. Of these, 30% (41 points) were assigned to the test of the model and another 30% to the training of the model, for a total of 97 points. The landslide susceptibility was classified into five categories based on frequency ratio analysis of the landslide susceptibility index (LSI): very low, low, moderate, high, and very high. The northeastern sector of the study area demonstrated a comparatively diminished susceptibility to landslides, ranging from low to moderate, whereas the central and southern regions showcased markedly elevated vulnerability. An evaluation of the model's accuracy using the area under the curve (AUC) method based on test inventory landslide data produced encouraging results: 84.8% accuracy on the success rate curve and 78.8% accuracy on the prediction rate curve. Based on the frequency ratio model, a susceptibility map is derived to represent susceptibility levels accurately.

Keywords: Ethiopia, frequency ratio, GIS, Lake Abaya catchment, landslide susceptibility

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Green and cost-effective biofabrication of copper oxide nanoparticles: Exploring antimicrobial and anticancer applications

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Abstract

Nanotechnology has made remarkable advancements in recent years, revolutionizing various scientific fields, industries, and research institutions through the utilization of metal and metal oxide nanoparticles. Among these nanoparticles, copper oxide nanoparticles (CuO NPs) have garnered significant attention due to their versatile properties and wide-range applications, particularly, as effective antimicrobial and anticancer agents. CuO NPs can be synthesized using different methods, including physical, chemical, and biological approaches. However, conventional chemical and physical approaches are expensive, resource-intensive, and involve the use of hazardous chemicals, which can pose risks to human health and the environment. In contrast, biological synthesis provides a sustainable and cost-effective alternative by eliminating chemical pollutants and allowing for the production of CuO NPs of tailored sizes and shapes. This comprehensive review focused on the green synthesis of CuO NPs using various biological resources, such as plants, microorganisms, and other biological derivatives. Current knowledge and recent trends in green synthesis methods for CuO NPs are discussed, with a specific emphasis on their biomedical applications, particularly in combating cancer and microbial infections. This review highlights the significant potential of CuO NPs in addressing these diseases. By capitalizing on the advantages of biological synthesis, such as environmental safety and the ability to customize nanoparticle characteristics, CuO NPs have emerged as promising therapeutic agents for a wide range of conditions. This review presents compelling findings, demonstrating the remarkable achievements of biologically synthesized CuO NPs as novel therapeutic agents. Their unique properties and mechanisms enable effective combating against cancer cells and various harmful microbial infections. CuO NPs exhibit potent anticancer activity through diverse mechanisms, including induction of apoptosis, inhibition of angiogenesis, and modulation of signaling pathways. Additionally, their antimicrobial activity manifests through various mechanisms, such as disrupting microbial membranes, generating reactive oxygen species, and interfering with microbial enzymes. This review offers valuable insights into the substantial potential of biologically synthesized CuO NPs as an innovative approach for future therapeutic interventions against cancer and microbial infections.

Keywords: Copper oxide nanoparticles, Biological synthesis, Antimicrobial activity, Anticancer activity, Green synthesis, Nanotechnology, Microbial infection

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Long-term spatiotemporal dynamics of groundwater storage in the data-scarce region: Tana sub-basin, Ethiopia

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Abstract

Imprudent extraction of groundwater tends to undue stress and portends its sustainability. Spatiotemporal analysis of groundwater storage anomaly (GWSA) is imperative for the judicious use, management, and sustainable development of a region. This study aimed to examine the changes in groundwater storage over the past 20 years in the Tana sub-basin using Gravity Recovery and Climate Experiment (GRACE) assimilated into Global Land Data Assimilation Systems (GLDAS). Validation analysis was carried out to evaluate the accuracy of GWSA against anomalies of Lake Tana water level, precipitation, and in-situ groundwater level. Modified Mann-Kendal test and Sen's slope estimator were applied for trend analysis of the GWSA. The results exhibited that GWSA strongly correlated (Pearson's correlation coefficient, R ranges from 0.75 to 0.96) with the three validation above variables, which elucidated in general, credible GWSA estimation. The net annual GWSA curve showed a non-significant ($p > 0.05$) decreasing trend from 2003 to 2012. However, years including 2005, 2006, and 2009 were drought periods, which caused 0.49 billion cubic meters (BCM) groundwater loss. In the entire study period (2003–2022), on the other hand, the net annual GWSA revealed a significant increasing trend ($p < 0.05$) with a rate of 0.333 cm/year. Generally, the Tana sub-basin was nurtured with a net 4.87 BCM groundwater gain in the study period. The most sensitive parts of the study area to large fluctuations of groundwater storage were mainly the nearby southern and eastern directions of Lake Tana.

Keywords: Groundwater storage change**,** Spatiotemporal**,** GRACE**,** GLDAS**,** Trend analysis**,** Tana sub-basin

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Global, regional, and national burden of disorders affecting the nervous system, 1990–2021: a systematic analysis for the Global Burden of Disease Study 2021

GBD 2021 Nervous System Disorders Collaborators

Abstract

Background: Disorders affecting the nervous system are diverse and include neurodevelopmental disorders, late-life neurodegeneration, and newly emergent conditions, such as cognitive impairment following COVID-19. Previous publications from the Global Burden of Disease, Injuries, and Risk Factor Study estimated the burden of 15 neurological conditions in 2015 and 2016, but these analyses did not include neurodevelopmental disorders, as defined by the International Classification of Diseases (ICD)-11, or a subset of cases of congenital, neonatal, and infectious conditions that cause neurological damage. Here, we estimate nervous system health loss caused by 37 unique conditions and their associated risk factors globally, regionally, and nationally from 1990 to 2021.

Methods: We estimated mortality, prevalence, years lived with disability (YLDs), years of life lost (YLLs), and disability-adjusted life-years (DALYs), with corresponding 95% uncertainty intervals (UIs), by age and sex in 204 countries and territories, from 1990 to 2021. We included morbidity and deaths due to neurological conditions, for which health loss is directly due to damage to the CNS or peripheral nervous system. We also isolated neurological health loss from conditions for which nervous system morbidity is a consequence, but not the primary feature, including a subset of congenital conditions (ie, chromosomal anomalies and congenital birth defects), neonatal conditions (ie, jaundice, preterm birth, and sepsis), infectious diseases (ie, COVID-19, cystic echinococcosis, malaria, syphilis, and Zika virus disease), and diabetic neuropathy. By conducting a sequela-level analysis of the health outcomes for these conditions, only cases where nervous system damage occurred were included, and YLDs were recalculated to isolate the non-fatal burden directly attributable to nervous system health loss. A comorbidity correction was used to calculate total prevalence of all conditions that affect the nervous system combined.

Findings: Globally, the 37 conditions affecting the nervous system were collectively ranked as the leading group cause of DALYs in 2021 (443 million, 95% UI 378–521), affecting 3·40 billion (3·20–3·62) individuals (43·1%, 40·5–45·9 of the global population); global DALY counts attributed to these conditions increased by 18·2% (8·7–26·7) between 1990 and 2021. Age-standardised rates of deaths per 100 000 people attributed to these conditions decreased from 1990 to 2021 by 33·6% (27·6–38·8), and age-standardised rates of DALYs attributed to these conditions decreased by 27·0% (21·5–32·4). Age-standardised prevalence was almost stable, with a change of 1·5% (0·7–2·4). The ten conditions with the highest age-standardised DALYs in 2021 were stroke, neonatal encephalopathy, migraine, Alzheimer's disease and other dementias, diabetic neuropathy, meningitis, epilepsy, neurological complications due to preterm birth, autism spectrum disorder, and nervous system cancer.

Interpretation: As the leading cause of overall disease burden in the world, with increasing global DALY counts, effective prevention, treatment, and rehabilitation strategies for disorders affecting the nervous system are needed. Funding: Bill & Melinda Gates Foundation.

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Phytochemical profiling, evaluation of heavy metal load, antioxidant and antibacterial activity of various medicinal plants

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Abstract

In Ethiopia, medicinal herbs have played a prominent role in relieving pain and curing various diseases for humans and animals for many years. However, consumers don't know what kinds of phytochemicals are in the plants or the amount of metal they contain. Thus, in this study, polyphenol content, flavonoid content, antioxidant capacities, antibacterial activity and the level of metals in Asparagus africanus root, Ferula communis, Stephania abyssinia, Brucea antidysenterica and Vernonia amygdalina, were analyzed. Identifying the phytochemicals, antioxidant and antibacterial activities, and levels of metals in medicinal plants ensures their safety and efficacy and provides a deeper understanding of the healing properties of plants in areas where modern medicines are not easily accessible. The antioxidant activity was determined by 2,2-diphenyl- 1-picrylhydrazyl (DPPH) radical assay, and the antibacterial activity was evaluated by disc diffusion method. Among the studied plant extracts, Vernonia amygdalina displayed the maximum phenolic content (810 mg GAE/100 g), flavonoid content (515.78 mg QE/100 g), and DPPH radical scavenging activity (14.42 mg AAE/g), whereas the least level of total phenolic (160.82 mg GAE/100 g), total flavonoid (30.65 mg QE/100 g), and DPPH radical scavenging (1.14 mg AAE/g) were recorded in Asparagus africanus. The highest inhibition zone was recorded, with an inhibitory zone of 11 mm for S. aurous and 11 mm for E. coli. The least zone of inhibition was obtained in gram-negative bacteria (K. pneumonia) with a diameter less than 8 mm. Asparagus africanus contained the highest levels of Mn and Fe, while Cu and Zn were found to be the highest in Stephania abyssinia. Cr was only detected in Ferula communis, and Cd was found to be below the detection limit. Due to their better antioxidant and antibacterial properties, the extracts of these plants might be used as a natural starting material in treating cancer and to prepare anti-cancer drugs.

Keywords: Medicinal plants, Metals, Polyphenols, Flavonoids, Antioxidants, Antibacterial activity

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Assessment of household's willingness to pay for improved water supply services in emerging nations: a case study of Adama City, Ethiopia

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Abstract

Adama City grew rapidly due to its proximity to Addis Ababa, resulting in increased industrial, urban activities, and population growth. However, this expansion has resulted in drinking water shortages, which is a critical community's concern. The aim of this study was to determine households' willingness to pay (WTP) for improved water supply services in Adama, with factors influencing WTP. To quantify households' WTP, a contingent valuation (CV) technique was used and data from 435 respondents was gathered through field surveys, KII, and HHs interviews. A binary logistic model was utilized to examine variables that have a significant impact on households' WTP. The analysis revealed several independent variables, such as gender, age, marital status, education level, and monthly income, additionally, water quantity, quality, availability, and affordability. The study found that 39.77 and 26.21% of residents of the city were dissatisfied with the quality and quantity of available water supply, respectively. The study discovered that 92% of households were willing to pay an additional $7.26 USD above their average monthly water cost of $3.58 USD to improve water delivery services. Factors that influence households' WTP for improved water supply services should be considered. The study's findings can help legislators and water supply companies to design sustainable projects that meet community needs.

Keyword: binary logistic model, contingent valuation, water supply service, willingness to pay

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Performance of a dual service station in stochastic inventory system with multi server and optional feedback service

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Abstract

This paper considers a stochastic queueing-inventory system with dual service stations, two groups of heterogeneous multi-servers, two finite waiting halls, and two classes of customers. Station-1 and station-2 provide an inventory sales service and feedback service, respectively. The feedback service option can be given to customers at the service completion epoch. If a customer requires feedback service, moves to an orbit; otherwise, leaves the system permanently. The classical retrial policy is applied to get feedback service. For the replenishment process, the system follows an (S−1,S) base stock ordering policy. This study analyzes the model under four classifications: 1) orbit size is finite and servers have homogeneous service rate; 2) orbit size is finite and servers have heterogeneous service rate; 3) orbit size is infinite and servers have homogeneous service rate; and 4) orbit size is infinite and servers have heterogeneous service rate. The steady-state probability vector for an infinite-size orbit case is computed using the Neuts and Rao truncation method. An expected total cost function is derived with sufficient system indicators for the four classifications. An optimized expected total cost is gained for classifications 2 and 4. The probability that a server is busy, the customer's waiting time, and the customer's loss rate are minimized for classifications 2 and 4.

Keywords: Dual service stationTwo class customersHomogeneous and heterogeneous serversBase stock ordering policy

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Groundwater potential identification in Temcha catchment, Upper Blue Nile Basin, Ethiopia

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Abstract

Groundwater is an important source of freshwater around the globe and Ethiopia. Despite there is a huge demand for groundwater development for various purposes, there is a dearth of understanding about groundwater potential, occurrence, and distribution in Temcha catchment, Ethiopia. The purpose of this study was to identify the groundwater potential zones of the Temcha catchment using remote sensing, Multi-Criteria Decision Making (MCDM) and GIS techniques. The study considered various factors such as lithology, slope, geomorphology, soil, lineament density, rainfall, drainage density, and land use and land cover. The Analytical Hierarchical Process (AHP) was used to assign relative weights to these factors, and the GIS overlay analysis tool was utilized to determine groundwater potential zones (GWPZs). The findings indicated that the Temcha catchment has a very good potential for groundwater development. Accordingly, only 1.21% of the catchment area is falling under very poor groundwater potential zone; 19.16% in poor; 39.97% in moderate; 28.40% in good and 11.27% in very good groundwater potential zones. The groundwater inventory data for validation purposes also showed the presence of a large potential of groundwater resource for various development works in the area. The validation showed that 73.3% of the time the GWPZ map and the borehole inventory data matched well. Well drillers, water managers, future researchers, farmers and other decision-makers dealing with water resources development, use and management may find this paper useful.

Keywords: Analytical hierarchical process**,** Groundwater potential**,** multi-criteria decision making**,** Temcha catchment**,** Upper Blue Nile

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Delay in reaching health facilities for emergency obstetric care and associated factors among postpartum mothers at Bale zones, Ethiopia. A cross-sectional study

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Abstract

Maternal mortality occurs in developing nations as a result of inadequate health care, delayed medical attention and the inability to access medical facilities. The three-delay model was employed to determine the causes of maternal death. There was limited data on maternal delay in reaching health facilities for emergency obstetric care services in the study area. Therefore, the aim of this study was to assess the prevalence of delay in reaching health facilities for emergency obstetric care and associated factors among postpartum mothers at Bale and east Bale zones. An institutional-based cross-sectional study was conducted among 407 postnatal women from April 6 to May 6, 2022. A systematic sampling technique was used to select study participants. The data were collected electronically using an Open Data Kit and exported to SPSS window version 25 for cleaning and analysis. Both bivariable and multivariable analysis was done by using a binary logistic regression model to identify factors associated with delay in traveling for emergency obstetric care services. Statistical significance was declared at P-value < 0.05. In this study, the prevalence of delay in reaching health facilities during emergency obstetric care was 38.1% (95%CI: 33.3, 43). The following factors showed significant association with delay in reaching health facilities during emergency obstetric care: Average monthly income (AOR = 1.87; 95% CI: 1.12, 3.14), distance (AOR = 4.35; 95% CI: 2.65, 7.14), a referral from other health facilities (AOR = 1.77; 95% CI: 1.01, 3.11) and delay one (AOR = 2.9; 95% CI: 1.7, 4.93). This study showed that the prevalence of delay in reaching health facilities for emergency obstetric care services in the study area was high. Promoting road accessibility and transport mechanisms and strengthening referral mechanisms shall be emphasized.

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Linear modeling of zonal level crop production in Ethiopia

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Abstract

Accounting for zonal-level variations and identifying factors that have linear effects on crop production help to make better decisions and plan new policies for effective crop production and food security. The main objective of this study is to identify potential subsets of covariates and estimate their linear effects on crop production. A linear mixed effects model (random--intercept) is used on agricultural sample survey data for Meher seasons from 2012/13 to 2019/20 to explore and identify the best variance-covariance structure for the longitudinal data on 90 zones with eight repeated observations and different sampling weights. The minimum, mean, and maximum crop production by farmers across the country are 1.616, 8.693, and 147.843 quintals, respectively, and about 98 % of farmers produced less than 25 quintals. There is a small rate of increase in mean and median crop production by farmers across the years, and the variability between zones is highest in the year 2019/20 and in the Somali region. The histogram, kernel density, and P–P plots suggested a common logarithm transformation on the crop production variable. Results from the data exploration and variance-covariance structure selection methods suggested a heterogeneous compound symmetry (CSH) structure. Covariates region, year, proportion of farmers who practice pure-agriculture and other-agriculture types, proportion of farmers who use any type of fertilizer, farmer's age, area used, farmer association crop production, indigenous seed used, improved seed used, UREA fertilizer used, other fertilizers used, and percentage of crop damaged are significant in linearly explaining/affecting log crop production, and among these area used, farmers association crop production, UREA fertilizer used, and indigenous seed used have relatively highest effect on log crop production. Zones Wolayita, North-Shewa (Am), West-Arsi, West-Welega, Dawro, and Guji are top/good performers while zones Southwest-Shewa, Waghimra, Guraghe, South-Omo, Keffa, North-Wello, South-Wello, and Eastern Tigray are bottom/poor performers in crop production. Model assumptions and influence diagnostics results suggested the linearity of the model and normality of random effects and residuals are not violated, even though some zones have influences on either model parameters, precisions of estimates of these parameters, and predicted values.

Keywords: Longitudinal**,** Variance covariance**,** Linear mixed models**,** Random intercepts**,** Crop production**,** Sample survey

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Nutritional response to water hyacinth (Eichhornia crassipes) challenges via blood biochemical profiles in goats and sheep

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Abstract

Eichhornia crassipes remains a significant threat to aquatic ecosystems and poses economic challenges globally. Interestingly, its high nutritional value and abundance in water bodies, making it a promising and cost-effective source of animal feed. The purpose of the study was to see how varying inclusion rates of E. crassipise affected the blood biochemical profiles of Doyogena sheep and Woyto-Guji goat local breeds. Twelve sheep and twelve goats were used in a 2*4 randomized crossover design with two species, four diets, and four phases (15-day adaptation plus 7-day experimental diets), and on the last day blood sample collected. The dietary treatments included E. crassipise (0, 25, 50, and 75%) as a substitute for commercial concentrate. The data were analyzed using SAS software tool PROC GLM, and Pearson's correlation coefficient between serum biochemical indices was computed. Results of AST, ALB, GLB, AST/ALT, and A/G showed significant ($P < 0.0001$), ALP ($P < 0.005$), and GLU ($P < 0.05$) differences between species of animals, except for ALT, CREAT, TP, and UREA. Sheep had higher values for AST, ALP, GLB, AST/ALT, CREAT, and UREA, except for A/G, ALB, ALT, and TP. Among treatments and treatment species interaction effect did not show variation in all studied parameters. Positive correlations were observed between ALT and AST, TP and ALB, and A/G and ALB, negative correlations were observed between ALT and AST/ALT, TP and A/G; GLB and A/G in sheep. Furthermore, positive correlations were observed between AST/ALT with ALT and AST and ALB with TP and A/G; however, negative correlations were observed between ALB with TP and A/G in goats. It was concluded that substituting E. crassipise with concentrate had no adverse effect on the serum biochemical profile.

Keywords: Biochemical profile**,** Doyogena sheep**,** Eichhornia crassipes**,** Woyto-guji goat

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Geotechnical Study for Assessing Slope Stability at the Proposed Weito Dam Site in Ethiopia: Implications for Environmental Sustainability and Resilience

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Abstract

There is a proposed dam at Weito in Ethiopia's Southern Nations Nationalities and People Regional State. This embankment-type dam primarily serves irrigation purposes. Weito's proposed dam's slope stability is the primary focus of this investigation. The objective is to assess the geological and geotechnical conditions influencing slope stability using the slope mass rating (SMR) classification system. This study examined various slope stability parameters. Uniaxial compressive strength, rock quality designation, joint condition, discontinuity spacing, joint orientation, and groundwater conditions were measured. An analysis of field data, including geological structures and lithology, was used to generate a structural discontinuity map. The slope mass rating was calculated to assess rock mass stability. The study area was examined for faults, joints, fractures, and shear zones during fieldwork. Schmidt hammer tests indicated a range of 10.5–50 MPa uniaxial compressive strength. Rock quality designation values were also within 72.5% to 95%. Additionally, the joint spacing of rocks varied from 3.95 cm to 47.5 cm. Rock mass ratings ranged from 39% to 62%. The study contributes to the understanding of the geological conditions at the Weito dam site and ensures the dam's safe design and construction.

Keywords: Ethiopia, geotechnical analysis, rock quality designation, slope stability, Weito proposed dam

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Visual impairment in Ethiopia: Systematic review and meta-analysis

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Abstract

WHO Prevention of Blindness Program launched ‘‘VISION 2020” in 1999 to reduce visual impairment and eradicate avoidable blindness by the year 2020. Ethiopia launched the “VISION 2020” initiative in 2002. This systematic review and meta-analysis aimed to present the national prevalence of visual impairment at the end of “VISION 2020”. Electronic search was conducted on the PubMed, SCOPUS, EMBASE, Web of Science, CINAHL, Google scholar databases for including articles. This systematic review and meta-analysis followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Endnote reference manager was used for downloading, organizing, and citing articles. Methodological quality was assessed using the Joanna Briggs Institute (JBI) quality appraisal tool for prevalence studies. Statistical analysis was done using the STATA™ software version 14. In this systematic review and meta-analysis, 18 studies involving 14,953 participants were included. The pooled prevalence of visual impairment in Ethiopia after correction for publication bias by Duval and Tweedie’s trim and fill analysis was estimated to be 6.24% (95% confidence interval [CI] = [2.66, 9.82]). The pooled prevalence of visual impairment among school children and adults in Ethiopia was 6.13% (95% CI = [4.27, 7.98]) and 19.89% (95% CI = [10.85, 28.93]), respectively. The most common causes of visual impairment in decreasing order of prevalence were refractive error, cataract, trachoma, glaucoma, and corneal opacity. Amblyopia was the cause of visual impairment among school-age child. The prevalence of visual impairment in Ethiopia was still significant at the end of “VISION 2020” program. Therefore, the program of “VISION 2020” should be extended and other large-scale programs were needed to reduce the prevalence of vision impairment in Ethiopia.

Keywords: Adult, Ethiopia**,** meta-analysis**,** school age child**,** systematic review**,** VISION 20, visual impairment

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Spatial variation and predictors of composite index of HIV/AIDS knowledge, attitude and behaviours among Ethiopian women: A spatial and multilevel analyses of the 2016 Demographic Health Survey

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Abstract

Background: Although the dissemination of health information is one of the pillars of HIV prevention efforts in Ethiopia, a large segment of women in the country still lack adequate HIV/AIDS knowledge, attitude, and behaviours. Despite many studies being conducted in Ethiopia, they mostly focus on the level of women's knowledge about HIV/AIDS, failing to examine composite index of knowledge, attitude, and behaviour (KAB) domains comprehensively. In addition, the previous studies overlooked individual and community-level, and spatial predictors. Hence, this study aimed to estimate the prevalence, geographical variation (Hotspots), spatial predictors, and multilevel correlates of inadequate HIV/AIDS-Knowledge, Attitude, and Behaviour (HIV/AIDS-KAB) among Ethiopian women.

Methods: The study conducted using the 2016 Ethiopian Demographic and Health Survey data, included 12,672 women of reproductive age group (15-49 years). A stratified, two-stage cluster sampling technique was used; a random selection of enumeration areas (clusters) followed by selecting households per cluster. Composite index of HIV/AIDS-KAB was assessed using 11 items encompassing HIV/AIDS prevention, transmission, and misconceptions. Spatial analysis was carried out using Arc-GIS version 10.7 and SaTScan version 9.6 statistical software. Spatial autocorrelation (Moran's I) was used to determine the nonrandomness of the spatial variation in inadequate knowledge about HIV/AIDS. Multilevel . multivariable logistic regression was performed, with the measure of association reported using adjusted odds ratio (AOR) with its corresponding 95% CI.

Results The prevalence of inadequate HIV/AIDS-KAB among Ethiopian women was 48.9% (95% CI: 48.1, 49.8), with significant spatial variations across regions (global Moran's I = 0.64, p<0.001). Ten most likely significant SaTScan clusters were identified with a high proportion of women with inadequate KAB. Somali and most parts of Afar regions were identified as hot spots for women with inadequate HIV/AIDS-KAB. Higher odds of inadequate HIV/AIDSKAB was observed among women living in the poorest wealth quintile (AOR = 1.63; 95% CI: 1.21, 2.18), rural residents (AOR = 1.62; 95% CI: 1.18, 2.22), having no formal education (AOR = 2.66; 95% CI: 2.04, 3.48), non-autonomous (AOR = 1.71; 95% CI: (1.43, 2.28), never listen to radio (AOR = 1.56; 95% CI: (1.02, 2.39), never watched television (AOR = 1.50; 95% CI: 1.17, 1.92), not having a mobile phone (AOR = 1.45; 95% CI: 1.27, 1.88), and not visiting health facilities (AOR = 1.46; 95% CI: 1.28, 1.72).

Conclusion: The level of inadequate HIV/AIDS-KAB in Ethiopia was high, with significant spatial variation across regions, and Somali, and Afar regions contributed much to this high prevalence. Thus, the government should work on integrating HIV/AIDS education and prevention efforts with existing reproductive health services, regular monitoring and evaluation, and collaboration and partnership to tackle this gap. Stakeholders in the health sector should strengthen their efforts to provide tailored health education, and information campaigns with an emphasis on women who lack formal education, live in rural areas, and poorest wealth quintile should be key measures to enhancing knowledge. enhanced effort is needed to increase women's autonomy to empower women to access HIV/AIDS information. The media agencies could prioritise the dissemination of culturally sensitive HIV/AIDS information to women of reproductive age. The identified hot spots with relatively poor knowledge of HIV/AIDS should be targeted during resource allocation and interventions.

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Healthcare waste management practice and associated factors among healthcare workers in public healthcare facilities of Southwest Shewa Zone, Oromia regional state, Ethiopia

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Abstract

Poor management of waste can cause serious disease to healthcare personnel, cleaners, waste handlers, patients and the public. An observation-supported cross-sectional study was conducted to assess healthcare waste (HCW) management practice and professional, management and resource availability-associated factors among healthcare workers of 23 public health facilities in Southwest Shewa Zone, Oromia regional state, Ethiopia, 2021. A total of 424 health workers participated in this study. The level of proper healthcare waste management (HCWM) practice was 38.4%. Lack of knowledge on different methods of healthcare waste treatment (adjusted odds ratio (AOR): 0.101, 95% confidence interval (CI) (0.042, 0.242, $p < 0.05$)), lack of knowledge about the types of healthcare waste (AOR: 0.136, 95% CI (0.039, 0.481, $p < 0.05$)), lack of knowledge on the use of different colour-coded waste bin and safety box (AOR: 0.145, 95% CI (0.040, 0.520, $p < 0.05$)), and healthcare workers who had no training/orientation on HCWM practice (AOR: 0.396, 95% CI (0.245, 0.639, $p < 0.05$)) were less likely to practice effective HCWM compared to their counterparts. The current HCWM practices in studied health facilities was inadequate. Professional knowledge and availability of training were independently associated with HCWM practice. Therefore, regular orientation during employment and on-job training on HCWM practice, regular monitoring and supervision of HCWM are important. Further research should be conducted on the area of HCWM, and its associated environmental impacts by using more strong methods and wider health facilities.

Keywords: Healthcare waste**,** knowledge of healthcare workers**,** healthcare waste management practice**,** South West Shewa Zone

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Geotechnical and slope stability analysis in the landslide-prone area: A case study in Sawla – Laska road sector, Southern Ethiopia

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Abstract

Examining the factors underlying landslides and assessing the stability of slopes is crucial for reducing the negative impact of landslides on the environment and the lifespan of infrastructure. This study assessed certain slope portions along the Sawla to Laska Road to determine the factors contributing to landslides and identify the mechanisms and conditions that lead to slope failure. Slope stability analysis was conducted using the limit equilibrium method, and a range of laboratory tests were conducted following ASTM standards. The analysis has shown that the three slope portions, specifically sections 1, 2, and 3, had distinct shear strength characteristics, as shown by variations in their cohesion and internal friction angle values. The average values for cohesion were 19.24, 10.41, and 12.9, respectively, while the internal friction angle values ranged from 11.32 to 17.8 for slope section three, 18.96 to 21.12 for slope section two, and 30.08 to 37.26 for slope section one. The limit equilibrium method was utilized to compute the safety factor of slopes. Five methods were employed to evaluate the safety factor: the ordinary method, Bishop method, Janbu method, Spencer method, and Morgenstern-Price method while considering three groundwater conditions (GWT at great depth, GWT at half of the slope, and GWT on the surface). Only slope section one exhibited a slightly stable safety factor that exceeded one under dry conditions. The slope-mass rating analysis showed that rock slopes one and two were deemed stable under class II, rock slopes three and four were partially stable under class III, and rock slope five was unstable under class IV. A slope mass range of 78 to 79 indicates excellent to very good rock mass quality and high stability potential for RSs1. In contrast, RSs5 shows a wide SMR range from 7 to 57, indicating a spectrum of very poor to fair to good quality rock mass and an associated range of stability from extremely low to moderate. RSs2 and RSs3 fall within the SMR range of 71.1–72 and 49.9–55.9, respectively, indicating good to fair rock mass quality with varying degrees of stability potential. Last, RSs4, with an SMR range of 39.6–45.1, shows poor rock mass quality and substantial stability concerns. RSs1 has a UCS of 28.68 MPa, indicating a "Medium strong" classification, and it belongs to the lithology type of "Trachyte." RSs2 showcases a higher UCS value of 32.25 MPa, similarly classified as "Medium strong," and is also identified as "Trachyte." RSs3, with a UCS of 28.83 MPa, falls under the "Medium strong" classification and is categorized as "Basalt." In contrast, RSs4 demonstrates a lower UCS of 18.41 MPa, leading to a "Weak" classification associated with the lithology type "Basalt." Lastly, RSs5 presents a UCS of 25.77 MPa, classified as "Medium strong," and shares the lithology type of "Basalt." The study identified that the landslide types in the study area were rockfall, earth flow, and soil/rock slides. The factors contributing to landslides in the study area were slope steepness, weathering, groundwater, and rainfall.

Keywords: Landslides, Slope stability analysis, Sawla-Laska road, Ethiopia, Geotechnical investigation

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Evaluating the future total water storage change and hydrological drought under climate change over lake basins, East Africa

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Abstract

Climate change led an increase in the frequency of severe droughts, the effects of which are exacerbated by a lack of water storage. Despite increasing research on global-scale total water storage (TWS) change and drought prediction, basin-scale long-term hydrological drought, TWS change, and El Nino–Southern Oscillation (ENSO) influence in East Africa (EA) remain unexplored. In this paper, we used multiple approaches, of ensemble machine learning (ML) and weighted averaging, to conduct a basin-scale exploratory analysis of future hydrological drought and TWS change for the period 2025–2099. Climate change will affect future hydrological conditions in the basins, with maximum severity values of −90.3, −726.6, and −2567.7 Gt in the Tana, Turkana, and Victoria basins, respectively, under RCP6.0. Similarly, we found maximum severities of −187.5 and −277.7 Gt in the Abaya-Chamo and Tanganyika basins, respectively, under RCP 2.6. The most severe El Nino drought and exceptional La Nina conditions in the basins were found under both RCP scenarios. To ensure future water security in EA, sustainable water resource management strategies that can mitigate the impacts of extreme climate events in the future are urgently needed.

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Integrated statistical and graphical non-parametric trend analysis of annual and seasonal rainfall in the Shire River Basin, Malawi

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Abstract

This study integrates purely statistical methods of Mann–Kendall (MK) and Spearman rho (SMR) with statistical-graphical methods of Onyutha trend (OT) test and innovative trend analysis (ITA) to examine annual and seasonal rainfall variations at 12 stations across the Shire River Basin (SRB) during 1976–2005. The results reveal a general decreasing trend for annual rainfall throughout the basin. At seasonal scale, the following trends were observed: an increase for the December-January–February (DJF) season, especially in the southern portion of the basin; a decrease for the March–April-May (MAM) and June-July–August (JJA) seasons; and inconclusive results for the September–October-November (SON) season. Despite nearly all time series indicating consistent trend direction as established by the four tests, the ITA identified the most significant rainfall patterns on both annual and seasonal basis. The performance abilities for the MK, SMR, and OT tests demonstrated the closest agreement at the verified significant level. In addition to the monotonic trend results obtained statistically, sub-trends are visually distinguished using the graphical features of the OT and ITA approaches. For the former, changes are seen as step jumps in the mean of the data, and for the latter, trends regarding high and low rainfall clusters are evaluated, hence offering more details regarding rainfall variability, such as the SRB's sensitivity to both floods and droughts. Thus, the completely different aspects offered by the visually oriented methods complement the purely monotonic trend detection methods.

Irrigation and Drainage
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73 (2024)

Field evaluation of haricot bean (Phaseolus vulgaris L.) response to supplemental irrigation in Arba Minch area: Southern Ethiopia

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Abstract

This study aimed to determine the impact of supplemental irrigation (SI) on the water use efficiency and yield of haricot beans during the growing seasons from 2020 to 2022. Six treatments were tested, including rain-fed/no irrigation (T1), full irrigation throughout the season (T2), SI at vegetative, flowering and pod formation (T3), SI at emergence, vegetative and pod formation (T4), SI at emergence, flowering and grain filling (T5) and SI at emergence, pod formation and grain filling (T6), with three replications arranged in a randomized complete block design. The results showed that T2 significantly affected all growth and yield parameters except pod length and harvest index. However, T3 provided better water use efficiency and more acceptable yield reduction than T2. Thus, applying SI during the vegetative, flowering and pod formation phases proves to be more efficient for the production of haricot beans in the area under study as it leads to better economic returns and water productivity. In summary, irrigating the crop during the critical growth stages would result in water conservation and improved water productivity. Further research is recommended on SI to improve water use efficiency across different locations and seasons.

Heliyon
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10 (2024)

Male partners involvement in their wives' antenatal care and its associated factors in southern Ethiopia. A community-based cross-sectional study

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Abstract

Background: Involvement of male partners in antenatal care (ANC) is an effective approach to improve maternal and child health outcomes. It also enhances maternal healthcare utilization as males prevails decision-making regarding healthcare utilization in most developing countries including Ethiopia. Despite the acknowledged importance of male partners involvement, there is no research data in the study area. Therefore, the purpose of this study is to assess the status of male partners' involvement in antenatal care and associated factors in Chencha town, which is found in southern region of Ethiopia.
Methods: The study adopted a community-based cross-sectional design from April 1–30, 2022, among 560 male partners in Chencha Town. To collect data, we use a structured, pretested and interviewer-administered questionnaire. The study participants were selected using a simple random sampling method. Analysis of data was performed using the statistical package for social sciences (SPSS) version 25. Descriptive statistics including mean, frequency, and percentage were used to summarize pertinent characteristics of study participants. Both bivariable and multivariable logistic regression analyses were carried out to detect the association between the independent and outcome variables. The statistical significance was set at $P < 0.05$ in the final model.
Result: The study found that 57% (95% CI: 53%–61%) of male partners were involved in antenatal care. Age 20 to 29 (AOR = 2.60, 95%CI:1.26, 5.37), more than secondary educational level (AOR = 2.04, 95%CI:1.08, 3.88), being government workers (AOR = 2.03, 95%CI:1.12, 3.67), exposure to information on male involvement during antenatal care (AOR = 4.37, 95%CI: 2.77, 6.91), and males' knowledge about pregnancy danger sign (AOR = 2.55, 95%CI: 1.62, 4.02) were factors positively associated with male partner involvement in antenatal care.
Conclusion: The prevalence of male partner involvement in antenatal care was relatively high, but it still needs to be improved to reach acceptable level. The involvement thrives among those aged 20–29 years, who have been exposed to information on male involvement in antenatal care, have higher education levels, government employees, and are aware of pregnancy danger signs. These factors can be used to target interventions that aim to increase male involvement in antenatal care, which helps to improve the health of both mothers and children.

Keywords: Male partner, Antenatal care, Involvement, Risk factors, Ethiopia

Journal of Hydrology
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635 (2024)

Threshold-based flood early warning in an urbanizing catchment through multi-source data integration: Satellite and citizen science contribution

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Abstract

An effective flood early warning system is vital to take action to save lives and protect properties in urban areas which are increasingly prone to flooding. Despite substantial progress in flood early warning systems, limited available and accessible data often impede their advancement and reliability. Engaging communities affected by flooding can help address data and information gaps in flood early warning systems, facilitated by appropriate methods. This study developed and evaluated a flood threshold combination method to support a community-based flood early warning system in the Akaki catchment, home to Addis Ababa, the capital city of Ethiopia. Various flood threshold combinations were formulated, calibrated and validated by integrating multiple sources of data: rainfall, antecedent precipitation index estimates, Sentinel-1 Synthetic Aperture Radar satellite time series of flood extent, long-term simulated streamflow, citizen science data, river water level and three days lead-time numerical weather prediction rainfall forecast. During validation, the rainfall and river water level threshold combination outperformed other threshold combinations with probability of detection, false alarm ratio, and critical success index estimates of 0.74, 0.18 and 0.63, respectively. The flood threshold combination showed high detection performance for most flooding conditions. Flood forecasts with a 1-day lead-time exhibited a high likelihood in detecting historical severe flood events. The study provides a tested methodology for selecting suitable flood threshold-combinations, enhance the engagement of citizen scientists in a community–based flood early warning system in urban communities.

PLOS Global Public Health
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4 (2024)

Assessing the influence of COVID-19 lockdown measures on cognition and behavior in school age children in Arba Minch Health and Demographic Surveillance site, Southern Ethiopia: A cross-sectional study

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Abstract

Ethiopian schools were closed for nearly 40 weeks as a measure to control the COVID-19 pandemic. The objective of the study was to evaluate the role of COVID-19 pandemic's restrictive measures on cognition and behavioral difficulties of schoolchildren in Arba Minch Health and Demographic Surveillance Site. Two cross-sectional surveys were conducted in November 2019 (pre-COVID-19-lockdown) and November 2020 (post-COVID-19 lockdown). Data were collected both at the school and homes of the children. Cognitive development of the children was assessed using digit span, Raven's coloured progressive matrices (RCPM) and Visual search using cancellation task. Behavioral difficulties score of the children was assessed using Strengths and Difficulties Questionnaire. Analysis of covariance (ANCOVA) was used to compare between the cognition outcomes and behavioral difficulties score pre- and post-COVID-19-lockdown. In a sub-group of children who provided data in both surveys, the difference in cognitive and behavioral outcomes was tested using a mixed effect model. Compared to the pre-COVID-19-lockdown, schoolchildren post-COVID-19-lockdown scored lower in the standardized performance index for the visual search task, which measures attention (0.27 SD, 95% confidence intervals (95%CI): −0.40, −0.13). However, they scored higher by 0.26 SD (95%CI: 0.13, 0.40) and 0.36 SD (95%CI: 0.22, 0.49) in digit span and RCPM, respectively, measuring working memory and non-verbal intelligence. There was no significant difference in total difficulties score between pre- and post-COVID-19-lockdown (0.01 SD, 95%CI: -0.12, 0.15). The subgroup analysis showed a significant increase in digit span among children post-COVID-19-lockdown while the other domains did not show a significant change. Factors contributing to the improvement of children's cognitive domains while away from the school environment should be explored and utilized to enhance child development. This study was registered at clinicaltrials.gov as NCT04137354 on October 14, 2019.

Journal of Water and Climate Change
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15 (2024)

Predicting sediment yield and locating hotspot areas in the Hamesa watershed of Ethiopia for effective watershed management

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Abstract

Locating hotspots and assessing sediment accumulation are crucial aspects of water body management. The primary aim of this study was to examine sediment yield in the Hamesa watershed utilizing the Soil and Water Assessment Tool (SWAT) model and to propose best management practices. The basin was divided into 15 sub-basins, with 103 hydrological response units at the outlet of the Hamesa watershed. Simulation was conducted using meteorological and spatial data. Monthly streamflow and sediment data were calibrated for the period from 2000 to 2010 and validated for the period from 2011 to 2015 using the SWAT Uncertainty Calibration Program Sequential Uncertainty Fit (SUFI-2). Model performance was assessed using metrics including the coefficient of determination (R2), Nash–Sutcliffe model efficiency, observation standard deviation ratio, and percentage bias, which demonstrated very good results in both calibration and validation periods. The average annual sediment production in the Hamesa watershed was estimated at 9,800 t/year. Nine out of 15 affected sub-basins were categorized as producing moderate to very high sediment content (4.54–12.82 t/ha/year) and were chosen for sediment reduction scenarios. This study will play a significant role in managing impacted watersheds affected by soil erosion.

Keyword: Hamesa watershed, reduction scenario, sediment yield, SWAT model

BMJ Open
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14 (2024)

Incidence, contributing factors and outcomes of birth injury among newborns in Africa: a systematic review of quantitative evidence protocol

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Abstract

Introduction: Birth injury is a significant public health problem in Africa, with a high incidence and associated mortality and morbidity. Systematic reviews that indicate the incidence, contributing factors and outcomes of birth injury in Africa provide valuable evidence to policy-makers and programme planners for improving prevention and treatment strategies. Therefore, this review is aimed to evaluate the incidence, contributing factors and outcomes of birth injury among newborns in Africa.

Methods and analysis: The data will be searched and extracted from JBI Database, Cochrane Database, MEDLINE/PubMed, CINAHL/EBSCO, EMBASE, PEDro, POPLINE, Proquest, OpenGrey (SIGLE), Google Scholar, Google, APA PsycInfo, Web of Science, Scopus and HINARI. Unpublished studies and grey literature will be searched from different sources. This systematic review will include quantitative observational studies, registry and census data, and experimental studies that report on the prevalence or incidence in Africa from 1 January 1990 to 30 September 2023. The Joanna Briggs Institute (JBI) quality appraisal checklist will be used to select eligible studies. Two researchers will independently appraise and extract the data from included studies and resolve discrepancies through discussion. Heterogeneity will be assessed using forest plots and the I2 statistic. If substantial heterogeneity is present, a random-effects model will be used to pool the data. Subgroup analyses will be used to explore the potential sources of heterogeneity. Publication bias will be assessed using funnel plots and Egger's regression test. The software package used to conduct the meta-analysis will be JBI SUMARI. An association will be considered significant if the $p<0.05$.

Ethics and dissemination: Ethical clearance is not needed for this systematic review and the results will be shared with relevant stakeholders to maximise reach and impact.

Mathematics and Statistics
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12 (2024)

Emerging Frameworks: 2-Multiplicative Metric and Normed Linear Spaces

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Abstract

This new study helps us understand 2-multiplicative or product metric spaces and normed linear spaces (NDLS) better than before, going beyond what we al-ready know. Seeing a gap in existing research, our main aim is to thoroughly explore the natural properties of 2-multiplicative NDLS. Using a careful approach that looks at continuity, compactness, and convergence properties, our research finds results that point out the special features of these spaces and show the connections between their algebraic and topological sides. The importance of our findings goes beyond just theory, affecting practical uses and encouraging collaboration across different fields. Our research builds a strong base in mathematical analysis, giving useful insights for making nuanced decisions. Acknowledging some limitations in our study opens the door for future improvements, creating promising paths for further exploration. In real-world terms, what we learn from this thorough study not only informs but also changes how we make decisions in mathematical analysis. In research community, our work makes people appreciate the connection between algebraic and topological spaces more deeply, sparking curiosity and inspiring future research. In essence, this research acts as a guiding light, showcasing the unique features of 2-multiplicative NDLS and paving the way for a deeper understanding of mathematical structures and their flexible uses in both theory and practice. Furthermore, our exploration motivates future researchers to dive into the details of 2-multiplicative NDLS, expanding their knowledge and looking into broader implications in the field of mathematical analysis.

Keywords: 2-multiplicative, 2-multiplicative Convergent, 2- multiplicative Open Ball, 2-multiplicative Continuous

Journal of Parasitic Diseases
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48 (2024)

Assessment of the selected hematological profiles among malaria and Schistosoma mansoni co-infected patients, Northwest Ethiopia

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Abstract

Malaria and schistosomiasis are infectious diseases that cause hematological profiles abnormalities. Malaria and Schistosoma mansoni co-infection causes exacerbation of health consequences and co-morbidities. The aim of this study was to assess the selected hematological profiles among malaria and S. mansoni co-infected patients at Dembiya Selected Health Institutions. An institutional-based comparative cross-sectional study was conducted from March 30 to August 10, 2022. A total of 140 individuals were enrolled in the study using a convenient sampling technique. Wet mount and Kato Katz technique were conducted to detect S. mansoni in Stool sample. Blood films were prepared for the detection of plasmodium. The data was coded and entered into EpiData version 3.1 before being analyzed with SPSS version 25. A P-value of less than 0.05 was considered statistically significant. Mean of WBC, neutrophil, lymphocyte, eosinophil, RBC, hemoglobin, and hematocrit [4.IU/L,2.2 IU/L, 1.4 IU/L, 0.1 IU/L, 3.13 IU/L, 9.5 g/dL, and 28.7%, resepectively] in co-infected were significantly lower than [7.5 IU/L, 4.6 IU/L, 2.1 IU/L, 0.38 IU/L, 4.8 IU/L, 14.6 g/dL, and 43.7%, resepectively] in the healthy control participants. Mean of RBC, hemoglobin, and hematocrit [3.13 IU/L, 9.5 g/dL, 28.7%, resepectively] in co-infected were significantly lower compared to [3.8 IU/L, 11.5 g/dL, 33.9%, resepectively] in the malaria monoinfected participants and [3.7 IU/L,11.5 g/dL, 33.6%, resepectively] in the S. mansoni monoinfected participants. The result of hematological profiles in healthy participants had no significant difference compared to light, moderate and heavy S. mansoni infection intensity in coinfection. The number of S. mansoni eggs per gram of stool had been negatively correlated with hematological profiles of co-infected participants except lymphocyte and monocyte which correlated positively. Hematological profiles status in coinfection were significantly altered compared to malaria monoinfection, S. mansoni monoinfection, and healthy participants. Therefore, hematological tests should be used to monitor and manage coinfection related complications, and to reduce coinfection associated morbidity and mortality.

Keywords: Hematological profile, Malaria, *S. mansoni*, Co-infection, Dembiya, Ethiopia

BMJ Open
DOI: https://doi.org/10.1136/bmjopen-2023-081904
14 (2024)

Barriers and enablers of quality high-acuity neonatal care in sub-Saharan Africa: protocol for a synthesis of qualitative evidence

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Abstract

Introduction: Neonatal intensive care unit (NICU) in sub-Saharan Africa face limited resources and systemic challenges, resulting in poorer quality care, higher infant mortality, and dissatisfaction among both patients and healthcare workers. This review aims to bridge the knowledge gap by identifying and analysing the key barriers and enablers affecting quality care, informing interventions to improve patient outcomes and overall NICU effectiveness in this critical region.

Methods and analysis: This systematic review will search and gather data from a variety of databases, including JBI Database, Cochrane Database, MEDLINE/PubMed, CINAHL/EBSCO, EMBASE, PEDro, POPLINE, Proquest, OpenGrey (SIGLE), Google Scholar, Google, APA PsycINFO, Web of Science, Scopus and HINARI. The review will also include unpublished studies and grey literature from a variety of sources. This review will only include qualitative and mixed-methods studies that explore the barriers and enablers of quality care for high-acuity neonates using qualitative data collection and analysis methods. The Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Qualitative Research will be used by two independent reviewers to critically appraise the eligible studies. Any disagreements that arise will be resolved through discussion. Qualitative research findings will be pooled using the meta-aggregation approach in QARI software, where possible. Only unequivocal and credible findings will be included in the synthesis. If textual pooling is not possible, the findings will be presented in narrative form.

Ethics and dissemination: This systematic review does not require ethical clearance, and the findings will be disseminated to relevant stakeholders to ensure the widest possible outreach and impact.

SAGE Open
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14 (2024)

Teacher-Students Collaboration: Using Guided-Writing Instruction to Assist Learners with Writing Difficulties and Low Motivation to Write

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Abstract

Despite the complex nature of writing, many students are hesitant to tackle difficult subjects. To help those facing writing difficulties and increase their motivation, this study examines the effect of teacher-student collaboration through guided-writing instruction. A two-group quasi-experimental design was used with a pre-treatment-post-tests format. The participants in this study were 50 11th-grade students (aged 17–24; 28 male and 22 female) from Data Sana Memorial School in Wolaita Sodo City, South Ethiopia. Writing skill tests and questionnaires about writing motivation were used to collect data, which was then analyzed using independent smples t-test analysis to determine the effectiveness of guided-writing on students' writing improvement and motivation. Although the pre-test results did not show a significant difference between the mean scores of the control and experimental groups, the post-test results of the writing skill tests showed a statistically significant difference between the means of the experimental and control groups. Additionally, the results of the writing motivation questionnaires revealed that the mean score of the experimental group increased significantly in the post-test compared to the pre-test. These findings demonstrate the usefulness of guided-writing instruction in assisting students with writing difficulties and motivation. In conclusion, the findings have implications for teaching writing through guided-writing instruction and it is recommended to help students struggling with writing and a lack of motivation. Moreover, further research into writing instruction through guided-writing in various ecological aspects and grade levels is required.

Keywords: teacher-students instruction, guided-writing instruction, writing ability, writing difficulty, writing motivation

International Journal of Climate Change Strategies and Management
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16 (2024)

Livelihood vulnerability of Borana pastoralists to climate change and variability in Southern Ethiopia

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Abstract

Purpose: The purpose of this study results and recommendations will have a paramount significance for policymakers, policy advocates, development planners and practitioners who may be in need of such information for reconsideration, evaluation and inclusion into their respective development and humanitarian programming and operational strategies. Above all, the study result has further provided the local community with viable adaptation strategies to climate-induced changes in the study area.

Design/methodology/approach: This study was conducted to measure the livelihood vulnerability of Borana pastoralists to climate change and variability in southern Ethiopia. Pastoralists' households were sampled using multistage sampling techniques. A total of 27 socio-economic and biophysical indicators were used to reflect vulnerability components: adaptive capacity, exposure and sensitivity. Principal component analysis was used to develop weights for indicators and to produce livelihood vulnerability index to classify households according to their level of vulnerability. Ordinal logistic regression was used to identify the determinants of vulnerability to climate-induced stresses.

Findings: The results showed that 24.4% of households were highly vulnerable, 60.3% were moderately vulnerable and 15.3% of households were less vulnerable to climate-induced stresses. Factor estimates of the logistic model further revealed that early warning information, bush encroachment, coping strategy, temperature, drought frequency, provision of humanitarian services and food shortage during the normal season of the year have a significant influence on vulnerability in the study area.

Social implications: The study's results and recommendations will be of great significance to policymakers, development planners, and practitioners who require such information for reconsideration, evaluation, and inclusion in their respective development and humanitarian program and operational strategies. Most importantly, the study's findings have provided the local community with practical adaptation strategies to climate-induced changes in the study area. Originality/value: The study explored pastoralist perception of climate change and variability and measured the livelihood vulnerability of pastoralists' households to climate change and variability and finally investigated viable adaptation and coping strategies in the study area.

Keywords: Borana pastoralist, Climate variability, Drought, Livelihood vulnerability, Vulnerability index

Earth (Switzerland)
DOI: https://doi.org/10.3390/earth5010002
5 (2024)

Assessing Groundwater Recharge in the Wabe River Catchment, Central Ethiopia, through a GIS-Based Distributed Water Balance Model

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Abstract

The utilization of groundwater has emerged as an indispensable asset in facilitating economic advancement, preserving ecological integrity, and responding to the challenges posed by climate change, especially in regions characterized by aridity and semi-aridity. The sustainable management of water resources requires an assessment of the geographical and temporal patterns of groundwater recharge. The present study employed the GIS-based WetSpass-M model to model the water balance components by utilizing hydro-meteorological and biophysical data from the Wabe catchment, which spans an area of 1840 km2 in central Ethiopia, for a long time. The objective of this study was to assess the long-term average annual and seasonal groundwater recharge for the catchment area utilizing the WetSpass-M model. The input data were collected through remote sensing data and surveys in the field. The model was employed to gain insights into the process of groundwater recharge in a particular region and to facilitate effective management, prudent utilization, and sustainable planning of water resources in the long run. Water balance components were estimated using seasonal fluctuations in evapotranspiration, surface runoff, and groundwater recharge. The Wabe catchment's summer, winter, and mean long-term yearly groundwater recharge were determined to be 125.5 mm, 78.98 mm, and 204.51 mm, respectively. The model indicates that summer seasons account for 86.5% of the mean annual precipitation, while winter seasons account for 13.5%. On the other hand, the groundwater system percolates 14.8% of the total annual rainfall (1374.26 mm). While evapotranspiration accounts for 51% of total precipitation and surface runoff accounts for 34.1%, the Wabe catchment's mean annual evapotranspiration and surface runoff values are simulated at 701.11 mm and 485.58 mm, respectively. The findings suggest the use of the WetSpass-M model to precisely calculate the water balance components within the Wabe catchment.

Keywords: Ethiopia; groundwater recharge; Wabe catchment; water balance components; WetSpass-M model

Practical Laboratory Medicine
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39 (2024)

Hematological predictors of preeclampsia among pregnant women attending ante-natal clinic at Arba Minch General Hospital, South Ethiopia: A comparative cross-sectional study

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Abstract

Background: Preeclampsia is a kind of pregnancy-related hypertension that affects 5.47 % of pregnancies in Ethiopia and 18.25 % of pregnant women who visit Arba Minch public health facilities for antenatal care. This study sought to identify hematological preeclampsia markers in pregnant women who received prenatal care at Arba Minch General Hospital.
Methodology: An institution-based comparative cross-sectional study was done from July 22 to October 30, 2021 at Arba Minch General Hospital. A total of 136 pregnant women were included in the study (46 with preeclampsia and 90 without preeclampsia). Epidata version 4.4. was used to enter data, and SPSS version 25.0 and Stata version17 were used for analysis. An independent sample t-test was used to examine the hematological parameter differences between study groups. Potential hematological markers were determined using receiver operating characteristic (ROC) analysis of the area under the curve (AUC). Statistical significance was defined if P value less than 0.05.
Results: A total of 136 pregnant women were studied. The complete blood count analysis showed that there were means differences in Red Cell Distribution (RDW) ($p < 0.036$), neutrophil-to-lymphocyte ratio (NLR) ($p < 0.016$) and relative lymphocyte count (Lymp%) ($p < 0.047$). The ROC analysis of the AUC for RDW, NLR and Lymp% resulted in 0.607, 0.609, 0.600 respectively.
Conclusion: RDW, NLR and Lymphocyte count could be potential candidate tools for the diagnosis and screening of preeclampsia. However, the robustness of the markers should be tested with prospective studies assessing changes present in each trimester.

Keywords: Hematological parametersPredictorsPreeclampsiaPregnant women

The Lancet
DOI: https://doi.org/10.1016/S0140-6736(24)00367-2
403 (2024)

Global burden of 288 causes of death and life expectancy decomposition in 204 countries and territories and 811 subnational locations, 1990–2021: a systematic analysis for the Global Burden of Disease Study 2021

GBD 2021 Causes of Death Collaborators

Abstract

Background: Regular, detailed reporting on population health by underlying cause of death is fundamental for public health decision making. Cause-specific estimates of mortality and the subsequent effects on life expectancy worldwide are valuable metrics to gauge progress in reducing mortality rates. These estimates are particularly important following large-scale mortality spikes, such as the COVID-19 pandemic. When systematically analysed, mortality rates and life expectancy allow comparisons of the consequences of causes of death globally and over time, providing a nuanced understanding of the effect of these causes on global populations. **Methods:** The Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) 2021 cause-of-death analysis estimated mortality and years of life lost (YLLs) from 288 causes of death by age-sex-location-year in 204 countries and territories and 811 subnational locations for each year from 1990 until 2021. The analysis used 56 604 data sources, including data from vital registration and verbal autopsy as well as surveys, censuses, surveillance systems, and cancer registries, among others. As with previous GBD rounds, cause-specific death rates for most causes were estimated using the Cause of Death Ensemble model—a modelling tool developed for GBD to assess the out-of-sample predictive validity of different statistical models and covariate permutations and combine those results to produce cause-specific mortality estimates—with alternative strategies adapted to model causes with insufficient data, substantial changes in reporting over the study period, or unusual epidemiology. YLLs were computed as the product of the number of deaths for each cause-age-sex-location-year and the standard life expectancy at each age. As part of the modelling process, uncertainty intervals (UIs) were generated using the 2·5th and 97·5th percentiles from a 1000-draw distribution for each metric. We decomposed life expectancy by cause of death, location, and year to show cause-specific effects on life expectancy from 1990 to 2021. We also used the coefficient of variation and the fraction of population affected by 90% of deaths to highlight concentrations of mortality. Findings are reported in counts and age-standardised rates. Methodological improvements for cause-of-death estimates in GBD 2021 include the expansion of under-5-years age group to include four new age groups, enhanced methods to account for stochastic variation of sparse data, and the inclusion of COVID-19 and other pandemic-related mortality—which includes excess mortality associated with the pandemic, excluding COVID-19, lower respiratory infections, measles, malaria, and pertussis. For this analysis, 199 new country-years of vital registration cause-of-death data, 5 country-years of surveillance data, 21 country-years of verbal autopsy data, and 94 country-years of other data types were added to those used in previous GBD rounds.
Findings: The leading causes of age-standardised deaths globally were the same in 2019 as they were in 1990; in descending order, these were, ischaemic heart disease, stroke, chronic

obstructive pulmonary disease, and lower respiratory infections. In 2021, however, COVID-19 replaced stroke as the second-leading age-standardised cause of death, with 94·0 deaths (95% UI 89·2–100·0) per 100 000 population. The COVID-19 pandemic shifted the rankings of the leading five causes, lowering stroke to the third-leading and chronic obstructive pulmonary disease to the fourth-leading position. In 2021, the highest age-standardised death rates from COVID-19 occurred in sub-Saharan Africa (271·0 deaths [250·1–290·7] per 100 000 population) and Latin America and the Caribbean (195·4 deaths [182·1–211·4] per 100 000 population). The lowest age-standardised death rates from COVID-19 were in the high-income super-region (48·1 deaths [47·4–48·8] per 100 000 population) and southeast Asia, east Asia, and Oceania (23·2 deaths [16·3–37·2] per 100 000 population). Globally, life expectancy steadily improved between 1990 and 2019 for 18 of the 22 investigated causes. Decomposition of global and regional life expectancy showed the positive effect that reductions in deaths from enteric infections, lower respiratory infections, stroke, and neonatal deaths, among others have contributed to improved survival over the study period. However, a net reduction of 1·6 years occurred in global life expectancy between 2019 and 2021, primarily due to increased death rates from COVID-19 and other pandemic-related mortality. Life expectancy was highly variable between super-regions over the study period, with southeast Asia, east Asia, and Oceania gaining 8·3 years (6·7–9·9) overall, while having the smallest reduction in life expectancy due to COVID-19 (0·4 years). The largest reduction in life expectancy due to COVID-19 occurred in Latin America and the Caribbean (3·6 years). Additionally, 53 of the 288 causes of death were highly concentrated in locations with less than 50% of the global population as of 2021, and these causes of death became progressively more concentrated since 1990, when only 44 causes showed this pattern. The concentration phenomenon is discussed heuristically with respect to enteric and lower respiratory infections, malaria, HIV/AIDS, neonatal disorders, tuberculosis, and measles.

Interpretation: Long-standing gains in life expectancy and reductions in many of the leading causes of death have been disrupted by the COVID-19 pandemic, the adverse effects of which were spread unevenly among populations. Despite the pandemic, there has been continued progress in combatting several notable causes of death, leading to improved global life expectancy over the study period. Each of the seven GBD super-regions showed an overall improvement from 1990 and 2021, obscuring the negative effect in the years of the pandemic. Additionally, our findings regarding regional variation in causes of death driving increases in life expectancy hold clear policy utility. Analyses of shifting mortality trends reveal that several causes, once widespread globally, are now increasingly concentrated geographically. These changes in mortality concentration, alongside further investigation of changing risks, interventions, and relevant policy, present an important opportunity to deepen our understanding of mortality-reduction strategies. Examining patterns in mortality concentration might reveal areas where successful public health interventions have been implemented. Translating these successes to locations where certain causes of death remain entrenched can inform policies that work to improve life expectancy for people everywhere.

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Spatial and seasonal groundwater quality assessment for drinking suitability using index and machine learning approach

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Abstract

Spatial and seasonal evaluation and monitoring of groundwater (GW) quality is essential for the sustainable management of this priceless resource and the provision of safe drinking water. Nevertheless, GW quality appraisal was not given due attention in the current study area (flat terrain part of the Tana sub-basin). This study sought to assess the seasonal and regional physicochemical GW quality parameters for drinking appropriateness using the drinking water quality index (DWQI) and support vector machine (SVM). The main cations in both the dry and wet study seasons were, in decreasing order, Na+, Ca2+, Mg2+, K+, and Fe2+, according to the results. Conversely, the main anions were HCO3−, CO32−, Cl− or NO3−, SO42− and PO43−, ordered from higher to lower. During the two research seasons, Ca–HCO3 and Na–HCO3 were the predominant water types based on Piper diagram results. Reverse ion exchange and evaporation were the principal hydrogeochemical processes that control the hydrogeochemistry identified by Durov and Gibbs diagrams, respectively. Excellent GW quality class for drinking was demonstrated by the majority of geographical and seasonal DWQI readings over the two seasons. Nevertheless, during the rainy season, there was a noticeable decline in the GW quality condition around the northern shores of Lake Tana. Therefore, it is advised to implement comprehensive GW quality protection measures and improve system management to mitigate pollution to reduce health hazards in the examined region.

Keywords: Drinking suitability, Drinking water quality index, Hydrogeochemical facies, Physicochemical characteristics, Support vector machine, Dry and wet seasons

Environmental Research
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242 (2024)

Groundwater potential delineation using geodetector based convolutional neural network in the Gunabay watershed of Ethiopia

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Abstract

Groundwater potential delineation is essential for efficient water resource utilization and long-term development. The scarcity of potable and irrigation water has become a critical issue due to natural and anthropogenic activities in meeting the demands of human survival and productivity. With these constraints, groundwater resource is now being used extensively in Ethiopia. Therefore, an innovative convolutional neural network (CNN) is successfully applied in the Gunabay watershed to delineate groundwater potential based on the selected major influencing factors. Groundwater recharge, lithology, drainage density, lineament density, transmissivity, and geomorphology were selected as major influencing factors during the groundwater potential of the study area. For dataset training, 70% of samples were selected and 30% were used for serving out of the total 128 samples. The spatial distribution of groundwater potential has been classified into five groups: very low (10.72%), low (25.67%), moderate (31.62%), high (19.93%), and very high (12.06%). The area obtains high rainfall but has a very low amount of recharge due to lack of proper soil and water conservation structures. The major outcome of the study showed that moderate and low potential is dominant. Geodetoctor results revealed that the magnitude influences on groundwater potential have been ranked as transmissivity (0.48), recharge (0.26), lineament density (0.26), lithology (0.13), drainage density (0.12), and geomorphology (0.06). The model results showed that using a convolutional neural network (CNN), groundwater potentiality can be delineated with higher predictive capability and accuracy. CNN based AUC validation platform showed that, 81.58% and 86.84% were accrued from the accuracy of training and testing values, respectively. Based on the findings, the local government can receive technical assistance for groundwater exploration, and sustainable water resource development in the Gunabay watershed. Finally, the use of a detector-based deep learning algorithm can provide a new platform for industrial sectors, groundwater experts, scholars, and decision-makers.

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98 (2024)

First-principles calculations to investigate small band gap Ca2ZrHfS6 double chalcogenide perovskites for optoelectronic application

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Abstract

In this study, the structural, electronic, elastic, lattice dynamic, thermodynamic, and optical properties of the face-centered cubic structure of Ca2ZrHfS6 space group Fm-3m (225) double chalcogenide perovskites were calculated by first-principles calculations. The investigation is made by utilizing plane-wave ultra-soft pseudopotentials in a generalized gradient approximation (GGA-PBE). In addition, we employed GGA + U approximations for exchange correlation potential, since it improves the accuracy of band gaps. Ca2ZrHfS6 has a direct band gap, and its value is 0.52 eV (0.95 eV) with GGA-PBE (GGA + U) approximations. The value of calculated formation energy is − 1.99 and describes the thermodynamic stability of Ca2ZrHfS6. The mechanical parameters such as the bulk modulus, shear modulus, Young's modulus, and elastic anisotropy are calculated from the obtained elastic constants. The absence of negative frequencies in the phonon dispersion curve and the phonon density of states confirm the dynamical stability of the system. Temperature-dependent thermodynamic properties such as free energy, entropy, and heat capacity are investigated. The calculated results have a similar trend to the existing works. Dielectric (real and imaginary) functions, absorption coefficient, electron energy loss function, reflectivity, and refractive index of Ca2ZrHfS6 are calculated in the spectral range 0–22 eV and discussed in detail. The findings of this study show that Ca2ZrHfS6 has an appropriate band gap and optical response from visible to ultraviolet, making it a promising candidate for use as a light detector.

Keywords: DFT, Double perovskites, Electronic property, Elastic property, Optical property

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1301 (2024)

Method development and validation for the quantitative determination of total flavonoids through the complexation of iron (III) and its application in real sample

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Abstract

Background: The determination of flavonoids in real sample using UV–Vis spectrophotometer commonly uses quercetin and catechin with Al+3 complexing agent as reference materials for the calibration of the instrument. However, getting these standard materials is challenging due to its expense and unavailability in the chemical reserve of the country. Moreover, the Al+3 - quercetin complexation standard method demands high amount of quercetin in spite of its high cost. Hence, developing alternative method that can solve this problem is crucial for the determination of flavonoids in the real sample.

Results: An iron-based complexation method for the determination of flavonoids in the real sample was developed that reduces the amount of quercetin by 200 times (1 mg/mL to 0.005 mg/mL) during the calibration of UV–Vis spectroscopy as an alternative method. The reaction parameters (incubation time, pH, and concentration of quercetin) were optimized using software Design Expert 11 and confirmed by the practical experiments. The kinetics of reaction between iron and quercetin was found to be pseudo first order with rate constant of kobs at 340 and 510 nm. The analysis window for the flavonoid complex was achieved with the kinetic discrimination of the interferences at its optimized time of complexation 20 min and absorbance maxima of 510 nm. The developed method was validated by evaluating its precision, accuracy, recovery test (84–117%), detection limit and quantification limit following the standard protocols. The calibration of the instrument has been developed for the new method and the linear regression coefficient (R2) of 0.998 was obtained.

Significance: Applying the developed standard material (Fe3+ - quercetin complex) gives freedom for the analytical chemists to find the standard materials that is accessible and cheaper than the existing one (Al3+-quercetin complex). The developed method can also be easily applied for determination of flavonoid in the real samples without potential interferences coming from sample matrix.

Clinical Nutrition Open Science
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Effect of mobile phone messaging on uptake of maternal and child health service in southern Ethiopia: Protocol for cluster randomized controlled trial

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Abstract

Introduction: Over the last two decades, there have been some efforts to improve maternal and child health around the globe. However, the efforts are still lacking longstanding outcomes. Lack of awareness and access to information for decision-making has been an obstacle for women, especially in developing countries. This study aims to find potential strategies to improve maternal and child health using mHealth in Ethiopia to enhance service uptake and future decisions. **Methods:** This study applies cluster randomized controlled trials to test if mobile phone (mHealth) text messages can improve the uptaking of postpartum family planning and child feeding practices such as prelacteal feeding, initiation of breastfeeding, exclusive breastfeeding, and complementary feeding. Repeated data collections during the first and fifth months enhance understanding of child feeding practice and its improvement compared to baseline information. It can also help to understand postpartum family planning practices among mothers. The sample size includes 672 mothers who are in the third trimester, have access to a mobile phone, can use mobile phones, and can read and understand text messages. Multilevel logistic regression, generalized estimation equation, and survival analysis are the models for final analysis. The models enable us to determine the percentage differences between baseline and intervention groups.
Ethics: The team has collected ethical clearance to conduct the study from the Arba Minch University Board of Institutional Ethical Review.
Dissemination: As part of open science communication, the team is committed to publishing the protocol, procedures, findings of the trial, and then the data.
Trial registration number: PACTR202211547107725 Pan African Clinical Trial Registry.

Keywords: Breastfeeding; Complementary feeding; mHealth; Message; Child feeding; Ethiopia

Water Supply
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24 (2024)

Assessment of customer satisfaction with the water supply system in low-income countries: A case of Adama City, Ethiopia

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Abstract

In developing countries like Ethiopia, ensuring the sustainability of water supply systems is a significant challenge. To achieve the Sustainable Development Goal 6 of providing clean water to people worldwide, understanding customer perceptions and satisfaction is crucial. This study conducted questionnaire surveys and interviews with key stakeholders in Adama town to assess customer satisfaction and service quality dimensions. Of 435 participants, 275 (63.22%) were females and 160 (36.78%) were males. The analysis revealed that all dimensions of service quality significantly affected customer satisfaction at a 5% level of significance. Specifically, tangibility, responsiveness, and assurance had a highly significant effect on customer satisfaction (p ¼ 0.001). However, reliability, tangibility, and responsiveness scored below 50% in the overall Customer Satisfaction Index, indicating customer dissatisfaction. On the other hand, assurance and empathy scored above or equal to 50%, suggesting satisfactory levels of customer satisfaction. The study highlighted the importance of addressing Adama's pressure and billing problems to improve the empathy dimension. Enhancing services in these areas would contribute to overall customer satisfaction. The findings of this study are valuable for appropriate municipal service planning and management, facilitating service enhancement and cost recovery efforts.

Keywords: customer satisfaction index; Ethiopia; models; water supply services

H2Open Journal
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7 (2024)

Evaluation of hydraulic adequacy of runoff disposal in urban watersheds of rapidly expanding towns

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Abstract

The growth of cities significantly alters natural catchments by increasing impervious surfaces and necessitating the installation of an appropriate drainage system. Arba Minch is rapidly expanding and facing street flooding. The objective of this study is to assess the hydraulic adequacy of runoff disposal in urban watersheds located in rapidly expanding towns. Stormwater Management Model (SWMM) was used to perform rainfall-runoff simulation. Personal Computer SWMM (PCSWMM) was used to carry out calibration and validation in the watershed. The primary and secondary data were used. Five Land Use/Land Cover (LULC) categories identified were asphalt, cobble, vegetation, bare soil, and roof. The result shows 33.49% area is covered with highly impervious land cover. The overall calibration and validation are a very good fit with the observed flow. The total runoff volume of 9494.15 km3 was generated from the town area which is 13.7 km2. The peak runoff determined from 373 sub-catchments varied from 0.01 to 4.48 m3s-1. According to the simulated result, 7.46% of existing drainage channels were flooded. Anticipating future runoff generation, this study evaluates the inadequacy of existing drainage channels in urban areas. Hydraulic analysis is recommended before constructing drainage structures to protect from flooding.

Keywords: Arba Minch, PCSWMM, percentage impervious, SWMM, urban drainage

Astrophysical Journal
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965 (2024)

Investigation of Profile Shifting and Subpulse Movement in PSR J0344-0901 with FAST

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Abstract

We report two phenomena detected in PSR J0344−0901 from two observations conducted at frequencies centered at 1.25 GHz using the Five-hundred-meter Aperture Spherical Radio Telescope. The first phenomenon manifests as the pulse emission shifting to later longitudinal phases and then gradually returning to its original location. The event lasts for about 216 pulse periods, with an average shift of about 0.°7 measured at the peak of the integrated profile. Changes in the polarization position angle (PPA) are detected around the trailing edge of the profile, together with an increase in the profile width. The second phenomenon is characterized by the apparent movement of subpulses, which results in different subpulse track patterns across the profile window. For the first time in this pulsar, we identify four emission modes, each with unique subpulse movement, and determine the pattern periods for three of them. Pulse nulling was not detected. Modeling of the changes in the PPA using the rotating vector model gives an inclination angle of 75.°12 ± 3.°80 and an impact parameter of −3.°17 ± 5.°32 for this pulsar. We speculate that the subpulse movement may be related to the shifting of the pulse emission.

Midwifery
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132 (2024)

Trends and disparities in perinatal health outcomes among women from refugee backgrounds in Victoria, Australia: A population-based study

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Abstract

Background: Women from refugee backgrounds generally experience poorer pregnancy-related outcomes compared to host populations. Aim: To examine the trend and disparities in adverse perinatal outcomes among women of refugee background using population-based data from 2003 to 2017. Methods: A population-based cross-sectional study of 754,270 singleton births in Victoria compared mothers of refugee backgrounds with Australian-born mothers. Inferential statistics, including Pearson chi-square and binary logistic regression, were conducted. Multiple logistic regression was conducted to explore the relationship between adverse perinatal outcomes and the women's refugee status. Findings: Women of refugee background had higher odds of adverse neonatal and maternal outcomes, including stillbirth, neonatal death, low APGAR score, small for gestational age, postpartum haemorrhage, abnormal labour, perineal tear, and maternal admission to intensive care compared to Australian-born women. However, they had lower odds of neonatal admission to intensive care, pre-eclampsia, and maternal postnatal depression. The trend analysis showed limited signs of gaps closing over time in adverse perinatal outcomes. Discussion and conclusion: Refugee background was associated with unfavourable perinatal outcomes, highlighting the negative influence of refugee status on perinatal health. This evidences the need to address the unique healthcare requirements of this vulnerable population to enhance the well-being of mothers and newborns. Implementing targeted interventions and policies is crucial to meet the healthcare requirements of women of refugee backgrounds. Collaborative efforts between healthcare organisations, government agencies and non-governmental organisations are essential in establishing comprehensive support systems to assist refugee women throughout their perinatal journey.

Keywords: Perinatal health, Maternal outcomes, Neonatal outcomes, Refugees

Hydrology Research
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55 (2024)

Assessment of anthropogenic and climate-driven water storage variations over water-stressed river basins of Ethiopia

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Abstract

Globally, surface water, groundwater, soil moisture, snow storage, canopy water, and wet biomass constituents make up water storage, which plays a significant role in the hydrological water balance. Evaluating the variations in water storage anomalies associated with climate forcing and human activities over river basins is crucial for assessing water scarcity and predicting potential pressures on water resources in the future. In this study, we assessed the impacts of climatic and anthropogenic drivers on the change in water storage in the river basins of Ethiopia by using the independent component analysis to examine Gravity Recovery and Climate Experiment with the Global Land Data Assimilate System-based water storage and comparing the independent component analysis with hydro-meteorological data and statistical data related to human activities. It is of great significance for helping people better understand the evaluation of terrestrial water storage anomalies under the combined influence of climatic change and anthropogenic activities and providing information for better protection and utilization of water resources at river basin level. It is crucial to take effective measures to protect this precious land and water resources and prevent their further deterioration. The estimated result will be essential for sustainable water management and protection.

Keywords: climatic and anthropologic factors, GLDAS and GRACE dataset, power dataset, evapotransipiration, water storage variation

Mathematics in Applied Sciences and Engineering
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5 (2024)

The impact of pollution reduction on the optimal harvesting strategy in a seasonally changing and polluted environment

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Abstract

This paper deals with the optimal harvesting of single-species populations in a polluted and seasonally varying environment. The presence of pollution negatively impacts resource growth, and as a result, the economic rent from harvest suffers. Assuming that pollution is inevitable, the harvester, who has a fixed flow of funds for harvesting activity, intends to invest the unused funds left over after harvesting in pollution control, expecting some increment in the economic rent. Thus, optimal harvesting problems in two different scenarios have been studied, and the solutions are compared to evaluate the impact of investing in pollution reduction on revenues. Pontryagin's Maximum Principle and the concept of blocked intervals are used to solve the aforesaid problems. Findings of the study indicate that funding pollution control programs should be considered as an alternative to promote conservation of resources and enhance net economic rent for harvesting systems impacted by pollution and seasonal fluctuations.

Key words and phrases: Seasonal change, polluted environment, optimal harvesting, pollution reduction, blocked intervals

Journal of Environmental Chemical Engineering
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12 (2024)

Enhanced removal of viral aerosols using nanosilver/TiO2-chitosan filters combined with a negative air ionizer

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Abstract

The presence of airborne viruses in bioaerosols is a significant and ongoing public health concern. In this context, this study aimed to develop a new filter that integrates nanosilver into a TiO2-chitosan matrix (nano-Ag/TiO2-CS) to inactivate the non-enveloped bacteriophage MS2 as a viral aerosol surrogate. The materials were characterized using various techniques, such as X-ray diffraction (XRD), scanning electron microscopy (SEM), high-resolution transmission electron microscopy (HR-TEM), and X-ray photoelectron spectroscopy (XPS). The SEM images showed that the nano-Ag particles were spheres with a high surface area for virus interactions and that the fiber surfaces were covered by nano-Ag, which enhanced contact with viruses. The optimal 5 wt% nano-Ag/TiO2-CS filter combined with a negative air ionizer (NAI) showed the highest viral aerosol removal efficiency, which reached 97 %. The use of an NAI during filtration enhanced the inactivation of the viral aerosols. A long-term antiviral efficacy assessment showed that the nano-Ag/TiO2-CS filter demonstrated robust durability, which is vital for real-world applications. The nanofilter proposed in this work is simple, safe, and cost-effective for inactivating viral aerosols to improve indoor air quality.

AIP Advances
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14 (2024)

Distant bipartite entanglement generation in a hybrid opto-magnomechanical system

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Abstract

In this work, we present a hybrid cavity opto-magnomechanical system to generate distant bipartite entanglement between different quantum carriers. Accordingly, the system consists of two cavity photons, a phonon of yttrium iron garnet (YIG), a magnon, and a phonon of membrane. Specifically, the two cavities are coupled through an optical fiber, and one of the optical cavities consists of a membrane coupled with the cavity photon through radiation pressure force. While the other cavity contains a YIG, the magnon mode connects to the cavity photon via magnetic dipole interaction and, simultaneously, couples to the mechanical resonator of the YIG through magnetostrictive interaction. We show that entanglement generation can be realized under indirectly coupled bipartitions for parameters and detunings within appropriate regimes. Furthermore, for various bipartitions, we also obtain appropriate cavity and magnon detuning values for a considerable remote entanglement. Moreover, the generation of distant bipartite entanglements and entanglement transfer between subsystems is predominantly influenced by the coupling strength. Remarkably, the distant bipartite entanglement is strongly contrary to the environmental temperature. Thus, optimizing the system's parameters allows for the maximum possible entanglement between various quantum carriers. We believe our results could provide more stable bipartite entanglements and serve as a potential quantum interface to realize particularly long-range entanglement transfers.

Journal of Agriculture and Food Research
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15 (2024)

The level of food insecurity among urban households in southern Ethiopia: A multi-index-based assessment

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Abstract

Food insecurity is a growing concern worldwide, particularly in urban areas of developing countries. However, it is a problem that is less discussed in Ethiopia. Therefore, this study has aimed to assess the level of food insecurity among urban households that benefit from the urban productive safety net program. The study included 310 household heads selected through a multi-stage sampling procedure. A survey questionnaire, focus group discussions, field observation, and key informant interviews were used to collect data. Descriptive and inferential statistics were employed to analyze the collected data. The multi-index approach was used to assess the level of food insecurity among households. The results showed that nearly 89% had varying levels of food insecurity. The study also revealed that the majority of households consumed vegetation (79.7%), roots (76.5%), cereals (74.8%), fruits (68.4%), and pulses (53.5%). On the other hand, a lower proportion of households consumed fish (2.3%) and meat (14.8%). The chi-square result shows that cereals, pulses, fruits, and meat were significant at $P < 0.01$, respectively. Milk and milk products, oil or butter, sugar or honey, and coffee or tea were statistically significant at $P < 0.00$. This indicates that there are meaningful associations between the consumption patterns of different food groups and the variables being investigated in the study. We recommend categorizing households based on the severity of food insecurity. This will enable policymakers and organizations to tailor their support mechanisms to address the specific needs of each category more sustainably, enabling the victimized households to be self-sufficient.

Keywords: Food security, Household food insecurity access scale, Household dietary diversity score, Household food insecurity access prevalence, Urban productive safety net program

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10 (2024)

Modeling canopy water content in the assessment for rainfall induced surface and groundwater nitrate contamination: The Bilate cropland sub watershed

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Abstract

Nitrate contamination in surface and groundwater remains a widespread problem in agricultural watersheds is primarily associated to high levels of percolation or leakage from fertilized soil, which allows easy infiltration from soil into groundwater. This study was aimed to predict canopy water content to determine the nitrate contamination index resulting from nitrogen fertilizer loss in surface and groundwater. The study used Geographically Weighted Regression (GWR) model using MODIS 006 MOD13Q1-EVI Earth observation data, crop information and rainfall data. Satellite data collection was synchronized with regional crop calendars and calibrated to plant biomass. The average plant biomass during observed plant growth stages was between 0.19 kg/m2 at the minimum and 0.57 kg/m2 at the maximum. These values are based on the growth stages of crops and provide a solid basis for monitoring and validating crop water productivity data. The simulation results were validated with a high correlation coefficient (R2 = 0.996, P < 0.0005) for the observed rainfall in the growing zone compared to the predicted canopy water content. The nitrate contamination index assessment was conducted in 2004, 2008, 2009, 2010, 2011, 2013, 2014, 2015, 2018 and 2020. Canopy water content and root zone seasonal water content were measured in (%) per portion as indicators of the NO−3-N-nitrate contamination index in these years (0.391, 0.316, 0.298, 0.389, 0.380, 0.339, 0.242, 0.342 and 0.356).

Keywords: GWR modeling**,** Monthly rainfall**,** Nitrate contamination**,** Nitrate leaching**,** MODIS-EVI

The Lancet
DOI: https://doi.org/10.1016/S0140-6736(24)00933-4
403 (2024)

Global burden and strength of evidence for 88 risk factors in 204 countries and 811 subnational locations, 1990–2021: a systematic analysis for the Global Burden of Disease Study 2021

GBD 2021 Risk Factors Collaborators

Abstract

Background: Understanding the health consequences associated with exposure to risk factors is necessary to inform public health policy and practice. To systematically quantify the contributions of risk factor exposures to specific health outcomes, the Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) 2021 aims to provide comprehensive estimates of exposure levels, relative health risks, and attributable burden of disease for 88 risk factors in 204 countries and territories and 811 subnational locations, from 1990 to 2021.
Methods: The GBD 2021 risk factor analysis used data from 54 561 total distinct sources to produce epidemiological estimates for 88 risk factors and their associated health outcomes for a total of 631 risk–outcome pairs. Pairs were included on the basis of data-driven determination of a risk–outcome association. Age-sex-location-year-specific estimates were generated at global, regional, and national levels. Our approach followed the comparative risk assessment framework predicated on a causal web of hierarchically organised, potentially combinative, modifiable risks. Relative risks (RRs) of a given outcome occurring as a function of risk factor exposure were estimated separately for each risk–outcome pair, and summary exposure values (SEVs), representing risk-weighted exposure prevalence, and theoretical minimum risk exposure levels (TMRELs) were estimated for each risk factor. These estimates were used to calculate the population attributable fraction (PAF; ie, the proportional change in health risk that would occur if exposure to a risk factor were reduced to the TMREL). The product of PAFs and disease burden associated with a given outcome, measured in disability-adjusted life-years (DALYs), yielded measures of attributable burden (ie, the proportion of total disease burden attributable to a particular risk factor or combination of risk factors). Adjustments for mediation were applied to account for relationships involving risk factors that act indirectly on outcomes via intermediate risks. Attributable burden estimates were stratified by Socio-demographic Index (SDI) quintile and presented as counts, age-standardised rates, and rankings. To complement estimates of RR and attributable burden, newly developed burden of proof risk function (BPRF) methods were applied to yield supplementary, conservative interpretations of risk–outcome associations based on the consistency of underlying evidence, accounting for unexplained heterogeneity between input data from different studies. Estimates reported represent the mean value across 500 draws from the estimate's distribution, with 95%

uncertainty intervals (UIs) calculated as the 2·5th and 97·5th percentile values across the draws.

Findings: Among the specific risk factors analysed for this study, particulate matter air pollution was the leading contributor to the global disease burden in 2021, contributing 8·0% (95% UI 6·7–9·4) of total DALYs, followed by high systolic blood pressure (SBP; 7·8% [6·4–9·2]), smoking (5·7% [4·7–6·8]), low birthweight and short gestation (5·6% [4·8–6·3]), and high fasting plasma glucose (FPG; 5·4% [4·8–6·0]). For younger demographics (ie, those aged 0–4 years and 5–14 years), risks such as low birthweight and short gestation and unsafe water, sanitation, and handwashing (WaSH) were among the leading risk factors, while for older age groups, metabolic risks such as high SBP, high body-mass index (BMI), high FPG, and high LDL cholesterol had a greater impact. From 2000 to 2021, there was an observable shift in global health challenges, marked by a decline in the number of all-age DALYs broadly attributable to behavioural risks (decrease of 20·7% [13·9–27·7]) and environmental and occupational risks (decrease of 22·0% [15·5–28·8]), coupled with a 49·4% (42·3–56·9) increase in DALYs attributable to metabolic risks, all reflecting ageing populations and changing lifestyles on a global scale. Age-standardised global DALY rates attributable to high BMI and high FPG rose considerably (15·7% [9·9–21·7] for high BMI and 7·9% [3·3–12·9] for high FPG) over this period, with exposure to these risks increasing annually at rates of 1·8% (1·6–1·9) for high BMI and 1·3% (1·1–1·5) for high FPG. By contrast, the global risk-attributable burden and exposure to many other risk factors declined, notably for risks such as child growth failure and unsafe water source, with age-standardised attributable DALYs decreasing by 71·5% (64·4–78·8) for child growth failure and 66·3% (60·2–72·0) for unsafe water source. We separated risk factors into three groups according to trajectory over time: those with a decreasing attributable burden, due largely to declining risk exposure (eg, diet high in trans-fat and household air pollution) but also to proportionally smaller child and youth populations (eg, child and maternal malnutrition); those for which the burden increased moderately in spite of declining risk exposure, due largely to population ageing (eg, smoking); and those for which the burden increased considerably due to both increasing risk exposure and population ageing (eg, ambient particulate matter air pollution, high BMI, high FPG, and high SBP). Interpretation: Substantial progress has been made in reducing the global disease burden attributable to a range of risk factors, particularly those related to maternal and child health, WaSH, and household air pollution. Maintaining efforts to minimise the impact of these risk factors, especially in low SDI locations, is necessary to sustain progress. Successes in moderating the smoking-related burden by reducing risk exposure highlight the need to advance policies that reduce exposure to other leading risk factors such as ambient particulate matter air pollution and high SBP. Troubling increases in high FPG, high BMI, and other risk factors related to obesity and metabolic syndrome indicate an urgent need to identify and implement interventions. **Funding:** Bill & Melinda Gates Foundation.

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Artificial neural networks for the food web model

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Abstract

The study of this work is to present the analytical solutions of prey-predator model by using the artificial neural networks (ANN). We studied the dynamics of a food web model consisting of one prey and two predators. We discussed the positivity, boundedness and well posedness of the system. The model was expressed in the form of an input, hidden layer and output, flow chart and ANN methods. We obtained the solutions of ANN simulations by using Mathematica programming. We analyzed the physical and geometrical interpretation of the solutions. Here, we found that preypredators population exist at the beginning phase, whereas the population of prey and middle spice predator decrease with respect to time. We further found that top predator population increases due to the availability of the food.

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Assessment of husbandry practices, egg production performance and egg quality traits of chickens in the baka dawula district, southern ethiopia

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Abstract

This study assessed the husbandry practices, egg production performances, egg quality traits, and constraints and opportunities for chicken production in Baka Dawula district. Six kebeles were selected based on production practices and availability of different chicken breeds. A total of 168 respondent households were interviewed and 108 eggs (36 from each breed) were evaluated based on their internal and external qualities. The majority of respondent households (86.9%) practiced scavenging type of feeding with maize, wheat and sunflower supplementation. All the respondent households provided free water access to their chickens. The majority (66%) of respondents kept their chickens in separate houses. The health care practiced was mainly traditional using plants extracts. The main purpose for chicken keeping was income generation followed by stock replacement. The average ages at first-egg laying for local and exotic (Sasso and Bovans brown) breeds were 7 and 5 months, respectively. The total number of eggs produced per hen per year was 206.79, 192.35 and 55.75 for Sasso, Bovan's brown, and local breeds respectively. Most external and internal egg quality traits varied significantly ($P<0.05$) between agro ecologies and chicken breeds. Generally, the egg production performance of the exotic chickens was higher than the local breed.

Keywords: Chicken, Egg, Production, Quality, Husbandry practices

Theoretical and Applied Climatology
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155 (2024)

Impact of satellite precipitation estimation methods on the hydrological response: case study Wadi Nu'man basin, Saudi Arabia

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Abstract

Arid regions have a strong lack of observational datasets, specifically in rainfall and runoff, which plays a crucial role in the effective management of water resources and the assessment of hydrological systems. Therefore, the objective of this study was to investigate the impact of different precipitation estimation methods on the hydrological response, specifically the runoff, in the Wadi Nu'man basin located in Saudi Arabia. To achieve this, rainfall data were collected over 13 years (2006–2018) from ground observations and satellite rainfall products. The remote sensing-based precipitation data utilized in this study includes Tropical Rainfall Measuring Mission (TRMM-3B42), TRMM-Realtime (TRMM-3B42RT), and Climate Hazards Group InfraRed Precipitation (CHRIPS) datasets. The performance of these datasets was evaluated using various statistical metrics. Additionally, a linear scaling bias correction method was performed to align the satellite and ground-based station data. Finally, the HEC-HMS model was utilized to simulate the runoff using all available bias-corrected precipitation datasets. This article primarily focuses on comparing and assessing two categories of data: rainfall and runoff. In terms of daily rainfall data, a lower correlation ($R2 < 0.5$) was observed when comparing the datasets. However, a moderate regression ($R2 = 0.52$) was found between the average values derived from the two gauges and the corresponding satellite data. Similarly, a moderate relationship ($R2 \geq 0.43$) was found on a monthly scale between ground observations and satellite precipitation. The average gauge data, along with the corresponding satellite data, were utilized for runoff modeling in HEC-HMS. The runoff model showed a high regression (R2) value of 0.75 between peak discharges generated by the gauges and CHRIPS data. However, a lower (R2) value of 0.3 was observed between gauge rainfall and TRMM rainfall. This research emphasizes the importance of utilizing the satellite rainfall dataset for runoff estimation in arid regions of Saudi Arabia where gauge data may be unavailable. Furthermore, future studies should focus on implementing more sophisticated bias correction techniques, testing diverse satellite datasets, and integrating advanced modeling tools such as machine learning for enhanced predictions of the hydrologic response.

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2 (2024)

Evaluation of hematological parameters and lipid profile in dyspeptic patient with gastric Helicobacter pylori infection, southern Ethiopia, 2022 GC

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Abstract

Arid regions have a strong lack of observational datasets, specifically in rainfall and runoff, which plays a crucial role in the effective management of water resources and the assessment of hydrological systems. Therefore, the objective of this study was to investigate the impact of different precipitation estimation methods on the hydrological response, specifically the runoff, in the Wadi Nu'man basin located in Saudi Arabia. To achieve this, rainfall data were collected over 13 years (2006–2018) from ground observations and satellite rainfall products. The remote sensing-based precipitation data utilized in this study includes Tropical Rainfall Measuring Mission (TRMM-3B42), TRMM-Realtime (TRMM-3B42RT), and Climate Hazards Group InfraRed Precipitation (CHRIPS) datasets. The performance of these datasets was evaluated using various statistical metrics. Additionally, a linear scaling bias correction method was performed to align the satellite and ground-based station data. Finally, the HEC-HMS model was utilized to simulate the runoff using all available bias-corrected precipitation datasets. This article primarily focuses on comparing and assessing two categories of data: rainfall and runoff. In terms of daily rainfall data, a lower correlation ($R2 < 0.5$) was observed when comparing the datasets. However, a moderate regression ($R2 = 0.52$) was found between the average values derived from the two gauges and the corresponding satellite data. Similarly, a moderate relationship ($R2 \geq 0.43$) was found on a monthly scale between ground observations and satellite precipitation. The average gauge data, along with the corresponding satellite data, were utilized for runoff modeling in HEC-HMS. The runoff model showed a high regression (R2) value of 0.75 between peak discharges generated by the gauges and CHRIPS data. However, a lower (R2) value of 0.3 was observed between gauge rainfall and TRMM rainfall. This research emphasizes the importance of utilizing the satellite rainfall dataset for runoff estimation in arid regions of Saudi Arabia where gauge data may be unavailable. Furthermore, future studies should focus on implementing more sophisticated bias correction techniques, testing diverse satellite datasets, and integrating advanced modeling tools such as machine learning for enhanced predictions of the hydrologic response.

Keywords: H. pylori, Hematological marker, Lipid profile, Severity of dyspeptic symptom

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Numerical groundwater flow modeling under future climate change in the Central Rift Valley Lakes Basin; Ethiopia

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Abstract

Study area: Katar and Meki subbasins, Rift Valley Lakes Basin, Ethiopia.Study focus: This research was carried out to characterized the recharge mechanism and quantify the steady-state groundwater balance and its sensitivity to future climate change. A groundwater simulation model was constructed and calibrated using a hydro-geo spatial dataset. Three regional climate models were used to assess the potential impact of changes in future precipitation on the recharge rate and groundwater balance components. New Hydrogeological Insight: Groundwater potential assessment depends on accurate estimation of the recharge rate. Precipitation contributed 11.95% and 11.96% to groundwater recharge in the Katar and Meki subbasins, respectively. The steady-state numerical groundwater model was calibrated and the model performed in the ranges of R2: 0.95–0.99; RMSE: 16.17–25.18; and MAE: 12.69–24.55, demonstrating 'excellent' model performance. In particular, the model exhibited high sensitivity to changes in the recharge rate and horizontal hydraulic conductivity. Future change in precipitation caused a reduction in groundwater potential in the range of 6.24–40.32% by the 2040 s and 2070 s, respectively, in the Katar subbasin. Likewise, the Meki Subbasin will experience a reduction in groundwater potential in the range of 0.29–37.17% by the 2040 s and 2070 s, respectively. These results emphasize how crucial it is for future water resource development initiatives to take into account climate variability for sustainable groundwater development.

Keywords: MODFLOW-NWT, Numerical Modeling, Climate change impact, Groundwater recharge, Hydrological Modeling, Central Rift Lakes Basin, Ethiopia

Journal of Agriculture and Food Research
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Study on the preparation and use of edible coating of fish scale chitosan and glycerol blended banana pseudostem starch for the preservation of apples, mangoes, and strawberries

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Abstract

Agro-industries and the fish processing sector generate large amounts of waste, which may be converted into useful ingredients for preserving fruit. Studies show that starch-based edible film still needs some improvement because it's brittle and weaker, which might be improved by adding chitosan. The study aimed to investigate the optimal composition of edible film-forming material prepared from banana pseudostem starch and fish-scale chitosan to preserve the selected fruits. In the current study, chitosan and starch were extracted from the waste of Nile tilapia fish scale and Dwarf cavendish banana pseudostem as found to be 29.66 ± 0.46 % and 4.26 ± 0.21 %, respectively. Central composite response surface experimental design combined banana pseudostem starch, chitosan, and glycerol to prepare the edible films. Using the Design-expert program, the ideal film-forming composition with an overall acceptability of 0.968 was identified based on the physico-mechanical characteristics of the created composite edible films. It comprised 15 mL of 1 % banana pseudostem starch, 3.2 mL of 0.5 % chitosan, and 0.6 mL of 30 % glycerol. The persistence of the microbial load on coated and uncoated fruits throughout the storage was also assessed in the study. The microbial and fungal growth was significantly lower (>37 %) in optimal edible film-coated fruits than in the control fruits. After 28 days of storage of fruits at room temperature, the microbial count (in CFU/mL) on the edible coated surfaces of apples, mangoes, and strawberries was found to be 2.04 ± 0.32x103, 2.71 ± 0.29x103, and 2.5 ± 0.51x104, respectively. Also noticed the fungus counts of 1.86 ± 0.48x03 (in apples), 1.09 ± 0.11x104 (in mangoes), and 1.56 ± 0.04x104 (in strawberries) in the studied coated fruits after 28 days of storage. Furthermore, the film-coated fruits had a significantly lower weight loss than uncoated fruits. Thus, the studied banana pseudostem starch-chitosan-glycerol composite edible coating potentially preserves by inhibiting the development of natural microbes when storing apples, mangoes, and strawberries, and it is adequate to extend their shelf life.

Keywords: Agro-wastesBanana pseudostem starchComposite filmFish scale chitosanFruit preservation

Sugar Tech
DOI: https://doi.org/10.1007/s12355-024-01363-7
26 (2024)

Evaluation of Okra (Abelmoschus esculentus) Powder and Nano CaO as Alternative Clarifiers for Lime in the Processing of Sugarcane Juice

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Abstract

The processing of sugar production to achieve purity with high yield presents challenges to the sugar industry. Clarification is one of the critical processes that call for additional clarifiers. In this context, the current study evaluates the efficacy of nano CaO and okra powders to clarify cane juice. A CaO nanoparticle was prepared and characterized through XRD, FAAS, and SEM. The extracted sugarcane (B52-298 variety) juice was clarified using different clarifiers such as Okra, calcium oxide nanoparticles (CaO NPs), laboratory calcium oxide (N-CaO), and their mixtures. The current study assessed the clarification efficacy by varying the clarification process parameters (amount of clarifier, volume of juice, pH, time, and temperature) with turbidity, mud volume, and settling rate using a conventional approach. Based on the reduction of turbidities, the clarification efficiency of studied clarifiers ranked as CaO NPs ≥ N-CaO (control) ≥ Okra ≥ N-CaO + Okra ≥ CaO NPs + Okra. Furthermore, physicochemical characterizations of raw juice, clarified juice, and the final sugar were carried out for the three clarified juices using CaO NPs, CaONP + Okra, and N-CaO + Okra. The study's findings thus indicated these novel clarifiers are promising for industrial and domestic applications as they produce quality white sugars.

Keywords: Clarification**,** Calcium-oxide**,** Nanoparticles**,** Green synthesis**,** Okra**,** Sugarcane

Irrigation and Drainage
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73 (2023)

Spatiotemporal variation in soil salinity under irrigated fields at Bochessa catchment in Central Ethiopia

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Abstract

Soil salinity and sodicity problems are one of the major challenges to the permanence of irrigated agriculture in Ethiopia. This manuscript, therefore, concerns its spatial and temporal variation under irrigated fields and suggests possible management options. For this investigation, eight monitoring locations were selected based on the irrigation intensity that farmers practised in the area. With each location, three irrigated farmers' fields were randomly selected for sampling purposes. Likewise, six farmers' fields from the rain-fed system were also selected for comparison purposes. Sampling was performed at the beginning and end of each cropping season for three consecutive years from 2017 to 2019. The major physical and chemical properties of the soil were analysed in accordance with standard laboratory procedures. A linear model of two-way analysis of variance was used to analyse parameters across time and space. The results indicated that the majority of the soil properties studied showed significant differences ($p < 0.05$) over time. This implies that the change is in accordance with the seasonal soil property, possibly due to irrigation practices. Similarly, approximately 90% of the soil properties studied showed noticeable differences ($p < 0.05$) across locations. Almost all salinity indicators showed an increasing trend in irrigated fields compared to their situation in rain-fed fields. For instance, the electrical conductivity (EC) and exchangeable sodium percentage (ESP) values across the fields ranged from 0.54 to 0.82 dS m^{-1} and 8–1%, respectively, with maximum values observed in irrigated fields. This implies that irrigation practices influence soil properties in the area. In addition, the ESP values approaching the maximum permissible limit suggest that sodicity may cause more problems than salinity in the area. Therefore, agronomic practices (e.g. residue management, deep tillage, salt-tolerant crops and periodic fallowing), irrigation and drainage management practices, and amendments may help farmers mitigate salinity and sodicity problems in the area.

Environmental Conservation
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51 (2024)

The Ethiopian wolf can act as a flagship and umbrella species to protect the Afroalpine ecosystem and foster sustainable development

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Abstract

Habitat alteration and climate change are important threats to terrestrial biodiversity in the tropics. Endorsing flagship or umbrella species can help conserve sympatric biodiversity, restore degraded ecosystems and achieve United Nations Sustainable Development Goals (UN SDGs). The Ethiopian wolf (Canis simensis) is a rare and endemic Ethiopian canid. It is Africa's most endangered canid species and is restricted to several isolated patches of Afroalpine habitats. While its behavioural ecology and conservation biology have been well studied, studies of the Ethiopian wolf's significance for the conservation of its habitat and sympatric species are lacking. Here we use geographical range overlap and geospatial modelling to evaluate the importance of the Ethiopian wolf as a flagship and/or umbrella species. We assess whether conservation interventions targeting the Ethiopian wolf could help to restore and protect Afroalpine habitat and conserve sympatric species whilst simultaneously providing a wide range of socioeconomic and environmental benefits. We found that Ethiopian wolves share their range with 73 endemic and/or threatened vertebrate species, 68 of which are Afroalpine ecosystem species, and at least 121 endemic and/or threatened plant species. Ethiopian wolves are taxonomically distinctive and charismatic species classified as Endangered on the International Union for Conservation of Nature (IUCN) Red List. Thus, they meet both the flagship and umbrella species criteria to restore Afroalpine habitats and conserve threatened sympatric species. A conservation strategy protecting and restoring Afroalpine habitat has the potential to contribute to achieving at least five of the 17 UN SDGs. The protection of flagship and umbrella species should be integrated into broader regional biodiversity and habitat conservation.

Keywords: Afroalpine ecosystem**,** Afroalpine protection**,** Canis simensis**,** climate change**,** ecosystem restoration**,** Sustainable Development Goals

Journal of Analytical and Applied Pyrolysis
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179 (2024)

Co-pyrolysis of microalgae residue and sewage sludge: An in-depth characterization of kinetics, drivers, and gas-oil-char behaviors

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Abstract

Environmental concerns linked to fossil fuels, including but not limited to global warming, climate change, water and soil acidification, are compelling countries to investigate and advance biomass energy sources. In this study, lipid-isolated Chlorella vulgaris residue (CVR) and sewage sludge (SS) were characterized for their pyrolytic drivers, behaviors, in situ gasses, kinetics, bio-chars, and bio-oils using a hyphenated thermogravimetric–Fourier infrared spectroscopy/gas chromatography− mass spectrometry (TG-FTIR/GC-MS), two-dimensional correlation spectroscopy (2D-COS), and fixed bed reactor techniques. Also, an integrated response surface methodology and artificial neural network (RSM-ANN) modelling technique were utilized to optimize the pyrolytic products. Based on the TG/DTG analyses of the co-pyrolysis, two decomposition stages can be distinguished: the first stage involved degradation of CVR (150–350 °C), whereas the second stage (350–550 °C) was due to degradation of CVR-SS blends. The average activation energy (Eavg) was 250 kJ/mol and 235 kJ/mol for CVR and SS degradation, respectively. The integrated RSM-ANN modelling led to the maximum bio-oil and minimum of gas yield. As revealed by TG-FT/IR-GC/MS, 2D-COS, and bio-oils' GC-MS analyses, co-pyrolysis synergistically improves the hydrocarbon production, while inhibited most of the nitrogenous and oxygenous compounds. However, some upgrading processes are necessary in order to be used as a drop-in fuel. In addition, the SEM and elemental analysis was used to evaluate the char product, which revealed its potency as a fuel in a variety of contexts. The findings presented herein offer both a practical and theoretical foundation for augmenting and optimizing the comprehensive circularity of CVR and SS co-pyrolysis.

Sustainable Water Resources Management
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10 (2024)

Integrated approach for groundwater potential exploration in Abbay River Basin, East Africa

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Abstract

This paper presents and examines groundwater potential zones with the help of remote sensing and GIS methods for controlling and investigating the geospatial data of each parameter. Groundwater is a very important source for water supply and others, considering its availability, quality, cost, and time-effectiveness to develop. It is virtually everywhere and yet variable in quantity. Because of several conditions, such as rapid population growth, urbanization, industrialization, and agricultural development, groundwater sources are under severe threat. Climate change plays an important role in the quality and quantity of groundwater potential. In addition, climate change severely affects parameters that influence groundwater recharge. Unreliable exploitation and poor quality of surface water resources tend to increase the decline in groundwater levels. Hence, it is necessary to identify groundwater potential zones that can be used to optimize and monitor groundwater resources. This study was conducted in the Abbay River Basin and identifies the location of groundwater potential for developing new supplies that could be used for a range of purposes in the study area, where groundwater serves as the main source for agricultural purposes rather than surface water. Seven selected parameters—lineament density, precipitation, geology, drainage density, land use, slope, and soil data—were collected, processed, resampled, projected, and reclassified for hydrological analysis. For the generation of groundwater zones, weightage was calculated using an analytical hierarchy method, reclassified, ranked, and overlaid with GIS. The obtained results of weightage were lineament density (37%), precipitation (30%), geology (14%), drainage density (7%), land use land cover (5%), slope (4%), and soil (3%). The consistency ratio estimated for this study was 0.089, which was acceptable for further analysis. Based on the integration of all thematic layers and the generated groundwater potential zones, the map was reclassified into five different classes, namely very good, good, moderate, poor, and very poor. The results of this study reveal that 1295.33 km2 of the study area can be considered very poor, 58,913.1 km2 is poor, 131,323 km2 is moderate, 18,557 km2 is good, and 311.5 km2 is very good. Any groundwater management project performed in the better regions would offer the greatest value. A similar study would be valuable before planning any water resource development activity, as this would save the expense of comprehensive field investigations. This study also demonstrates the importance of remote sensing and GIS techniques in mapping groundwater potential at the basin scale and suggests that similar methods could be applied across other river basins.

Keywords: Ground water**,** Sensitivity analysis**,** AHP**,** GIS**,** Thematic layer**,** Watershed

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11 (2024)

Characterization of wear rate of Al-12 wt%Si alloy based MMC reinforced with ZrO2 particulates

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Abstract

The primary objective of this study is to fabricate an Al-12 wt% Si Alloy/ZrO2 composite using the Stir Casting technique, with a specific focus on assessing its performance, particularly in terms of wear characteristics. This research presents a unique approach by utilizing Al-12 wt% Si Alloy as the matrix material, aiming to develop tailored Al Alloy matrix composites suitable for applications requiring enhanced tribological properties. The composites are systematically manufactured with varying percentages of micro-sized ZrO2 reinforcements, specifically 0.5, 1, and 3 wt%. The incorporation of ZrO2 results in significant improvements in wear resistance, a critical attribute for Al-12 wt% Si Alloy-based composites. These composites find extensive utility across industries such as marine, aerospace, automotive, and the power sector, where they are indispensable for producing vital components like electrical sliding contacts, gears, bearings, bushes, pistons, piston rings, and clutches. Despite the availability of various promising reinforcement materials, researchers persistently explore novel combinations of matrices and reinforcements to tailor properties and enhance cost-effectiveness. ZrO2 has emerged as a notable reinforcement material in metal matrix composites, as evidenced by numerous research endeavours. The composites fabricated with ceramic reinforcement's exhibit enhanced tribological characteristics. The study observes that the wear rate decreases up to 3 wt% of reinforcements, beyond which it increases due to reinforcement agglomeration. The optimal wear-resistant combination is found at 3 wt% of ZrO2, attributed to robust micro-coring and interstitial metal-oxygen bonding facilitated by the Si content in the Al-12%Si matrix. The results are further optimized using Response Surface Methodology (RSM) techniques and validated using the ANOVA table to elucidate the behaviour of the composites under different operational conditions. The hardness results further ascertain the decrease in the wear rate due to the inclusion of ZrO2 reinforcements owing to micro coring and strengthening.

Keywords: ZrO2, Al-12 wt% Si alloy, stir casting method, wear test, wear rate, RSM

Toxics
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12 (2024)

Elucidating Amendment Resources for Reclaiming Efficacy of Sodic Soils around Abaya and Chamo Lakes, South Ethiopia Rift Valley

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Abstract

Background: Sodic soils are harmful to agricultural and natural environments in Ethiopia's semi-arid and arid regions, leading to soil degradation and reduced productivity. This study investigated how amendment resources could help improve the chemical properties of sodic soils around the Abaya and Chamo Lakes in the South Ethiopia Rift Valley. Methods: A factorial experiment was conducted to study the effects of gypsum (GYP) and farmyard manure (FYM) on sodic soil reclamation. The experiment had four levels of GYP (0, 50, 100, and 150%) and four levels of FYM (0, 10, 20, and 30 tons ha−1), with three replications. The pots were incubated for three months and leached for one month, after which soil samples were collected and analyzed for chemical properties. ANOVA was performed to determine the optimal amendment level for sodic soil reclamation. Results: The study found that applying 10 ton FYM ha−1 and gypsum at 100% gypsum required (GR) rate resulted in a 99.8% decrease in exchangeable sodium percentages (ESP) compared to untreated composite sodic soil and a 1.31% reduction over the control (GYP 0% + FYM 0 ton ha−1). As a result, this leads to a decrease in soil electrical conductivity, exchangeable sodium (Ex. Na), and ESP values. The results were confirmed by the LSD test at 0.05. It is fascinating to see how different treatments can have such a significant impact on soil properties. The prediction models indicate that ESP's sodic soil treatment effect (R2 = 0.95) determines the optimal amendment level for displacing Ex. Na from the exchange site. The best estimator models for ESP using sodic soil treatment levels were ESP = 1.65–0.33 GYP for sole gypsum application and ESP = 1.65–0.33 GYP + 0.28 FYM for combined GYP and FYM application, respectively. Conclusion: The study found that combined GYP and FYM applications reduced ESP to less than 10% in agriculture, but further research is needed to determine their effectiveness at the field level.

Keywords: sodic soil; soil properties; arid regions; gypsum; farmyard manure

Heliyon
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10 (2024)

Comparative analysis in selecting best irrigation method to maximize tomato yield from various irrigation approaches in water scarce regions

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Abstract

It is now essential for farmers to evaluate and compare different irrigation scheduling strategies in order to operate their irrigation systems in accordance with their resources and achievements. For tomato crops, a rigorous comparison was made between the yield of soil moisture and irrigation scheduling systems based on evapotranspiration. The experimental setup used a randomized complete block design (RCBD) with three replications, with water requirements of 100%, 75%, and 50%. Using a ReplogleBos-Clemmens (RBC) flume with an input rate of 1.62 l/s, water was applied to the furrows. The total applied amount in the Soil Moisture (SM) and Evapotranspiration (ET) based methods was 229.1 mm, and 280 mm, respectively. The collected data were assessed using ANOVA at a 5% significance level. For every technique, yield values, yield attributes, and agronomic traits were computed. The result indicates that there is no appreciable variation among the factors. The net yield advantage was highest at 75% SM and lowest at 25% SM. Furthermore, compared to the ET-based approach, it was demonstrated that the SM-based method conserved approximately 18.2% of irrigation water. As a result, when producing crops that require a lot of water, like tomatoes, in areas with limited water resources, SM-based irrigation scheduling is preferable to ET-based irrigation scheduling.

Keywords: Evapotranspiration method**,** Irrigation scheduling**,** Soil moisture method**,** Tomato**,** Yield attributes

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Global age-sex-specific mortality, life expectancy, and population estimates in 204 countries and territories and 811 subnational locations, 1950–2021, and the impact of the COVID-19 pandemic: a comprehensive demographic analysis for the Global Burden of Disease Study 2021

GBD 2021 Demographics Collaborators [1]

Abstract

Background: Estimates of demographic metrics are crucial to assess levels and trends of population health outcomes. The profound impact of the COVID-19 pandemic on populations worldwide has underscored the need for timely estimates to understand this unprecedented event within the context of long-term population health trends. The Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) 2021 provides new demographic estimates for 204 countries and territories and 811 additional subnational locations from 1950 to 2021, with a particular emphasis on changes in mortality and life expectancy that occurred during the 2020–21 COVID-19 pandemic period.

Methods: 22 223 data sources from vital registration, sample registration, surveys, censuses, and other sources were used to estimate mortality, with a subset of these sources used exclusively to estimate excess mortality due to the COVID-19 pandemic. 2026 data sources were used for population estimation. Additional sources were used to estimate migration; the effects of the HIV epidemic; and demographic discontinuities due to conflicts, famines, natural disasters, and pandemics, which are used as inputs for estimating mortality and population. Spatiotemporal Gaussian process regression (ST-GPR) was used to generate under-5 mortality rates, which synthesised 30 763 location-years of vital registration and sample registration data, 1365 surveys and censuses, and 80 other sources. ST-GPR was also used to estimate adult mortality (between ages 15 and 59 years) based on information from 31 642 location-years of vital registration and sample registration data, 355 surveys and censuses, and 24 other sources. Estimates of child and adult mortality rates were then used to generate life tables with a relational model life table system. For countries with large HIV epidemics, life tables were adjusted using independent estimates of HIV-specific mortality generated via an epidemiological analysis of HIV prevalence surveys, antenatal clinic serosurveillance, and other data sources. Excess mortality due to the COVID-19 pandemic in 2020 and 2021 was determined by subtracting observed all-cause mortality (adjusted for late registration and mortality anomalies) from the mortality expected in the absence of the pandemic. Expected mortality was calculated based on historical trends using an ensemble of models. In location-years where all-cause mortality data were unavailable, we estimated excess mortality rates using a regression model with covariates pertaining to the pandemic. Population size was computed using a Bayesian hierarchical cohort component model. Life expectancy was calculated using age-specific mortality rates and standard demographic methods. Uncertainty intervals (UIs) were calculated for every metric using the 25th and 975th ordered values from a 1000-draw posterior distribution.

Findings: Global all-cause mortality followed two distinct patterns over the study period: age-standardised mortality rates declined between 1950 and 2019 (a 62·8% [95% UI 60·5–65·1] decline), and increased during the COVID-19 pandemic period (2020–21; 5·1% [0·9–9·6] increase). In contrast with the overall reverse in mortality trends during the pandemic period, child mortality continued to decline, with 4·66 million (3·98–5·50) global deaths in children younger than 5 years in 2021 compared with 5·21 million (4·50–6·01) in 2019. An estimated 131 million (126–137) people died globally from all causes in 2020 and 2021 combined, of which 15·9 million (14·7–17·2) were due to the COVID-19 pandemic (measured by excess mortality, which includes deaths directly due to SARS-CoV-2 infection and those indirectly due to other social, economic, or behavioural changes associated with the pandemic). Excess mortality rates exceeded 150 deaths per 100 000 population during at least one year of the pandemic in 80 countries and territories, whereas 20 nations had a negative excess mortality rate in 2020 or 2021, indicating that all-cause mortality in these countries was lower during the pandemic than expected based on historical trends. Between 1950 and 2021, global life expectancy at birth increased by 22·7 years (20·8–24·8), from 49·0 years (46·7–51·3) to 71·7 years (70·9–72·5). Global life expectancy at birth declined by 1·6 years (1·0–2·2) between 2019 and 2021, reversing historical trends. An increase in life expectancy was only observed in 32 (15·7%) of 204 countries and territories between 2019 and 2021. The global population reached 7·89 billion (7·67–8·13) people in 2021, by which time 56 of 204 countries and territories had peaked and subsequently populations have declined. The largest proportion of population growth between 2020 and 2021 was in sub-Saharan Africa (39·5% [28·4–52·7]) and south Asia (26·3% [9·0–44·7]). From 2000 to 2021, the ratio of the population aged 65 years and older to the population aged younger than 15 years increased in 188 (92·2%) of 204 nations.

Interpretation: Global adult mortality rates markedly increased during the COVID-19 pandemic in 2020 and 2021, reversing past decreasing trends, while child mortality rates continued to decline, albeit more slowly than in earlier years. Although COVID-19 had a substantial impact on many demographic indicators during the first 2 years of the pandemic, overall global health progress over the 72 years evaluated has been profound, with considerable improvements in mortality and life expectancy. Additionally, we observed a deceleration of global population growth since 2017, despite steady or increasing growth in lower-income countries, combined with a continued global shift of population age structures towards older ages. These demographic changes will likely present future challenges to health systems, economies, and societies. The comprehensive demographic estimates reported here will enable researchers, policy makers, health practitioners, and other key stakeholders to better understand and address the profound changes that have occurred in the global health landscape following the first 2 years of the COVID-19 pandemic, and longer-term trends beyond the pandemic.

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Burden of disease scenarios for 204 countries and territories, 2022–2050: a forecasting analysis for the Global Burden of Disease Study 2021

GBD 2021 Forecasting Collaborators

Abstract

Background: Future trends in disease burden and drivers of health are of great interest to policy makers and the public at large. This information can be used for policy and long-term health investment, planning, and prioritisation. We have expanded and improved upon previous forecasts produced as part of the Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) and provide a reference forecast (the most likely future), and alternative scenarios assessing disease burden trajectories if selected sets of risk factors were eliminated from current levels by 2050.

Methods: Using forecasts of major drivers of health such as the Socio-demographic Index (SDI; a composite measure of lag-distributed income per capita, mean years of education, and total fertility under 25 years of age) and the full set of risk factor exposures captured by GBD, we provide cause-specific forecasts of mortality, years of life lost (YLLs), years lived with disability (YLDs), and disability-adjusted life-years (DALYs) by age and sex from 2022 to 2050 for 204 countries and territories, 21 GBD regions, seven super-regions, and the world. All analyses were done at the cause-specific level so that only risk factors deemed causal by the GBD comparative risk assessment influenced future trajectories of mortality for each disease. Cause-specific mortality was modelled using mixed-effects models with SDI and time as the main covariates, and the combined impact of causal risk factors as an offset in the model. At the all-cause mortality level, we captured unexplained variation by modelling residuals with an autoregressive integrated moving average model with drift attenuation. These all-cause forecasts constrained the cause-specific forecasts at successively deeper levels of the GBD cause hierarchy using cascading mortality models, thus ensuring a robust estimate of cause-specific mortality. For non-fatal measures (eg, low back pain), incidence and prevalence were forecasted from mixed-effects models with SDI as the main covariate, and YLDs were computed from the resulting prevalence forecasts and average disability weights from GBD. Alternative future scenarios were constructed by replacing appropriate reference trajectories for risk factors with hypothetical trajectories of gradual elimination of risk factor exposure from current levels to 2050. The scenarios were constructed from various sets of risk factors: environmental risks (Safer Environment scenario), risks associated with communicable, maternal, neonatal, and nutritional diseases (CMNNs; Improved Childhood Nutrition and Vaccination scenario), risks associated with major non-communicable diseases (NCDs; Improved Behavioural and Metabolic Risks scenario), and the combined effects of these three scenarios. Using the Shared Socioeconomic Pathways climate scenarios SSP2-4.5 as reference and SSP1-1.9 as an optimistic alternative in the Safer Environment scenario, we accounted for climate change impact on health by using the most recent Intergovernmental Panel on Climate Change temperature forecasts and published trajectories of ambient air pollution for the same two scenarios. Life expectancy and healthy life expectancy were computed using standard methods. The forecasting framework includes computing the age-sex-specific future population for each location

and separately for each scenario. 95% uncertainty intervals (UIs) for each individual future estimate were derived from the 2·5th and 97·5th percentiles of distributions generated from propagating 500 draws through the multistage computational pipeline.

Findings: In the reference scenario forecast, global and super-regional life expectancy increased from 2022 to 2050, but improvement was at a slower pace than in the three decades preceding the COVID-19 pandemic (beginning in 2020). Gains in future life expectancy were forecasted to be greatest in super-regions with comparatively low life expectancies (such as sub-Saharan Africa) compared with super-regions with higher life expectancies (such as the high-income super-region), leading to a trend towards convergence in life expectancy across locations between now and 2050. At the super-region level, forecasted healthy life expectancy patterns were similar to those of life expectancies. Forecasts for the reference scenario found that health will improve in the coming decades, with all-cause age-standardised DALY rates decreasing in every GBD super-region. The total DALY burden measured in counts, however, will increase in every super-region, largely a function of population ageing and growth. We also forecasted that both DALY counts and age-standardised DALY rates will continue to shift from CMNNs to NCDs, with the most pronounced shifts occurring in sub-Saharan Africa (60·1% [95% UI 56·8–63·1] of DALYs were from CMNNs in 2022 compared with 35·8% [31·0–45·0] in 2050) and south Asia (31·7% [29·2–34·1] to 15·5% [13·7–17·5]). This shift is reflected in the leading global causes of DALYs, with the top four causes in 2050 being ischaemic heart disease, stroke, diabetes, and chronic obstructive pulmonary disease, compared with 2022, with ischaemic heart disease, neonatal disorders, stroke, and lower respiratory infections at the top. The global proportion of DALYs due to YLDs likewise increased from 33·8% (27·4–40·3) to 41·1% (33·9–48·1) from 2022 to 2050, demonstrating an important shift in overall disease burden towards morbidity and away from premature death. The largest shift of this kind was forecasted for sub-Saharan Africa, from 20·1% (15·6–25·3) of DALYs due to YLDs in 2022 to 35·6% (26·5–43·0) in 2050. In the assessment of alternative future scenarios, the combined effects of the scenarios (Safer Environment, Improved Childhood Nutrition and Vaccination, and Improved Behavioural and Metabolic Risks scenarios) demonstrated an important decrease in the global burden of DALYs in 2050 of 15·4% (13·5–17·5) compared with the reference scenario, with decreases across super-regions ranging from 10·4% (9·7–11·3) in the high-income super-region to 23·9% (20·7–27·3) in north Africa and the Middle East. The Safer Environment scenario had its largest decrease in sub-Saharan Africa (5·2% [3·5–6·8]), the Improved Behavioural and Metabolic Risks scenario in north Africa and the Middle East (23·2% [20·2–26·5]), and the Improved Nutrition and Vaccination scenario in sub-Saharan Africa (2·0% [–0·6 to 3·6]).

Interpretation: Globally, life expectancy and age-standardised disease burden were forecasted to improve between 2022 and 2050, with the majority of the burden continuing to shift from CMNNs to NCDs. That said, continued progress on reducing the CMNN disease burden will be dependent on maintaining investment in and policy emphasis on CMNN disease prevention and treatment. Mostly due to growth and ageing of populations, the number of deaths and DALYs due to all causes combined will generally increase. By constructing alternative future scenarios wherein certain risk exposures are eliminated by 2050, we have shown that opportunities exist to substantially improve health outcomes in the future through concerted efforts to prevent exposure to well established risk factors and to expand access to key health interventions. **Funding:** Bill & Melinda Gates Foundation.

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Physicochemical and microbial community dynamics of Kocho fermented from different enset varieties in South West Ethiopia

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Abstract

Enset (Ensete ventricosum (Welw.) Cheesman) is an indigenous multipurpose plant in Ethiopia. More than 20 % of people in Ethiopia rely on enset for their subsistence livelihood. Its fermentation produces a starchy food named Kocho, which is yet poorly studied. In this study, physicochemical and microbial community dynamics of Kocho fermented from different enset varieties (Maziya, Genna, and Arkiya) were collected at Dawro Zone (Southern Ethiopia). Samples were collected at various fermentation times (days 1–60) for physicochemical and microbial (culture-dependent and culture-independent) characterization. Results showed that increasing fermentation time has a significantly strong positive ($R2 = 0.768$, $p = 0.004$) correlation between titrable acidity, and a significantly strong negative association with pH ($R2 = −0.715$, $p = 0.009$), moisture ($R2 = −0.982$, $p < 0.05$), ash ($R2 = −0.932$, $p < 0.05$), fat ($R2 = −0.861$, $p < 0.05$), fiber ($R2 = −0.981$, $p < 0.05$) and carbohydrate ($R2 = −0.994$, $p < 0.001$) contents. An increasing or decreasing trend of physicochemical parameters observed during enset fermentation is significantly associated with microbial community dynamics. Shifts of microbial community observed during culture-dependent analysis were also confirmed by metagenomic results. During fermentation, Firmicutes (39–68 %) > Proteobacteria (7–53 %) > Cyanobacteria (7–24 %) were dominant phyla in the three enset varieties. Gamma (traditional starter culture) is dominated by Lactobacillus plantrum and Lactobacillus manihotivorans most probably the two species that play a significant role in initiating enset fermentation.

Keywords: Enset**,** Kocho**,** South West Ethiopia**,** Microbial community**,** Gamma

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Citizen science data to improve rainfall-runoff model performance in urbanizing Akaki catchment, Awash Basin, Ethiopia

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Abstract

Study region: Akaki is a headwater catchment of the Awash River Basin in Ethiopia and hosts Addis Ababa. The catchment remains ungauged despite providing diverse ecosystem services. **Study focus:** Studies typically assume that calibrated model parameters remain valid outside the calibration period despite many catchments undergoing anthropogenic change. We evaluated the value of citizen science data to improve a rainfall-runoff model performance in the urbanizing Akaki catchment. Five and nineteen people trained as citizen scientists monitored river stage and rainfall data, respectively, for three years. Rating curves were developed for the conversion of stage data into river flow data. A HEC-HMS model, calibrated for a historical period, was evaluated using citizen science data. Next, we assessed the effectiveness of progressively updating model parameters using a recent land use land cover map and citizen science data. Then, the HEC-HMS model was recalibrated at the catchment outlet and validated at multiple sub-catchments' outlets. Finally, the model was recalibrated at multiple sub-catchments' outlets using citizen science data.
New hydrological insights for the region: the HEC-HMS model of the Akaki, which was calibrated for a historical period, does not capture the current rainfall-runoff response. However, the model simulations were made useful by revisiting the model calibration at multiple sub-catchments' outlets using citizen science data. Overall, this article demonstrates the value of citizen science data for model calibration and validation.

Keywords: Citizen science; Rainfall-runoff model; Validation; Recalibration: Akaki; Ethiopia

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Co-existence of maternal overweight/obesity, child undernutrition, and anaemia among mother-child pairs in Ethiopia

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Abstract

Ethiopia is currently known to be the most food-insecure country in sub-Saharan Africa, where childhood undernutrition remains endemic. While attention is increasingly being paid to childhood undernutrition in Ethiopia, a current surge of "triple burden of malnutrition"(TBM) has received less attention. The purpose of this study was to determine the prevalence of TBM and identify the associated factors in Ethiopia. Data were from the Ethiopian Demographic and Health Surveys (2005-2016) and a total of 20,994 mother-child pairs were examined in this study. The TBM was our primary outcome variable, which encompasses three types of nutritional problems-when a mother may be overweight/obese, while her child is stunted, wasted, or underweight plus has anaemia under the same roof. A multilevel logistic regression explored the individual- and community-level factors associated with TBM. Our study indicated that children under-five years of age were anaemic, stunted, wasted, and underweight [49.3% (95% CI: 48.7-49.9), 43.1% (95% CI: 42.4-43.7), 10.3% (95% CI: 9.9-10.7), and 27.6% (95% CI: 27.0-28.1)] respectively. The overall prevalence of TBM was 2.6% (95% CI: 2.39-2.83). Multilevel analyses revealed that TBM was more likely to occur among children aged 12-23 months (AOR: 2.54, 95% CI: 1.68-3.83), 24-35 months (AOR: 1.54, 95% CI: 1.03-2.29), children perceived by their mothers to be smaller than normal at birth (AOR: 1.94, 95% CI: 1.48-2.56), who experienced fever in the past 2 weeks (AOR: 1.58, 95% CI: 1.24-2.01), and lived in urban settings (AOR: 1.79, 95% CI: 1.13-2.86). Lower odds of TBM were reported among female children (AOR: 0.59, 95% CI: 0.47-0.72), and those who lived in rich households (AOR: 0.69: 95% CI: 0.49-0.98). TBM was found to be present in almost three percent of households in Ethiopia. Addressing the TBM through double-duty actions will be of critical importance in achieving malnutrition in all its forms in Ethiopia.

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Flood Inundation mapping and mitigation options in data-scarce region of Beledwayne town in the Wabi Shebele River Basin of Somalia

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Abstract

Somalia has experienced extreme flash floods in recent years across the arid regions causing tremendous loss of lives and properties. However, the flood magnitude, depth, and frequency of occurrence are not yet quantified. This is mainly due to scarce datasets in the area. In this study, integration of observed and Climate Hazards Infrared Precipitation (CHIRP) satellite rainfall products and remote sensing raster data were used to improve hydrological model simulation outputs. The Hydrologic Engineering Center namely HEC-HMS and HEC-RAS models were used to simulate the rainfall-runoff processes and flood inundation, respectively. The land use, soil, slope and Digital Elevation map (DEM) were used to set-up the models and generate outputs. The HEC-HMS model calibration results depict that the model is able to reproduce the observed streamflow The simulated flows generated by the model predicted good agreement with the observed flow with values of 0.79, 0.74, 0.78, and 0.78 evaluated through the Nash and Sutcliffe Efficiency (NSE), Runoff Volume Error (RVE), coefficient of determination (R2), and percentage error of peak flow (PEPF), respectively. The HEC-RAS model result indicates that the maximum flood depth and velocity were obtained at the floodplain area. The peak flood at 50, 100, and 200-year return period using General Extreme Value (GEV) distribution revealed 384m3s-1, 409m3s-1, and 434m3s-1, respectively. The 100-year peak flood discharge in a specific part of the river revealed a flood depth of 7.53m. The provision of Levees as mitigation measures revealed reduction of the flood extent by 35% and suggested as possible flood protection measures for the study area. © 2023 National Institute of Natural Hazards, Ministry of Emergency Management of China

Keywords: Flood inundation mapping**,** CHIRP**,** HEC-HMS**,** HEC-RAS**,** Levee**,** Beledwayne**,** Somalia

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Comparative evaluation of the dynamics of terrestrial water storage and drought incidences using multiple data sources: Tana sub-basin, Ethiopia

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Abstract

Evaluating water storage changes and addressing drought challenges in areas like the Tana sub-basin in Ethiopia is difficult due to limited data availability. The aim of this study was to evaluate the dynamics of terrestrial water anomaly and drought incidences by employing multiple data source. The Gravity Recovery and Climate Experiment (GRACE) and Global Land Data Assimilation System (GLDAS) datasets were used to assess the long-term water storage dynamics and drought incidences using the weighted water storage deficit index (WWSDI). WWSDI was used to identify drought periods, which ranged from severe to extreme drought. Despite the overall increase in average annual total water storage anomaly (TWSA) by 0.43 cm/year and a net gain of 50.68 cm equivalent water height from 2003 to 2022, there were instances of terrestrial water storage deficits, particularly in 2005, 2006, and 2009, during historical drought periods. The TWSA exhib-ited a strong correlation with Lake Tana water storage and precipitation anomalies after adjusting lag times. WWSDI displayed a high correlation with WSDI but a weak correlation with SPI and SPEI. Therefore, utilization of GRACE and GLDAS data is promising for evaluating terrestrial water storage and monitoring drought in data-deficient regions like the Tana sub-basin in Ethiopia.

Keywords: climate extremes, drought indices, GLDAS, GRACE, Tana sub-basin, TWS

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Spatiotemporal analysis of meteorological drought in El Niño years over Oromia region, Ethiopia

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Abstract

Drought is one of the most common natural disasters globally; having major impacts on environmental, economic, and social conditions and Ethiopia is no exception particularly the Oromia region. In order to evaluate and characterize the meteorological droughts associated with El Niño years over the Oromia region, the satellite data CHIRPS was used. The monthly time series data for the period from 1991 to 2020 was used for temporal and spatial analysis of meteorological drought using standardized precipitation index (SPI) across SPI3, SPI6, SPI9 and SPI12 indices using GeoCLIM, GIS, and Python tools. The results of this study show that meteorological droughts during the El Niño years indicated an increment across weak, moderate, and strong El Niño events over the Oromia region. The dryness was visualized with frequency and duration in time-scale across short-term drought indices in time steps. The time-scale temporal meteorological drought indices in three to twelve months show that the drought indices varied in magnitude, duration, and frequency in meteorological droughts. In general, the meteorological drought severity of correlation for the remaining zones analysis between SPI3 and SPI6, SPI6 and SPI12, and SPI9 and SPI12 indices was dominated by an increment of the correlation values over short to long timescales over the study area.

Keywords: Meteorological drought; El Niño; SPI; impact

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Gamo's cultural forum-Dubussha as a tool for social change communication: Illiteracy and child labor abuse as a case in point

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Abstract

This study investigated the instrumental potential of Gamo's traditional dialogue forum-Dubussha-for social change communication in general, using illiteracy and child labour abuse as a case in point. The study went on to analyze the motive that when traditions pave the way for new ways of life and thinking, changes are more applicable and transformative. As a result, this study sought to apply current values in a more local context and discovered that using culture as a vehicle for transformation yielded positive results. The two most popular tactics used to satisfy the study's goal of gathering information from largely alternatively educated respondents were intensive interviews and focus group discussions. Since cultural societies' skills, expertise, and knowledge are intricately related to their culture, the qualitative technique was effective in understanding and testing the research questions of this study. According to the study's objectives, three different focus group discussions (FGDs) were held in the Dita, Daramalo, and Chencha districts. Participants in the focus groups ranged in age, gender, and cultural background. Each FGD session included a diverse variety of participants, including women, men, student participants, and cultural leaders (Haleqas and/or Hudugas (opinion leaders). The FGD had 27 participants until it was full. Participants, facilitators, and in-depth interviewees were also purposively chosen. Finally, the study's findings indicated that Dubussha had a large potential for social change communication, particularly to reduce illiteracy and child labour abuse. Given that the cultural communication forum, Dubussha, is the major pillar of Gamo society's psychosocial structure, its use as an effective instrument for social change communication produced significant outcomes. Despite the gender and age differences in the application of "Dubussha," the outcome, acceptance, and glory of Dubussha among the Gamo community remained consistent.

Keywords: Grass-root communication**,** Dubussha**,** Illiteracy**,** Child labour abuse**,** social change communication**,** Alternative knowledge**,** Participatory approach

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In-service teacher trainees experience with and preference for online learning environments during Covid-19 pandemic

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Abstract

The Covid-19 pandemic has forced the educational sector to quickly adapt to the crisis and shift to online learning environments (OLEs). Therefore, a critical area for research is assessing the readiness of teachers in terms of their familiarity and preference for OLEs. In this study, we aimed to improve the experience and preference of in-service teacher trainees with OLEs during the Covid-19 pandemic in Ethiopia. To achieve this goal, questionnaires were used to gather data from in-service teacher trainees. Descriptive and inferential statistical methods, including exploratory factor analysis (EFA) and confirmatory factor analysis (CFA), Pearson correlation, and one-way ANOVA, were used to analyze the data and determine the participants' opinions and experiences with OLEs. The results showed that while in-service teacher trainees had less experience in knowledge and skills compared to cooperation and interaction, they preferred online learning platforms over online learning strategies. Additionally, correlations were found between cooperation and interaction, knowledge and skills; cooperation and interaction, online learning platforms; cooperation and interaction, online learning strategies; and online learning platforms and online learning strategies. Interestingly, no statistically significant correlation was found between knowledge and skills and online learning platforms. In conclusion, Ethiopian in-service teacher trainees favored online learning platforms over traditional online learning strategies, despite having less experience in knowledge and skills. Further research is needed to explore the experiences and preferences of in-service teacher trainees in various ecological aspects.

Keywords: In-service teacher trainees**,** Online learning environments**,** Teacher trainees' experience**,** Teacher trainees' preference**,** Covid-19 pandemic

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Graded mesh modified backward finite difference method for two parameters singularly perturbed second-order boundary value problems

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Abstract

The existence of boundary layers in the solutions of two-parameter singularly perturbed boundary value problems makes classical numerical methods insufficient in providing accurate approximations. Consequently, the development of layer-adapted mesh methods that achieve parameter uniform convergence and are specifically designed to accurately handle these layers becomes highly significant. The aim of this paper is to construct and examine a numerical approach for obtaining approximate solutions to a specific class of two-parameter singularly perturbed second order boundary value problems whose solutions exhibit boundary layers at both ends of the domain. The problem is discretized by employing a modified backward finite difference method on a mesh that is graded. To validate the theoretical findings, well known test problems from the existing literature are utilized. Moreover, the efficiency of the proposed method is demonstrated by comparing it to other existing methods in the literature. The stability and uniform convergence with respect to the parameters of the proposed method have been verified, revealing that it attains second-order convergence in the maximum norm. The numerical outcomes illustrate that the proposed method offers remarkably accurate approximations of the solution. Theoretical findings are in agreement with the experimental results.

Keywords: Singularly perturbed problems; Two parameters; Graded mesh; Modified backward finite difference; Parameters uniform convergence

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The diversity and abundance of soil macrofauna under different agroforestry practices in the drylands of southern Ethiopia

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Abstract

The conversion of natural lands to agricultural uses is a significant threat to soil biodiversity. Within agriculture, monoculture based systems are the most common which often result in low biodiversity because they impact the abundance, diversity, and composition of soil macrofauna (SMF). The objective of this paper was to analyze SMF abundance and diversity across different agroforestry practices (AFP) in the drylands of southern Ethiopia. The soil monolith and soil samples were collected from homegarden, cropland, woodlot, and trees on soil and water conservation based AFP using the standard Tropical Soil Biology and Fertility Institute manual, and the identification was done based on morphological characteristics and standard identification keys. The abundance, occurrence, and community composition of SMF were significantly different across the different AFPs ($P < 0.05$). In this study, 378 SMF belonging to 13 families, including unnamed were identified. The soil ecosystem of AFP was dominated by earthworms (relative abundance = 0.43), followed by termites (relative abundance = 0.12). The homegarden AFP type had a significantly higher number of SMF occurrence index of 46.03 (174), followed by woodlot, 26.72 (101) practices, and the lowest was recorded under cropland, 12.70 (48). The abundance, diversity, richness, and similarity of SMF were significantly related to soil total nitrogen and organic carbon. Phosphorus and pH were significantly related to the abundance and richness of SMF. The homegarden and woodlot AFP types were suitable for SMF biodiversity conservation.

Keywords: Abundance**,** Cropland**,** Diversity**,** Homegarden**,** Trees on soil and water conservation**,** Wood lot

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Regulatory problems and associated factors among infants in Arba Minch health and demographic surveillance system sites, southern Ethiopia

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Abstract

Introduction: Infant regulatory problems are a common source of concern for parents, and they increase the risk of impaired infant-caregiver bonding. Despite their impact, they are often overlooked in Ethiopia. Hence, this study aimed to determine the prevalence and associated factors of infant regulatory problems in Arba Minch Health and Demographic Surveillance System sites in southern Ethiopia.
Methods: A community-based cross-sectional study was conducted among 451 mother-infant pairs from February 15 to March 15, 2022. Regulatory problems were assessed using diagnostic interviews for regulatory problems. The data was collected using an open data kit Android application and analyzed with Stata version 17.0. Bivariable and multivariable logistic regression analyses were computed to identify factors associated with each infant regulatory problem. Statistical significance was declared at a p-value < 0.05.
Results: In this study, four hundred forty-nine mother-infant pairs were involved, with a response rate of 99.5%. The prevalence of excessive crying, feeding problems, and sleeping difficulties was 14.03% [95% CI: 10.95, 17.59], 20.04% [95% CI: 16.44, 24.05], and 13.59% [95% CI: 10.55, 17.11], respectively. Attending primary education (AOR: 2.54, 95% CI: 1.22, 5.32), high perceived social support (AOR: 0.32, 95% CI: 0.12, 0.89), feeding problems (AOR: 5.0, 95% CI: 2.65, 9.45), and depression, anxiety, and stress (DAS) symptoms (AOR: 2.67, 95% CI: 1.19, 5.98) were associated with excessive crying. In addition, a family size of above five (AOR: 1.82, 95% CI: 1.03, 3.22), excessive crying (AOR: 3.76, 95% CI: 1.85, 7.65), sleeping problems (AOR: 2.29, 95% CI: 1.13, 4.65), comorbid DAS symptoms (AOR: 3.42, 95% CI: 1.64, 7.11), alcohol abuse (AOR: 1.89, 95% CI: 1.04, 3.42), and late initiation of complementary feeding (AOR: 2.67, 95% CI: 1.22, 5.88) were associated with feeding problems. Furthermore, attending primary education (AOR: 2.35, 95% CI: 1.16, 4.77), feeding problems (AOR: 3.47, 95% CI: 1.86, 6.48), and comorbid DAS symptoms (AOR: 3.23, 95% CI: 1.53, 6.84) were associated with sleeping problems.
Conclusions: Approximately one-third of infants encountered at least one regulatory problem. Level of education, perceived social support, feeding problems, and DAS symptoms were associated with excessive crying. Large family sizes, excessive crying, sleeping problems, comorbid DAS symptoms, alcohol abuse and, late initiation of complementary feeding increase the likelihood of feeding problems. Moreover, attending primary education, feeding problems, and comorbid DAS symptoms increase the odds of sleeping problems. Continuous guidance and support on infant soothing techniques, cognitive and behavioral therapy, and counselling on appropriate coping strategies for postpartum women are imperative to reduce the burden of infant regulatory problems.

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Landslide susceptibility modeling in the Kulfo river catchment, rift valley, Ethiopia: An integrated geospatial and statistical analysis

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Abstract

Landslides occur when debris, rocks, or soil particles move downward. Examining the susceptibility of landslides is essential for safeguarding human well-being and assessing the consequences of landslides on the natural surroundings and ecosystems. This study utilized the frequency ratio technique to evaluate the probability of landslides happening in the Kulfo River watershed, situated in the Rift Valley area of Ethiopia. In order to ensure a comprehensive analysis, many data sources were employed, including satellite images, geological data, and historical records of landslides. This study developed a systematic approach to assess the probability of landslides by considering ten (10) influential factors: land use/land cover, slope, aspect, elevation, curvature, lithology, proximity to lineament, and normalized difference vegetation index (NDVI). The ten influential elements were prioritised based on literature review, expert knowledge, and preliminary study area analysis. The aforementioned causal elements are integrated with a comprehensive landslide inventory map. The sensitivity of the study's area to landslides was mapped using a frequency ratio (FR) model. Subsequently, it was classified as representing various degrees of vulnerability, spanning from extremely minimal to quite significant. The effectiveness of the suggested model was measured by evaluating the accuracy of the generated map of landslide susceptibility by the area under the curve (AUC) technique. Based on the most recent study results, the success rate curve has an area under the curve (AUC) of 79.6%, which indicates a highly satisfactory level of performance. Policymakers may utilize the findings of this study to make educated decisions on how to mitigate the risks of landslides in relation to land use and preparedness for disasters.

Keywords: Ethiopia; Frequency ratio; Geospatial; Kulfo river; Landslide susceptibility; Rift valley

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Predicting reservoir sedimentation using multilayer perceptron – Artificial neural network model with measured and forecasted hydrometeorological data in Gibe-III reservoir, Omo-Gibe River basin, Ethiopia

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Abstract

The estimation and prediction of the amount of sediment accumulated in reservoirs are imperative for sustainable reservoir sedimentation planning and management and to minimize reservoir storage capacity loss. The main objective of this study was to estimate and predict reservoir sedimentation using multilayer perceptron–artificial neural network (MLP-ANN) and random forest regressor (RFR) models in the Gibe-III reservoir, Omo-Gibe River basin. The hydrological and meteorological parameters considered for the estimation and prediction of reservoir sedimentation include annual rainfall, annual water inflow, minimum reservoir level, and reservoir storage capacity. The MLP-ANN and RFR models were employed to estimate and predict the amount of sediment accumulated in the Gibe-III reservoir using time series data from 2014 to 2022. ANN-architecture N4-100-100-1 with a coefficient of determination (R2) of 0.97 for the (80, 20) train-test approach was chosen because it showed better performance both in training and testing (validation) the model. The MLP-ANN and RFR models' performance evaluation was conducted using MAE, MSE, RMSE, and R2. The models' evaluation result revealed that the MLP-ANN model outperformed the RFR model. Regarding the train data simulation of MLP-ANN and RFR shown R2 (0.99) and RMSE (0.77); and R2 (0.97) and RMSE (1.80), respectively. On the other hand, the test data simulation of MLP-ANN and RFR demonstrated R2 (0.98) and RMSE (1.32); and R2 (0.96) and RMSE (2.64), respectively. The MLP-ANN model simulation output indicates that the amount of sediment accumulation in the Gibe-III reservoir will increase in the future, reaching 110 MT in 2030–2031, 130 MT in 2050–2051, and above 137 MTin 2071–2072.

Keywords: Artificial neural network; Machine learning; Multilayer perceptron; Random Forest regressor; Remote sensing; Reservoir sedimentation

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Correction to: Recharge Estimation Approach in a Data-Scarce Semi-Arid Region, Northern Ethiopian Rift Valley (Sustainability, (2023), 15, 22, (15887), 10.3390/su152215887)

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Abstract

Sustainable management of groundwater resources highly relies on the accurate estimation of recharge. However, accurate recharge estimation is a challenge, especially in data-scarce regions, as the existing models are data-intensive and require extensive parameterization. This study developed a process-based hydrologic model combining local and remotely sensed data for characterizing recharge in data-limited regions using a Basin Characterization Model (BCM). This study was conducted in Raya and Kobo Valleys, a semi-arid region in Northern Ethiopia, considering both the structural basin and the surrounding mountainous recharge areas. Climatic Research Unit monthly datasets for 1991 to 2020 and WaPOR actual evapotranspiration data were used. The model results show that the average annual recharge and surface runoff from 1991 to 2020 were 73 mm and 167 mm, respectively, with a substantial portion contributed along the front of the mountainous parts of the study area. The mountainous recharge occurred along and above the valleys as mountain-block and mountain-front recharge. The long-term estimates of the monthly recharge time series indicated that the water balance components follow the temporal pattern of rainfall amount. However, the relation of recharge to precipitation was nonlinearly related, showing the episodic nature of recharge in semi-arid regions. This study informed the spatial and temporal distribution of recharge and runoff hydrologic variables at fine spatial scales for each grid cell, allowing results to be summarized for various planning units, including farmlands. One third of the precipitation in the drainage basin becomes recharge and runoff, while the remaining is lost through evapotranspiration. The current study's findings are vital for developing plans for sustainable management of water resources in semi-arid regions. Also, monthly groundwater withdrawals for agriculture should be regulated in relation to spatial and temporal recharge patterns. We conclude that combining scarce local data with global datasets and tools is a useful approach for estimating recharge to manage groundwater resources in data-scarce regions.

Keywords: water balance; groundwater; recharge; runoff; fine scale

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Hydrologic responses contemplating to Land use Land cover change and water balance of Lake Chamo sub-basin of Ethiopia

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Abstract

Land use and Land cover (LULC) change is one of the main driving forces of environmental change that can potentially alter the hydrological response of an area. Lake Chamo sub-basin is subjected to severe erosion as a result of climate change and sedimentation, which further exacerbates the amount due to land use and land cover changes. However, less research attention had been given to evaluate the effect of LULC on the propagation of lake water balance. Therefore, in this study, the hydrological responses to changes in LULC as well as the Lake Chamo water balance were evaluated using physically distributed hydrological model, Soil Water Assessment Tool (SWAT). Four (4) periods of LULC datasets, namely 1990, 2000, 2010 and 2021, were used to analyze the effects of LULC change on the water balance of the sub-basin. The simulation result indicates that 2.6% and 2.1% of forest converted to agricultural land and built-up area, respectively; 18.3% and 14.3% of shrub land converted to agricultural land and built-up area, respectively between 1990 and 2021. The findings of Lake Chamo water balance analysis revealed total inflow of 392 million cubic meters per year (MCM year−1), outflow of 366 MCM year−1, and the change in storage of 25.4 MCM year−1. Results have shown that the surface runoff increases from 4.6 to 72.5 mm as well as sediment load rose from 0.26 to 4.21 t/ha due to LULC changes, mainly expanding to urbanization and intensive agriculture. This study suggests the LULC is crucial for integrated water resources management in the study area.

Keywords: Lulc, swat, water balance, hydrologic response, image classification, lake chamo

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Determinants for male involvement in family planning and contraception in Nakawa Division, Kampala, Uganda; An urban slum qualitative study

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Abstract

Current evidence shows that male involvement in family planning (FP) is crucial to women's contraceptive use decisions. This study explored the reasons for male involvement in FP and contraception in slum areas in Nakawa Division, Kampala, Uganda. A qualitative study was conducted among sexually active males in a slum area in Nakawa Division, Kampala. A purposive sampling technique was utilised to recruit 40 men for a Focus Group Discussion (FGDs), and 2 key informants (KI) for critical perspective interviews. A semi-structured FGDs and interview guides were used to collect the data. The FGDs were conducted in both English and the local language, Luganda. All interviews were recorded and transcribed verbatim. Transcripts for both FGDs and KI interviews were imported into the NVivo Qualitative Data Analysis Software version 10 application, and thematic data analysis was conducted. The findings show that males' involvement in FP and its decisions were minimal. The findings also show that several factors emerged as contributing to male's participation in FP and utilisation of contraceptives. Inadequate understanding of FP and contraceptives, lack of clarity on males' role in FP, unfriendly healthcare environment and community members' perceptions of male involvement in FP were reported as reasons contributing to male participation in FP and contraction. There is limited involvement of males in FP. There is a need for renewed efforts that will positively alter the factors that impact male involvement favourably. Promotion and education about FP for males will significantly address issues of limited understanding and clarity of males' role in FP services.

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Global, regional, and national burden of neck pain, 1990–2020, and projections to 2050: a systematic analysis of the Global Burden of Disease Study 2021

GBD 2021 Neck Pain Collaborators

Abstract

Background: Neck pain is a highly prevalent condition that leads to considerable pain, disability, and economic cost. We present the most current estimates of neck pain prevalence and years lived with disability (YLDs) from the Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) by age, sex, and location, with forecasted prevalence to 2050.
Methods: Systematic reviews identified population-representative surveys used to estimate the prevalence of and YLDs from neck pain in 204 countries and territories, spanning from 1990 to 2020, with additional data from opportunistic review. Medical claims data from Taiwan (province of China) were also included. Input data were pooled using DisMod-MR 2.1, a Bayesian meta-regression tool. Prevalence was forecast to 2050 using a mixed-effects model using Socio-demographic Index as a predictor and multiplying by projected population estimates. We present 95% UIs for every metric based on the 2·5th and 97·5th percentiles of 100 draws of the posterior distribution.
Findings: Globally, in 2020, neck pain affected 203 million (95% uncertainty interval [UI] 163–253) people. The global age-standardised prevalence rate of neck pain was estimated to be 2450 (1960–3040) per 100 000 population and global age-standardised YLD rate was estimated to be 244 (165–346) per 100 000. The age-standardised prevalence rate remained stable between 1990 and 2020 (percentage change 0·2% [–1·3 to 1·7]). Globally, females had a higher age-standardised prevalence rate (2890 [2330–3620] per 100 000) than males (2000 [1600–2480] per 100 000), with the prevalence peaking between 45 years and 74 years in male and female sexes. By 2050, the estimated global number of neck pain cases is projected to be 269 million (219–322), with an increase of 32·5% (23·9–42·3) from 2020 to 2050. Decomposition analysis of the projections showed population growth was the primary contributing factor, followed by population ageing. **Interpretation:** Although age-standardised rates of neck pain have remained stable over the past three decades, by 2050 the projected case numbers are expected to rise. With the highest prevalence in older adults (higher in females than males), a larger effect expected in low-income and middle-income countries, and a rapidly ageing global population, neck pain continues to pose a challenge in terms of disability burden worldwide. For future planning, it is essential we improve our mechanistic understanding of the different causes and risk factors for neck pain and prioritise the consistent collection of global neck pain data and increase the number of countries with data on neck pain.
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In vitro antileishmanial activities of hydro-methanolic crude extracts and solvent fractions of Clematis simensis fresen leaf, and Euphorbia abyssinica latex

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Abstract

As a result of increasing drug resistance, crossover resistance development, prolonged therapy, and the absence of different agents with innovative methods for implementation, the efficacy of recent antileishmanial medications is severely declining. So, it is vital to look for other medications from botanical remedies that have antileishmanial activity. The latex of Euphorbia abyssinica (E abyssinica) and the leaves of Clematis simensis fresen (C simensis) were macerated in methanol (80%). In vitro antileishmanial activity of the preparation was tried on promastigotes of Leishmania aethiopica (L aethiopica) and Leishmania donovani (L donovani) using resazurin assay, and fluorescence intensity was measured. One percent of dimethyl sulfoxide (DMSO) and media as negative control and amphotericin B as positive control were used. Additionally, hemolytic & phytochemical tests of the preparation were done. The mean and standard errors of each extract were evaluated and interpreted for statistical significance using one-way analysis of variance. From sigmoidal dose-response curves of % inhibition, half maximal inhibitory concentration (IC50) values were determined by GraphPad Prism and Microsoft Excel; outcomes were presented as mean±standard error of mean of triplicate trials. $P<.05$ was statistical significance. The phytochemical screening of C simensis and E abyssinica confirmed the existence of steroids, phenols, tannins, saponins, alkaloids, terpenoids, flavonoids and glycosides. C simensis possesses antileishmanial activity with IC50outcomes of 46.12±0.03 and 8.18±0.10 g/mL on the promastigotes of L aethiopica and L donovani, respectively. However, E abyssinica showed stronger activity with IC50outcomes of 16.07±0.05 g/mL and 4.82±0.07 g/mL on L aethiopica and L donovani, respectively. C simensis and E abyssinica have a less hemolytic effect on human red blood cells at low concentrations. The outcomes from this investigation demonstrated that the preparation of C simensis and E abyssinica indicated significant antileishmanial activity. Therefore, further in vivo assessment of antileishmanial, cytotoxicity activity and quantitative identification of secondary metabolites are highly recommended.

Keywords: antileishmanial, hemolytic, in vitro, medicinal plants, phytochemical

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Global fertility in 204 countries and territories, 1950–2021, with forecasts to 2100: a comprehensive demographic analysis for the Global Burden of Disease Study 2021

GBD 2021 Fertility and Forecasting Collaborators

Abstract

Background: Accurate assessments of current and future fertility—including overall trends and changing population age structures across countries and regions—are essential to help plan for the profound social, economic, environmental, and geopolitical challenges that these changes will bring. Estimates and projections of fertility are necessary to inform policies involving resource and health-care needs, labour supply, education, gender equality, and family planning and support. The Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) 2021 produced up-to-date and comprehensive demographic assessments of key fertility indicators at global, regional, and national levels from 1950 to 2021 and forecast fertility metrics to 2100 based on a reference scenario and key policy-dependent alternative scenarios.
Methods: To estimate fertility indicators from 1950 to 2021, mixed-effects regression models and spatiotemporal Gaussian process regression were used to synthesise data from 8709 country-years of vital and sample registrations, 1455 surveys and censuses, and 150 other sources, and to generate age-specific fertility rates (ASFRs) for 5-year age groups from age 10 years to 54 years. ASFRs were summed across age groups to produce estimates of total fertility rate (TFR). Livebirths were calculated by multiplying ASFR and age-specific female population, then summing across ages 10–54 years. To forecast future fertility up to 2100, our Institute for Health Metrics and Evaluation (IHME) forecasting model was based on projections of completed cohort fertility at age 50 years (CCF50; the average number of children born over time to females from a specified birth cohort), which yields more stable and accurate measures of fertility than directly modelling TFR. CCF50 was modelled using an ensemble approach in which three sub-models (with two, three, and four covariates variously consisting of female educational attainment, contraceptive met need, population density in habitable areas, and under-5 mortality) were given equal weights, and analyses were conducted utilising the MR-BRT (meta-regression—Bayesian, regularised, trimmed) tool. To capture time-series trends in CCF50 not explained by these covariates, we used a first-order autoregressive model on the residual term. CCF50 as a proportion of each 5-year ASFR was predicted using a linear mixed-effects model with fixed-effects covariates (female educational attainment and contraceptive met need) and random intercepts for geographical regions. Projected TFRs were then computed for each calendar year as the sum of single-year ASFRs across age groups. The reference forecast is our estimate of the most likely fertility future given the model, past fertility, forecasts of covariates, and historical relationships between covariates and fertility. We additionally produced forecasts for multiple alternative scenarios in each location: the UN Sustainable Development Goal (SDG) for education is achieved by 2030; the contraceptive met need SDG is achieved by 2030; pro-natal policies are enacted to create supportive environments for those who give birth; and the previous three scenarios combined. Uncertainty from past data inputs and model estimation was propagated throughout analyses by taking 1000 draws for past and present fertility estimates and 500 draws for future forecasts

from the estimated distribution for each metric, with 95% uncertainty intervals (UIs) given as the 2·5 and 97·5 percentiles of the draws. To evaluate the forecasting performance of our model and others, we computed skill values—a metric assessing gain in forecasting accuracy—by comparing predicted versus observed ASFRs from the past 15 years (2007–21). A positive skill metric indicates that the model being evaluated performs better than the baseline model (here, a simplified model holding 2007 values constant in the future), and a negative metric indicates that the evaluated model performs worse than baseline.

Findings: During the period from 1950 to 2021, global TFR more than halved, from 4·84 (95% UI 4·63–5·06) to 2·23 (2·09–2·38). Global annual livebirths peaked in 2016 at 142 million (95% UI 137–147), declining to 129 million (121–138) in 2021. Fertility rates declined in all countries and territories since 1950, with TFR remaining above 2·1—canonically considered replacement-level fertility—in 94 (46·1%) countries and territories in 2021. This included 44 of 46 countries in sub-Saharan Africa, which was the super-region with the largest share of livebirths in 2021 (29·2% [28·7–29·6]). 47 countries and territories in which lowest estimated fertility between 1950 and 2021 was below replacement experienced one or more subsequent years with higher fertility; only three of these locations rebounded above replacement levels. Future fertility rates were projected to continue to decline worldwide, reaching a global TFR of 1·83 (1·59–2·08) in 2050 and 1·59 (1·25–1·96) in 2100 under the reference scenario. The number of countries and territories with fertility rates remaining above replacement was forecast to be 49 (24·0%) in 2050 and only six (2·9%) in 2100, with three of these six countries included in the 2021 World Bank-defined low-income group, all located in the GBD super-region of sub-Saharan Africa. The proportion of livebirths occurring in sub-Saharan Africa was forecast to increase to more than half of the world's livebirths in 2100, to 41·3% (39·6–43·1) in 2050 and 54·3% (47·1–59·5) in 2100. The share of livebirths was projected to decline between 2021 and 2100 in most of the six other super-regions—decreasing, for example, in south Asia from 24·8% (23·7–25·8) in 2021 to 16·7% (14·3–19·1) in 2050 and 7·1% (4·4–10·1) in 2100—but was forecast to increase modestly in the north Africa and Middle East and high-income super-regions. Forecast estimates for the alternative combined scenario suggest that meeting SDG targets for education and contraceptive met need, as well as implementing pro-natal policies, would result in global TFRs of 1·65 (1·40–1·92) in 2050 and 1·62 (1·35–1·95) in 2100. The forecasting skill metric values for the IHME model were positive across all age groups, indicating that the model is better than the constant prediction.

Interpretation: Fertility is declining globally, with rates in more than half of all countries and territories in 2021 below replacement level. Trends since 2000 show considerable heterogeneity in the steepness of declines, and only a small number of countries experienced even a slight fertility rebound after their lowest observed rate, with none reaching replacement level. Additionally, the distribution of livebirths across the globe is shifting, with a greater proportion occurring in the lowest-income countries. Future fertility rates will continue to decline worldwide and will remain low even under successful implementation of pro-natal policies. These changes will have far-reaching economic and societal consequences due to ageing populations and declining workforces in higher-income countries, combined with an increasing share of livebirths among the already poorest regions of the world.

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Incidence and Predictors of Successful Vaginal Birth Among Women With a History of Cesarean Section in Public Health Facilities of Southern Ethiopia in 2021

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Abstract

Background: Even though a cesarean section (CS) performed greater than 15% has no significant association with a reduction in maternal and neonatal mortality, repeat elective CS contributes to unnecessary CS worldwide. Trial of labor after cesarean (TOLAC) is one of the strategies to reduce the rate of CS. However, the selection of candidates for a TOLAC is not an easy task without evidence. This study was conducted to determine the incidence of successful vaginal birth after one CS and the associated factors in public health facilities in southern Ethiopia.
Methods: An institutional-based cross-sectional study was conducted from June 10, 2020, to December 10, 2021, on laboring women, and the data were collected using a pretested interviewer-administered questionnaire and a data extraction sheet. A binary logistic regression model was used to assess the factors associated with successful vaginal birth after cesarean (VBAC) section using SPSS version 25. Bivariate and multivariate analyses were performed, and independent variables with p <.05 along with an odd ratio and 95% confidence interval (CI) declare the associated factors.
Results: A total of 417 women participated in this study with a response rate of 98.8%. The incidence of vaginal births after cesarean was 51.1% (CI, 46%–56%). The likelihood of successful VBAC was observed in women with a history of vaginal delivery before CS (AOR, 3.7, CI = 1.06, 13.19), favorable Bishop score at admission (AOR, 19.1, CI = 2.69, 134.98), greater than 4 cm cervical dilatation at admission (AOR, 171.3, CI = 1.8, 16,722), and clear color of amniotic fluid (AOR,.096, CI =.02,.38).
Conclusion: The incidence of VBAC in this study was slightly greater than half of all women who had a TOLAC. There were complications such as uterine rupture, whole blood transfusions, neonatal death (1 in 40 deliveries), and an emergency cesarean section rate of 48.9%. Therefore, health professionals need to be well-versed in these potential complications and obtain informed consent from properly identified potential TOLAC candidates. In choosing a woman for the TOLAC, health professionals might need to pay attention to intrapartum variables, such as cervical dilatation, Bishop score, and color of the amniotic fluid.

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Thermal degradation of emerging pollutants in municipal solid wastes and agro wastes: effectiveness of catalysts and pretreatment for the conversion of value-added products

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Abstract

In this study, emerging soil pollutants in the form of municipal solid waste (MSW) and agricultural waste were converted into biofuel via thermal degradation process. Among various waste-to-energy conversion processes, the pyrolysis of biomass is considered the most significant due to its maximum biofuel yield than other conversion techniques. Individual and co-pyrolysis of MSW and sugarcane residue (SR) as well as its treated variant (TSR) were performed in a lab-setup fixed-bed reactor with and without catalyst. The effect of acid pretreatment and catalytic effects on the pyrolysis process was assessed in terms of product yields and characterization. The acidic pretreatment of SR and catalyst in the pyrolysis process alters the process yield and its composition. The maximum oil yield of 50.5 wt% was achieved by catalytic co-pyrolysis of MSW + TSR + HZSM5, whereas the maximum gas yield of 38.1 wt% was achieved by catalytic co-pyrolysis of MSW + SR + HZSM5. This suggests that intrinsic minerals present in the biomass and MSW, particularly alkali and alkaline earth metals, have a catalytic effect on the devolatilization of organic material and the char cracking event. The pretreatment of biomass showed considerable improvement in the properties of the produced pyrolysis oil and char. Compared to the pyrolysis oil and char obtained from MSW + SR, the oil and char obtained from MSW + TSR + HZSM5 showed a small increment in their heating values. Pretreatment and the catalytic co-pyrolysis process influenced the structure of the pyrolysis oils, increasing the production of phenolic compounds and aromatic hydrocarbons. The amount of gas components in pyrolysis gas, such as CH4, CO2, and CO also changed more according to the feedstock used for the process. Overall, the HZSM-5 catalyst and co-pyrolysis of MSW with pretreated SR enhanced the pyrolysis conversion of waste municipal solids and agricultural wastes into energy-rich products.

Keywords: Waste treatment**,** Acid pretreatment**,** Pyrolysis**,** Fixed bed**,** Biofuel

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Flood hazard map of the Becho floodplain, Ethiopia, using nonstationary frequency model

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Abstract

Flood estimates based on stationary flood frequency models are commonly used as inputs to flood hazard mapping. However, changing flood characteristics caused by climate change necessitate more accurate assessments of the probabilities of rare flood events. This study aims to develop a flood hazard map based on the nonstationary flood frequency using a generalized extreme value distribution model for the Becho floodplain in the upper Awash River basin. The distributional location parameter was modeled as a function of rainfall amount of different durations, annual total precipitation from wet days, yearly mean maximum temperature and time as covariates. The one-dimensional Hydrological Engineering Center River Analysis System (HEC-RAS) hydraulic model with steady flow analysis was used to generate flood hazard map input, depth and velocity, and inundation extent for different return periods. The result indicated that the model as a function of rainfall, such as monthly rainfall (August) and annual wet day precipitation, provided the best fit to the observed hydrological data. Rainfall as a covariate can explain the variation in the peak flood series. The developed hazard map based on depth alone and the combination of depth and velocity thresholds resulted in more than 70% of the floodplain area being classified as a high hazard zone under 2, 25, 50, and 100-years return periods. The current study assists water resource managers in considering changing environmental factors and an alternative flood frequency model for developing flood hazard management and mitigation strategies.

Keywords: Flood hazard, Nonstationary, Flood frequency, HEC-RAS, Awash river basin

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Medicinal plants with promising antileishmanial activity in Ethiopia: A systematic review and meta-analysis

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Abstract

Introduction: Toxicity and resistance to chemotherapy used to treat leishmaniasis are increasing. Research on natural plant compounds has revealed their antileishmanial effects on certain Leishmania organisms. This review aimed to estimate the pooled IC50 values of medicinal plants with promising antileishmanial activity in Ethiopia.
Methods: A systematic literature search was conducted using Science Direct, PubMed, Cochrane Library, and Google Scholar to locate potential studies. Studies published in peer-reviewed journals and gray literature in university repositories before April 1, 2022, which included a full-length study reporting the half-maximal inhibitory concentration (IC50) of Ethiopian medicinal plants that were written in English were included. Conference proceedings, review articles, letters to the editor, and correspondence were excluded. The quality of the included studies was assessed using the GIVIMP critical appraisal tools. Heterogeneity between studies was verified using Cochrane Q test statistics and I2 test statistics, and the effects were checked using Egger statistical test at a level of significance. A random-effects model was used to estimate the pooled IC50 of the medicinal plants.
Results: Six articles that were conducted in Ethiopia that fulfilled the inclusion criteria, with a total of 62 in vitro experiments, were reviewed. The aggregated mean IC50 for medicinal plants in Ethiopia was 16.80 (95% CI: 12.44, 21.16) and 13.81 (95% CI: 13.12, 14.50) µg/mL for antipromastigote and antiamastigote activity, respectively. Aqueous was the significant preparation with IC50 of 0.53 (0.34, 0.73) µg/mL against promastigote and 0.98 (0.20, 1.76) µg/mL against the amastigote stage.
Discussion: This review indicated that the pooled mean of IC50 for Ethiopian medicinal plants against promastigotes and amastigotes was relatively low and showed better efficacy. This strongly suggests the need to focus on antipromastigote and antiamastigote medicinal plants in Ethiopia for the development of antileishmanial drugs. It is necessary to identify their active components, and their potential toxic effects can lead to the production of well-tolerated and safe drugs for leishmaniasis. The high heterogeneity is the limitation of this study.

Keywords: Ethiopia, herbal extracts, Leishmania, medicinal plants, meta-analysis, natural products, systematic review

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Relative and Combined Impacts of Climate and Land Use/Cover Change for the Streamflow Variability in the Baro River Basin (BRB)

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Abstract

The interplay between climate and land use/cover significantly shapes streamflow characteristics within watersheds, with dominance varying based on geography and watershed attributes. This study quantifies the relative and combined impacts of land use/cover change (LULCC) and climate change (CC) on streamflow variability in the Baro River Basin (BRB) using the Soil and Water Assessment Tool Plus (SWAT+). The model was calibrated and validated with observed streamflow data from 1985 to 2014 and projected the future streamflow from 2041 to 2070 under two Shared Socio-Economic Pathway (i.e., SSP2-4.5 and SSP5-8.5) scenarios, based on the ensemble of four Coupled Model Intercomparison Project (CMIP6) models. The LULCC was analyzed through Google Earth Engine (GEE) and predicted for the future using the Land Change Modeler (LCM), revealing reductions in forest and wetlands, and increases in agriculture, grassland, and shrubland. Simulations show that the decrease in streamflow is attributed to LULCC, whereas an increase in flow is attributed to the impact of CC. The combined impact of LULCC and CC results in a net increase in streamflow by 9.6% and 19.9% under SSP2-4.5 and SSP5-8.5 scenarios, respectively, compared to the baseline period. Our findings indicate that climate change outweighs the impact of land use/cover (LULC) in the basin, emphasizing the importance of incorporating comprehensive water resources management and adaptation approaches to address the changing hydrological conditions.

Keywords: CMIP6; SWAT+; Baro River Basin; climate scenarios; land use/cover scenarios

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Pollution sources apportionment and suitability assessment of Lah River, Ethiopia: Conjunctive application of multivariate statistical analysis and water quality index

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Abstract

This study aimed to assess spatiotemporal water quality variation and its suitability for irrigation and domestic purposes in Lah River using the irrigation water quality index (IWQI) and the weighted arithmetic water quality index (WAWQI). The IWQI analysis result showed that the sodium absorption ratio, residual sodium carbonate, potential salinity, Kelly index, magnesium ratio, sodium percentage, and permeability index were found to be 1.07 mEq/L, -0.43 mEq/L, 0.8 mEq/L, 0.78 mEq/L, 43.01%, 42.95%, and 63.46%, respectively. The IWQIs revealed that the water quality of the river was appropriate for agricultural use during the dry season. Furthermore, the calculated WAWQI of the river water ranged from 123.13 to 394.72 during the wet season, indicating the high pollution levels in the Lah River and incompatibility for drinking purposes. On the other hand, the principal component analysis identified two pollution sources during the wet season and three during the dry season. In addition, the positive matrix prioritization model predicted the pollution source's contribution quite well with a signal-to-noise ratio of .2 and a residual error between -3 and 3 for both seasons. This study suggests that water quality of Lah River is degrading periodically necessitating proper pollution management.

Keywords: Lah River, PCA, PMF, water quality, WQI

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Crop water requirement and irrigation scheduling under climate change scenario, and optimal cropland allocation in lower kulfo catchment

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Abstract

Crop water requirement and irrigation scheduling in Lower Kulfo Catchment of southern Ethiopia have not assessed under climate change scenarios, and the allocation of crop land also not optimal that signifcantly challenges to crop productivity. Therefore, this study was conducted to evaluate the effects of climate change on future crop water requirements, and irrigation scheduling, and to allocate cropland optimally. Bias of projected precipitation and temperature were corrected by utilizing Climate Model data with the hydrologic modeling tool (CMhyd). Alongside, crop water requirements and irrigation scheduling were assessed using Crop Water Assessment Tool. After estimating crop water requirement, crop land were allocated optimally using General Algebraic Modeling System programming with non-negativity constraints (scenario 1), and non-negativity constraints based on farmers adaptation (scenario 2). Average reference evapotranspiration from 2030 to 2050 and 2060 to 2080 was increased by 11.9 %, and 16.2 %, respectively compared with the reference period (2010–2022). The total seasonal crop water requirements were 4,529 mm, 4866.7 mm, and 5272.2 mm under 2010 to 2022, 2030 to 2050, and 2060 to 2080 climate change scenarios, respectively. The meean irrigation interval in 2010–2022, 2030 to 2050, and 2060 to 2080 climate change scenarios were 8 days, 7 days, and 5 days, respectively. This irrigation interval was decreased by 14 % (2030–2050), and 34 % (2060–2080) compared with the reference period. In 2030 to 2050 and 2026 to 2080 climate change scenarios, the required irrigation water at the inlet of main canal increased by 6.8 %, and 18 %, respectively. The optimal allocated area for tomato (60.4 %), maize (20.8 %), and watermelon (18.8 %) in scenario 1 with net benefit of 1.47*108 Ethiopian Birr. The allocated areas in scenario 2 were (48 %) for maize, (31.6 %) for tomato, and (20.4 %) for watermelon with 1.34*108 Ethiopian Birr net benefit it was reduced by 19.1 % compared with the net benefit in scenario 1. Fruit crops alone may not suffice for local food needs and to address this, small farmers should grow maize, tomato, and watermelon. This research aids policymakers in encouraging climate-resilient agriculture and improving small-scale farmers' awareness through conducting workshops and training.

Keywords: GAMS code**,** CropWat**,** Climate change**,** Cropland allocation

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Global incidence, prevalence, years lived with disability (YLDs), disability-adjusted life-years (DALYs), and healthy life expectancy (HALE) for 371 diseases and injuries in 204 countries and territories and 811 subnational locations, 1990–2021: a systematic analysis for the Global Burden of Disease Study 2021

GBD 2021 Diseases and Injuries Collaborators

Abstract

Background: Detailed, comprehensive, and timely reporting on population health by underlying causes of disability and premature death is crucial to understanding and responding to complex patterns of disease and injury burden over time and across age groups, sexes, and locations. The availability of disease burden estimates can promote evidence-based interventions that enable public health researchers, policy makers, and other professionals to implement strategies that can mitigate diseases. It can also facilitate more rigorous monitoring of progress towards national and international health targets, such as the Sustainable Development Goals. For three decades, the Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) has filled that need. A global network of collaborators contributed to the production of GBD 2021 by providing, reviewing, and analysing all available data. GBD estimates are updated routinely with additional data and refined analytical methods. GBD 2021 presents, for the first time, estimates of health loss due to the COVID-19 pandemic.

Methods: The GBD 2021 disease and injury burden analysis estimated years lived with disability (YLDs), years of life lost (YLLs), disability-adjusted life-years (DALYs), and healthy life expectancy (HALE) for 371 diseases and injuries using 100 983 data sources. Data were extracted from vital registration systems, verbal autopsies, censuses, household surveys, disease-specific registries, health service contact data, and other sources. YLDs were calculated by multiplying cause-age-sex-location-year-specific prevalence of sequelae by their respective disability weights, for each disease and injury. YLLs were calculated by multiplying cause-age-sex-location-year-specific deaths by the standard life expectancy at the age that death occurred. DALYs were calculated by summing YLDs and YLLs. HALE estimates were produced using YLDs per capita and age-specific mortality rates by location, age, sex, year, and cause. 95% uncertainty intervals (UIs) were generated for all final estimates as the 2·5th and 97·5th percentiles values of 500 draws. Uncertainty was propagated at each step of the estimation process. Counts and age-standardised rates were calculated globally, for seven super-regions, 21 regions, 204 countries and territories (including 21 countries with subnational locations), and 811 subnational locations, from 1990 to 2021. Here we report data for 2010 to 2021 to highlight trends in disease burden over the past decade and through the first 2 years of the COVID-19 pandemic.

Findings: Global DALYs increased from 2·63 billion (95% UI 2·44–2·85) in 2010 to 2·88 billion (2·64–3·15) in 2021 for all causes combined. Much of this increase in the number of DALYs was due to population growth and ageing, as indicated by a decrease in global age-standardised all-cause DALY rates of 14·2% (95% UI 10·7–17·3) between 2010 and 2019. Notably, however, this decrease in rates reversed during the first 2 years of the COVID-19

pandemic, with increases in global age-standardised all-cause DALY rates since 2019 of 4·1% (1·8–6·3) in 2020 and 7·2% (4·7–10·0) in 2021. In 2021, COVID-19 was the leading cause of DALYs globally (212·0 million [198·0–234·5] DALYs), followed by ischaemic heart disease (188·3 million [176·7–198·3]), neonatal disorders (186·3 million [162·3–214·9]), and stroke (160·4 million [148·0–171·7]). However, notable health gains were seen among other leading communicable, maternal, neonatal, and nutritional (CMNN) diseases. Globally between 2010 and 2021, the age-standardised DALY rates for HIV/AIDS decreased by 47·8% (43·3–51·7) and for diarrhoeal diseases decreased by 47·0% (39·9–52·9). Non-communicable diseases contributed 1·73 billion (95% UI 1·54–1·94) DALYs in 2021, with a decrease in age-standardised DALY rates since 2010 of 6·4% (95% UI 3·5–9·5). Between 2010 and 2021, among the 25 leading Level 3 causes, age-standardised DALY rates increased most substantially for anxiety disorders (16·7% [14·0–19·8]), depressive disorders (16·4% [11·9–21·3]), and diabetes (14·0% [10·0–17·4]). Age-standardised DALY rates due to injuries decreased globally by 24·0% (20·7–27·2) between 2010 and 2021, although improvements were not uniform across locations, ages, and sexes. Globally, HALE at birth improved slightly, from 61·3 years (58·6–63·6) in 2010 to 62·2 years (59·4–64·7) in 2021. However, despite this overall increase, HALE decreased by 2·2% (1·6–2·9) between 2019 and 2021.

Interpretation: Putting the COVID-19 pandemic in the context of a mutually exclusive and collectively exhaustive list of causes of health loss is crucial to understanding its impact and ensuring that health funding and policy address needs at both local and global levels through cost-effective and evidence-based interventions. A global epidemiological transition remains underway. Our findings suggest that prioritising non-communicable disease prevention and treatment policies, as well as strengthening health systems, continues to be crucially important. The progress on reducing the burden of CMNN diseases must not stall; although global trends are improving, the burden of CMNN diseases remains unacceptably high. Evidence-based interventions will help save the lives of young children and mothers and improve the overall health and economic conditions of societies across the world. Governments and multilateral organisations should prioritise pandemic preparedness planning alongside efforts to reduce the burden of diseases and injuries that will strain resources in the coming decades.

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Boosting macroscopic entanglement in charged cavity optomechanical system through coherent feedback loop

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Abstract

In this paper, we propose a scheme to boost a macroscopic entanglement between two mechanical modes assisted by an optical parametric amplifier (OPA) with a coherent feedback loop. Thus, the hybrid quantum system consists of an optical cavity, an OPA is placed inside, and two charged mechanical oscillators are coupled through a Coulomb force interaction, where the coherent feedback loop is implemented. Following the dynamics of quantum Langevin equations, we employed the quantum Lyapunov continuous variable solution numerically to quantify the macroscopic entanglement through logarithmic negativity. The results show that the presence of OPA, coherent feedback, and robust Coulomb interaction improve the macroscopic entanglement between the two mechanical modes. This phenomenon occurs due to the enhancement of the non-linear gain in the optical parametric amplifier, which leads to an increased number of photons in the cavity. Furthermore, we observe that the state transfer between the spatially separated mechanical oscillators is enhanced with an increase in the intensity of the driving laser. We believe that the present scheme enhances phonon-phonon entanglement transfer through the presence of an OPA and coherent feedback loop and has potential applications in continuous-variable quantum information processing.

Keywords: Quantum entanglement**,** Coherent feedback**,** Optical parametric amplifier**,** Electro-optomechanical system

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ML and DL-based Phishing Website Detection: The Effects of Varied Size Datasets and Informative Feature Selection Techniques

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Abstract

One must interact with a specific webpage or website in order to use the Internet for communication, teamwork, and other productive activities. However, because phishing websites look benign and not all website visitors have the same knowledge and skills to inspect the trustworthiness of visited websites, they are tricked into disclosing sensitive information and making them vulnerable to malicious software attacks like ransomware. It is impossible to stop attackers from creating phishing websites, which is one of the core challenges in combating them. However, this threat can be alleviated by detecting a specific website as phishing and alerting online users to take the necessary precautions before handing over sensitive information. In this study, five machine learning (ML) and DL algorithms—cat-boost (CATB), gradient boost (GB), random forest (RF), multilayer perceptron (MLP), and deep neural network (DNN)—were tested with three different reputable datasets and two useful feature selection techniques, to assess the scalability and consistency of each classifier's performance on varied dataset sizes. The experimental findings reveal that the CATB classifier achieved the best accuracy across all datasets (DS-1, DS-2, and DS-3) with respective values of 97.9%, 95.73%, and 98.83%. The GB classifier achieved the second-best accuracy across all datasets (DS-1, DS-2, and DS-3) with respective values of 97.16%, 95.18%, and 98.58%. MLP achieved the best computational time across all datasets (DS-1, DS-2, and DS-3) with respective values of 2, 7, and 3 seconds despite scoring the lowest accuracy across all datasets.

Keywords: ANOVA-F-test; deep learning; feature selection technique; machine learning; mutual information; phishing website datasets; phishing website detection

Frontiers in Climate
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Urban ecology in the context of urban heat island vulnerability potential zone mapping: the case of Mekelle city, Ethiopia

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Abstract

While urban heat islands (UHIs) have been thoroughly studied in cities worldwide, the specific risks and vulnerabilities related to urban heat in Ethiopia and Africa as a whole has given less attention. Urbanization often replaces green spaces with impervious surfaces, which diminishes natural cooling, precipitation, and water infiltration. This change can significantly affect land surface temperatures (LST) and contribute to UHI formation and its impacts. This study aimed to identify and assess the risk factors linked to UHIs, focusing on pinpointing the most vulnerable areas within cities using principal components explanatory factor analysis (HV-PC-EFA) and the urban heat vulnerability index (UHVI) model. The analysis utilized 19 composite indicators under well-established categories such as exposure, sensitivity, and adaptive capacity to assess potential risk zones. The results from the two models were compared, and their variations were examined. In the HV-PC-EFA model, indicators like urban density and roof type, along with adaptive factors such as vegetation cover, urban thermal field variances, and relative humidity, were not distinctly separated as individual components. This may cause discrepancies in the final outcomes, impacting the spatial distribution and extent of vulnerability. Despite observing some spatial variations in identifying risk areas, the study provides a broad perspective essential for developing evidence-based policies and strategies to enhance cities' resilience to high temperatures and promote sustainable environments. Given the challenges in modifying existing infrastructure, it is practical to regularly implement adaptive measures, such as preserving and restoring urban water bodies, planting trees, creating green public spaces, and raising public awareness about these risks.

Keywords: impervious surface, surface temperature, urban heat isand, vulnerability, thermal field

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Seasonal variation in the prevalence and antimicrobial resistance of Campylobacter species in milk and milk products in Ethiopia

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Abstract

Seasonal variation in the prevalence and antimicrobial resistance of Campylobacter species in the Ethiopian dairy value chain was investigated. Dairy food samples (456) were collected in the dry and wet seasons in three regions of Ethiopia. Campylobacter species were detected in 20 % of samples collected in the wet season. The overall prevalence did not differ significantly between the wet and dry seasons. However, in the Oromia region, there was a 5 times greater chance of finding Campylobacter species in milk and milk products during the wet season than in the dry season. Among Campylobacter-positive samples collected countrywide, 89 % were contaminated with Campylobacter jejuni, and 11 % with Campylobacter coli. In the dry season, all Campylobacter-positive samples were contaminated with C. jejuni. Most Campylobacter species were resistant to tetracycline (89 %), followed by erythromycin (74 %), and ciprofloxacin (57 %); 43 % of the isolates were resistant to more than two drugs from two different classes.

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Equine helminths: prevalence and associated risk factors in Gamo Gofa Zone, Ethiopia

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Abstract

Importance: Equines are indispensable in reducing the huge burden on children and women and income generation. On the other hand, minimal attention is given to improving their health and welfare.

Objective: This study examined the prevalence and associated risk factors of helminth parasites of equine in the Gamo Gofa Zone.

Methods: A cross-sectional study was employed from June 2019 to March 2020. The study districts and Kebeles were selected purposively based on agroecology whereas selection of study households and animals were performed based on simple random sampling techniques. Identification of nematode, trematode parasite ova and larvae of D. arnfieldi were done by floatation, sedimentation, and Baermann techniques respectively. Descriptive statistics and logistic regression was applied to estimate the prevalence and association of risk factors with helminth parasites.

Results: The overall helminth parasite prevalence in the study area was 90.4%, 425/470 (95% [CI], 87.16–92.9). The prevalence of Strongyle, Fasciola, O. equi, P. equorum, D. arnfieldi, and mixed parasite infections were 65.1%, 21.7%, 17.4%, 34%, 34%, and 58.1%, respectively. Infections from Fasciola species and D. arnfieldi infection were four ([AOR], 4.4; 95% CI, 2–9.4) and two times (AOR, 2; 95% CI, 1.1–3.6) respectively more likely occur in donkeys than in mules. The occurrence of Strongyle species in midland agroecology was two times (AOR, 2.6; 95% CI, 1.4–4.7) more likely than lowland agroecology.

Conclusions and Relevance: The present study identified diverse species of equine helminth parasites that necessitate urgent disease control and prevention measures.

Keywords: Horses, helminths, prevalence, risk factors

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Potentials of Moringa stenopetala foliage as livestock feed, Southern Ethiopia

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Abstract

The Moringa stenopetala tree is a highly versatile plant with numerous applications. It serves as a reliable source of food, feed, and income for farming households in Ethiopia. A study conducted in the Southern region of Ethiopia aimed to evaluate the potential of the Moringa stenopetala as a livestock feed resource. The study examined various factors, including year-round availability, usage trends, farmers' attitudes, and livestock preferences, through a survey of 379 households using diverse techniques. Results revealed that the abundance of Moringa stenopetala trees ranged from 1 to 100 trees per household. Most households (95.5%) supplied the edible parts of the tree to their livestock for sufficient amounts of quality protein. However, the study identified a lack of awareness regarding harvesting, conservation, and processing during ample yield of trees for dry and seasonal fluctuations, limiting the potential of the tree for farming households. The study found that in the Gofa and Gamo zones, 64.8% and 52.73% of households, respectively, supplied cattle with edible parts of Moringa stenopetala, while 56.69% of households in the Konso zone mainly provided for goats. Livestock preferences for tree parts differ, with the earliest leaves being the most popular choice. Providing Moringa stenopetala parts in fresh and dried forms was important in replacing feed quality and quantity gaps during dry seasons. In conclusion, promoting the planting of the Moringa stenopetala tree and raising awareness of its nutritional composition of edible parts could help further utilize this valuable resource in drought-prone areas.

Keywords: Farmers' perceptionfeedlivestock preferenceMoringa stenopetala

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Dynamics of Soil Physical and Chemical Properties under Different Current Land Use Types and Elevation Gradients in the Sala Watershed of Ari Zone, South Ethiopia

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Abstract

The dynamics of soil physical and chemical properties have been increasing due to inappropriate land use and unsustainable land management practices in Ethiopia. This study aims to assess the dynamics of selected soil physical and chemical properties under different current land use types and altitudinal gradients in the Sala watershed of Ari Zone in South Ethiopia. In the study area, analyzing and understanding the dynamics of soil physicochemical properties under different land use types play a vital role in sustainable soil productivity. Before collecting a soil sample, land use types and altitudinal variations were surveyed in the study watershed. Three random strata were selected from the watershed, and the major adjacent land use types in each stratum were identified across elevation gradients. A total of 30 composite soil samples were collected from different land uses and elevations using a zigzag sampling technique at 0-20 cm soil depth from upland (12), midland (9), and lowland (9). Laboratory results showed that most soil physical and chemical properties had poor ratings in the watershed area. All soil properties were significantly affected by land use types and elevation factors ($P<0.05$), except for soil texture, TN, and CEC. Soil texture is highest in the upper and lower elevations of grazing land (61.3%) and shrubland (55.4%), while lowest in cultivated land (11.3%) and barren land (11.6%) at higher altitudes. The highest mean of soil texture was dominated by clay soil (55%) in shrubland followed by sand soil (50.30%) in the barren land and silt soil (20.06%) in cultivated land. Chemical soil properties (pH, SOM, TN, Av. P, Av. K, and CEC) were significantly varied under each land use type across altitudes. The results of this study showed that inappropriate land use and unsustainable agricultural practices had more significantly influenced the soil fertility status. Therefore, appropriate soil and water conservation measures should be implemented in the studied watershed to improve soil fertility and crop productivity.

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River Flow Analysis using HEC-HMS and Assessing the Impact of Climate Change on Hydropower Generation by MODSIM in the Koka Reservoir of Ethiopia

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Abstract

Climate change results in precipitation variation in rivers and other water bodies, resulting in a decline in reservoir inflow and hydropower generation. This study is aimed at the assessment of climate change under different environments for hydropower generation and optimal reservoir operation using updated representative pathways (RCPs) in the Koka reservoir of Ethiopia. The power transformation function and variance scaling techniques of numerous meteorological data were adopted for bias correction. The simulation of flow was performed using HEC-HMS and the generation of hydropower from the reservoir was estimated using MODSIM 8.1 under different climatic scenarios. NSE and R2 (90.72 and 0.70) were calculated based on the model performance features for calibration and validation, respectively. There was a remarkable anomaly in the pattern of precipitation and temperature based on the projection of future climate scenarios. This change ultimately affects the power generation with an apprehension of reduction of 0.54% and 0.72% in the near term (2021–2050) and long term (2051–2080) under RCP4.5. Similarly, the mean generation of energy will reduce by 1.04% in the short term and 1.32% in the long-term for RCP8.5. This shows that the reduction is more prevalent in RCP8.5 in comparison to RCP4.5. Simply, it can be concluded that if strict measures are not timely initiated, there will be an acute power shortage. The research findings warn the concerned bodies to take timely measures to reduce recurring sediment deposits and ensure future hydropower output.

Natural Hazards
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Life cycle of gullies: a susceptibility assessment in the Southern Main Ethiopian Rift

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Abstract

Gullies experience varying states of activity during their life cycle. For example, their highest growth rates are commonly observed in the period that follows their initiation, whereas they are less active when reaching stability. Understanding the environmental conditions under which gullies initiate, expand, and stabilize is therefore vital to mitigate their impacts. Data-driven susceptibility assessments are key approaches to understanding these conditions at the catchment scale. However, such assessments commonly focus, at best, only on one part of the problem (e.g., on the gully heads) and do not consider gully erosion processes. So far, no study has attempted to explicitly model the life cycle of gullies at regional scale using statistical approach. Here, we help bridging this research gap through modeling separately the location where new gullies initiate and where they stabilize using both gully initiation points and gully heads. More specifically, we study over 4400 active and inactive gullies in the Southern Main Ethiopian Rift. Using logistic regression models, we assess the susceptibility to gully initiation points derived from slope-drainage area (S–A) thresholds. This is then compared with the susceptibility of active or inactive gully heads at the level of four catchments considered together and separately. Highly susceptible areas for gully initiation are mainly located in rejuvenated landscapes downslope of rifting-associated knickpoints, where steep hillslopes are more recent than those of the surrounding relict landscapes and where landslides are present. Planform concave slopes with a higher surface runoff concentration favor initiation of gullies. In contrast, gullies stabilize in planform convex slopes with a more diffusive characteristic. The resulting susceptibility models can contribute to the decision-making process on the optimized locations of soil and water conservation measures during several stages of the life cycle of gullies.

Keywords: Gully initiation**,** Expansion**,** And stabilization**,** Slope-area thresholds**,** Logistic regression analysis**,** Knickpoint**,** Landslide

Frontiers in Public Health
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Predictors of delayed health seeking for febrile children: multi-level analysis of cross-sectional study data from southern Ethiopia

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Abstract

Background: Febrile illnesses are commonly reported as a primary reason for seeking healthcare in sub-Saharan Africa. Timely diagnosis and getting prompt treatment within 24 h of fever onset is crucial to avert the risk of developing severe complications and death. Understanding factors contributing to delayed health seeking is important for public health interventions. Hence, this study aimed to assess individual- and contextual-level factors associated with the delay in seeking prompt treatment for children with fever.
Method: A community-based cross-sectional study was conducted from September 2022 to June 2023 in Gamo zone, southern Ethiopia. Three districts were chosen, and then, from each district, six clusters or kebeles were chosen by simple random sampling. A total of 820 caregivers were randomly selected. A two-level mixed-effects logistic regression model was employed to identify factors associated with the delay in seeking prompt treatment. The associations were measured by an adjusted odds ratio (AOR), and statistical significance was declared at a 5% level of significance.
Result: The prevalence of the delay in seeking prompt care was 47.8%. Factors contributing to the delay were caregivers who were aged 30 years and above [AOR 0.23, 95% confidence interval (CI): 0.10–0.52], caregivers who followed the Protestant religion (AOR 3.67, 95% CI: 2.08–6.48), caregivers unable to read and write (AOR 5.32, 95% CI: 6.80–11.70), merchant caregivers (AOR 6.63, 95% CI: 2.75–15.97), caregivers who were exposed to only one media source (AOR 9.3, 95% CI: 8.43–15.60), caregivers with the experience of child death (AOR 0.05, 95% CI: 0.01–0.22), and caregivers seeking permission from their partners to access healthcare (AOR 12.64, 95% CI: 6.98–22.89).
Conclusion and recommendations: There was a high level of delay in seeking healthcare. Targeted community education through mass media, healthcare facilities, and community-level awareness campaigns should be strengthened to improve early treatment seeking and lessen the consequences of delayed treatment seeking.

Keywords: delay treatment seeking, Gamo zone, Ethiopia, under five children, multi-level, prompt treatment seeking, fever

Applied and Environmental Soil Science
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The Effects of Various Land Use Types on Particular Physicochemical Characteristics of the Soil in Mante Watershed, South Regional Government of Ethiopia

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Abstract

Soil quality is threatened when the forest cover is replaced by cultivated and grazing lands in Mante watershed found in South Ethiopia. The study aimed to ascertain how different land use patterns and slope gradients affected the physicochemical characteristics of the soil. The watershed was stratified according to the predominant land use types, namely, grazing land, cultivated land, and forest lands with slope gradient variations to choose sites for soil sampling. Three slope classes were used to categorize the catchments of the watershed: 0-15%, 15-30%, and >30%. In soil depths of 0-20 cm and 20-40 cm, fifty-four (54) composite soil samples were taken (3 land use types × 3 slope classes × 2 soil depths × 3 replications). The results showed that the highest mean values of total nitrogen, available phosphorus, CEC, Ca, K, Mg, and Na were high but pH was low under forest lands and slope gradients of >30% but cultivated lands with the lowest mean values found in the range of 0-15% slopes. Regarding soil depth, the upper layer (0-20 cm) had higher mean values for silt fraction, pH, CEC, and Mg, while the lower layer (20-40 cm) had lower mean values. The soil quality was higher under the forests because Na had a greater significance in the upper soil layer and a lower value in the lower soil layer. The decline in the soil quality under the cultivated land suggests that integrated soil and water management is necessary to maintain the favorable soil physicochemical properties and replenish the degraded soil.

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GIS-Based Soil Erosion Dynamics Modeling by RUSLE at Watershed Level in Hare Watershed, Rift Valley Basin, Ethiopia

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Abstract

The current issue affecting land and water resources is soil erosion. Its numerous detrimental effects include deforestation, unfavorable farming methods, and decreased fertility, all of which impede socioeconomic growth. This research aimed to evaluate the effects of land use land cover (LULC) dynamics on soil erosion and its spatial distribution patterns over the Hare Watershed for the periods 2001–2021. Revised Universal Soil Loss Equation (RUSLE) model coupled with a geographic information system (GIS) was applied to estimate potential soil losses; this involved utilizing data on rainfall erosivity (R) using interpolating rainfall data, topography (LS) using digital elevation model (DEM), soil erodibility (K) using the William equation and digital soil map, conservation practices (P) using DEM and satellite images, and vegetation cover (C) using satellite images. To account for the change in LULC over the past 20 years, three separate maps of C-factors were developed for the years 2001, 2011, and 2021. The remaining four factors were kept constant. Finally, after the successful running of the model, the estimated annual average soil loss rate (A) of the watershed is 211.38, 223.79, and 235.64 t·ha−1yr−1 for the years 2001, 2011, and 2021, respectively. This is a result of grazing areas and shrubland being lost for agricultural land. Moreover, in the past period, the watershed was found to show an increase in the yearly mean soil loss rate of 24.26 t·ha−1yr−1. Consequently, the northeastern, northwest, and southern regions of the watershed require the implementation of suitable land management.

Keywords: erodibilty; LULC change; RUSLE; soil loss and Hare Watershed

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Anemia among malaria patients with and without soil-transmitted helminths in Arba Minch town health facilities: A comparative cross-sectional study

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Abstract

Anemia is one of the severe clinical outcomes associated with concomitant infection of malaria and soil-transmitted helminths (STH). Since STH infections mostly share similar geographical areas with malaria, the influence of co-infections on the epidemiology and course of Anemia deserves greater consideration to assess the impact of interventions, the adequacy of strategies implemented, and the progress made in the fight against Anemia. So, this study was done to investigate Anemia among STH-negative malaria patients and malaria patients co-infected with single or multiple STHs, in 3 health facilities of Arba Minch, 2020 to 2021. An institutional-based comparative cross-sectional study was conducted at 3 Governmental Health Institutions, Arba Minch, and southern Ethiopia from November 2020 to February 2021 on a total of 321 malaria-positive study participants. Thick and thin blood films were prepared for microscopic examination of malaria parasites and identification of species. A malaria parasite count was done to determine the intensity of the infection. A stool wet mount was done to identify STHs. Kato-Katz was done for microscopic quantitative examination of STHs. A complete blood cell count was done to determine hemoglobin level. Socio-demographic data were collected using a questionnaire. Data were analyzed using SPSS version 25. Independent samples t test and one-way analysis of variance were done. Anemia magnitude in this study was 38.3% and it was higher in malaria with multiple STH co-infection groups (55.1%). Malaria parasite density was significantly higher in malaria with multiple STHs co-infected study participants $F(2, 318) = 20.075$. It increased with the increasing intensity of hookworm, Trichuris trichiura, and several co-infecting helminth species. But it decreased with increasing intensity of Ascaris lumbricoides. The mean hemoglobin concentration of malaria with multiple STHs co-infection study participants was significantly lower than mono malaria-infected and malaria with single STHs co-infection study participants. The management of malaria should take account of STH infections and optimal modalities of treatment should be devised. Anti-helminthic treatments of malaria patients through regular, inexpensive, single-dose, and highly effective drugs must be seriously considered to protect the population from exacerbation of Anemia by intestinal helminth infections.

Keywords: anemia, Arba Minch, intensity, malaria, parasite density, soil-transmitted helminths

IEEE Access
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Hybrid Ant Lion Mutated Ant Colony Optimizer Technique With Particle Swarm Optimization for Leukemia Prediction Using Microarray Gene Data

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Abstract

Leukemia refers to a type of blood malignancy that develops due to certain hematological disorders. Identifying leukemia at its earlier stages through clinical operations are highly complicated task with invasive methods. Gene expression data could be collected and computational methods could be adopted which could lead to better prediction of leukemia that leads to prevention at its earlier stages. Today, feature selection has become an important step in pre-processing that helps bring improvement to the classification system and its performance that is done by choosing optimal feature subsets by means of reducing or eliminating redundant or irrelevant features. Particle Swarm Optimization (PSO) is a popular algorithm wherein certain solutions that are generated randomly move within the search space to obtain optimal solutions. Another relatively new and evolutionary method computation is the Ant Lion Optimization (ALO) algorithm that has lower computation cost compared to the other techniques. In this work, a new technique known as the Hybrid Ant Lion Mutated Ant Colony Optimize along with Particle Swarm Optimization (PSO) was proposed for the prediction of leukaemia with the microarray gene data. The proposed model that is used for identifying the optimal set of features from which the classification has been done using the Support Vector Machine (SVM) has produced a significant prediction accuracy of 87.88%.

IEEE Keywords: Feature extraction, Optimization, Gene expression, Classification algorithms, Support vector machines, Search problems, Particle swarm optimization

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Effectiveness of intermittent iron and high-dose vitamin A supplementation on cognitive development of school children in southern Ethiopia: a randomized placebo-controlled trial

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Abstract

Background: Iron is an essential mineral whose deficiency results in cognitive alteration, impaired emotional behaviors, and altered myelination and neurotransmission. In animal models, it has been shown that vitamin A (VA) could affect cognition.
Objectives: The study aimed to evaluate the effectiveness of intermittent iron and VA supplementation on cognitive development of schoolchildren, and to assess the interaction between these supplementations.
Methods: Considering a 2 × 2 factorial design, 504 children were randomly assigned to 1 of the 4 arms: placebo VA and placebo iron supplement; high-dose vitamin VA and placebo iron supplement; iron supplement and placebo VA; and iron and high-dose vitamin VA supplements. Cognitive development was assessed using Raven's Coloured Progressive Matrices, digit span, Tower of London, and visual search tasks.
Results: The mean [± standard deviation (SD)] age of the enrolled children was 9.6 (±1.6) y. One-fifth of the children had iron deficiency or anemia, whereas 2.9%, 3.9%, and 12.1% of children had low iron stores, iron deficiency anemia, and VA deficiency, respectively. Intermittent iron supplementation did not result in any significant improvement of children's cognitive development and had a negative effect on the performance index of the visual search task compared with placebo (−0.17 SD, 95% confidence interval: −0.32, −0.02). Effects were evident among children with stunting, thinness, or children coming from understimulating home environments. High-dose VA supplementation resulted in a significant improvement of digit span z-score with a mean difference of 0.30 SD (95% confidence interval: 0.14, 0.46) compared with placebo VA. VA had a more beneficial impact for girls, children infected with helminths, and those from food secure households.
Conclusion: In a population where the prevalence of iron deficiency is low, intermittent iron supplementation did not have any or negative effect on the child's cognitive development outcomes. Conversely, VA supplementation improved the child's working memory.

Keywords: cognitive developmentiron supplementationschoolchildrenvitamin A supplementation

International Journal of Forestry Research
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2024 (2024)

The Rate of Leaf Litter Decompositions and Nutrient Release Patterns of Four Selected Agroforestry Tree Species in Southern Ethiopia

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Abstract

The aim of this study was to examine the decomposition rates of leaf litter, nutrient release patterns, and the relationship between nutrient release from leaf litter and soil nutrients of four specific agroforestry tree species of Balanites aegyptiaca (L.) Delile, Terminalia brownii (Fresen.) J. Léonard, Croton macrostachyus Hochst, and Cordia africana Lam. The study was conducted in the Gamo zone of southern Ethiopia, specifically at three sites, i.e., Lante, Chano, and Shara. For this study, the litterbag techniques was employed, which involved placing dried leaf litter into nylon mesh bags. These nylon mesh bags were then buried in the soil and periodically retrieved to assess the remaining litter mass and its associated nutrients. SPSS version 24 software was used to analysis the collected data. Significant differences in half-life and turnover rates were observed among all tree species ($P<0.05$). Terminalia brownii exhibited the longest half-life of 21.7 days and the highest turnover rate of 93.9 days, while Balanites aegyptiaca had the shortest half-life and turnover rates at 14 days and 60.6 days, respectively. The release rates of organic carbon from leaf litter of Terminalia brownii, Croton macrostachyus, and Cordia africana showed negative correlations with soil organic carbon, whereas Balanites aegyptiaca displayed a significant positive correlation, with Pearson values of -0.94, -0.397, -0.95, and 0.71, respectively ($P<0.05$). Additionally, the rates of nutrient release varied among the four tree species across different time intervals. Generally, this research finding indicates that the rate of leaf litter decomposition and nutrient release patterns vary significantly among the four selected agroforestry tree species.

Heliyon
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Water quality assessment of Elgo river in Ethiopia using CCME, WQI and IWQI for domestic and agricultural usage

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Abstract

The increasing demand for water due to the escalation in population and aggressive agricultural activities for drinking and irrigation purposes in the rural areas of Ethiopia has put tremendous stress on water requirements. The Elgo River in southern Ethiopia is deteriorating due to sedimentation, soil erosion, stormwater runoff, and anthropogenic activities. Elgo village faces water shortages and a lack of safe drinking water. The purpose of this research was to identify the extent of pollution in Elgo River water using the Canadian Council of Ministers of the Environment (CCME), Water Quality Index (WQI), and Irrigation Water Quality Index (IWQI). A total of 12 water samples were collected from 3 river sampling sites for the dry and wet seasons to test the physicochemical and biological parameters. Results obtained were: turbidity (46.5–156) NTU, colour (103.65–606.5) TCU, EC (182–268) µS/cm, TDS (192.5–275.5) mg/l, TSS (680–2774) mg/l, Ca2+ (22–45) mg/l, Mg2+ (19.5–23.5) mg/l, Cl- (10.5–16.65) mg/l, and SO42- (17.18–47) mg/l for both the dry and wet seasons, respectively. The CCME WQI revealed that the overall results were 38.38 for the dry season and 36.6 for the wet season for drinking water parameters. The CCME WQI categorization indicates that the Elgo River water is classified as poor, with results ranging from 0 to 44. For irrigation purposes 10, parameters such as SAR, PS, PI, MAR, KI, RSC, EC, SSP, TH, and %Na were examined to compute indices using the IWQI model. The overall result of water quality indicated that IWQIs of 81.4 and 62.14 are good for the dry season and poor for the wet season, respectively. This research provides a thorough analysis through modelling to determine the suitability of water for different purposes for the tribal and backward communities of the area.

Keywords: CCME, WQI, IWQI, Elgo river, Ethiopia

Advances in Civil Engineering
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Potential Use of Reclaimed Asphalt Pavement Aggregate and Waste Plastic Bottles for Sustainable Asphalt Pavement Production

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Abstract

The main objective of this study was to evaluate the potential use of reclaimed asphalt pavement aggregate (RAPA) and waste plastic bottles (WPBs) for sustainable asphalt pavements production in hot weather conditions. To enhance the adhesion between neat bitumen, RAPA, and WPBs-coated aggregates, a rougher surface texture is created for aggregate particles in the modified asphalt mix. This improvement enhances asphalt mix engineering properties, rutting resistance, and stability. However, bituminous mixtures containing 20% RAPA exhibit tendencies toward strip resistance, this mixture is weak in terms of strength and incapable of supporting loads when utilizing the RAPA. Therefore, due to the moisture susceptibility of the RAPA, it is advised to employ several types of aggregates in future studies to determine the optimal aggregate that can resist stripping and, at the same time, handle heavy loads. Finally, for better asphalt mix performance, it is recommended to use a combination of 70% crushed stone aggregate, 20% RAPA, and 10% WPBs in asphalt mix with a 5.0% optimum modifier content. The experimental results for tensile strength ratio, proportional rut depth, and mean rut depth meet the required specifications of the Ethiopian Road Authority for all properties tested. Therefore, this combination is strongly advised for use in hot mix asphalt production.

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110 (2024)

Enhancing precision and efficiency: harnessing robotics and artificial intelligence for endoscopic and surgical advancements

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Abstract

Dear Editor,
Digital technology is essential in modern endoscopic operations, from image sensors and displays with high resolution to electronics linking adjustable lighting and actuation systems. The digitalization of the procedural toolbox allows for more precise diagnostic and therapeutic procedures and permits unprecedented amounts of video data acquisition of the interior human anatomy. Information on the patient's anatomy, events, activities, and surgical procedures are all captured in the data that is captured during an intervention. This comprehensive but puzzling log of endoscopic operations may be connected to other data or images of the patient from before and after the surgery. Data from endoscopic operations may be used by the rapidly developing field of artificial intelligence (AI), specifically supervised deep learning, to create systems for helping procedures, eventually leading to computer-aided interventions (CAI). Improved navigation during operations, automated picture interpretation, and robotically aided tool manipulation are just a few of the many benefits that CAI systems may provide

Cogent Social Sciences
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The influence of household size on socioeconomic conditions of rural farm households in Damot Woyde District, Wolaita Zone, Southern Ethiopia

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Abstract

There is little debate about the relationship between rising fertility and declining income. Rapid population growth can have serious implications for people's standard of living—their incomes, savings, health, education, and general well-being. Thus, the objective of this study is to analyze the impacts of household sizes on rural farm households' savings, consumption spending, and financial capacity to cover the expenses of children's education and the health of household members. 346 rural farm household heads took part in the study, which used a multistage sample technique. Along with the survey results, six focus group discussions, 27 key informant interviews, and personal observations were done. The outcomes showed that the savings-to-income ratios of rural households decreased with increasing household size, whereas consumption-to-income ratios increased due to a portion of the income that was not saved being spent on supporting the consumption demands of the additional household member. The MANOVA post hoc analysis also revealed that the large household size group's average yearly savings were significantly lower than the small household size group, whereas consumption expenses grew with increasing household size. Furthermore, ordinal logistic regressions show that increasing household size without increasing income diminishes rural farm households' existing financial capacity to afford the expenditures of their children's education and healthcare for household members. Thus, it is preferable to advocate that rural households have access to quality reproductive health-care services, like safe and effective family planning alternatives, and that households strive to diversify their income sources to promote savings.

Keywords: Household size, savings, consumption costs, rural households, Damot Woyde

Cogent Economics and Finance
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12 (2024)

Intellectual capital and total factor productivity

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Abstract

This paper defines total factor productivity as a function of a nation's intellectual capital. By developing a simple model, it explored the long-run relationship between intellectual capital and total factor productivity. The value of total factor productivity for each country was computed from Penn World Tables 10 using the residual method, and an index of intellectual capital was constructed from several indicators taken from world development indicators. Using a common correlated effect approach, a panel of 29 countries over 31 years was estimated using various dynamic macro panel models. The result confirmed the existence of a positive and significant link between total factor productivity and intellectual capital index. This implies that a potential source of productivity difference lies with a nation's research and development, human capital, processing, and marketing capabilities in boosting the general innovation process. Thus, national and regional development policies need to consider ways to improve broader innovation. Future research on total factor productivity needs to consider things outside the box.

Keywords: Total factor productivityintellectual capitalcross-sectional dependenc

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2024 (2024)

Assessment of Irrigation Water Management Performance Indicators and Mitigation Measure in Arba Minch Irrigation Scheme, Ethiopia

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Abstract

Irrigated agriculture has been practiced in Ethiopia for several centuries and performance of scheme was poor due to inadequate irrigation water management practices. This study was conducted to evaluate irrigation water management indicators and to suggest possible mitigation measure for Arba Minch irrigation scheme. Primary data such as field and canal flow, soil moisture content, and canal slope were measured on field and soil physical properties were evaluated in the laboratory. Utilizing climate and crop data, the CropWat 8 model was employed to estimate seasonal crop water requirements, while furrow and border irrigation dimensions were designed using SURDEV software. The average field application efficiency (30%), storage efficiency (76%), percolation losses (66%), and overall efficiency (25%). The average relative water and irrigation supply in the scheme were 1.7 and 3.3, respectively. The mean water and land productivity of the wheat, onion, pepper, watermelon, and maize of the Arba Minch irrigation scheme were 0.1 kg/m3 and 0.5 ton/ha, 0.9 kg/m3 and 4.9 ton/ha, 1.5 kg/m3 and 6.2 ton/ha, 0.5 kg/m3 and 0.6 ton/ha, and 0.9 kg/m3 and 4.2 ton/ha, respectively. Watermelon had the highest net returns per hectare ($1,693), followed by onion ($1,829), pepper ($1,221), and wheat ($1,057). In terms of net returns per cubic meter of water, onion led with $0.3, followed by watermelon ($0.2), pepper and wheat with the lowest at $0.1 (top of form). The average value conveyance efficiency, water surface elevation ratio and manning coefficient were 82%, 42%, and 0.06%, respectively. The existing, and corrected length were 843 and 135 m (border irrigation) and 20 and 595 m (furrow irrigation), respectively. In conclusion, the Arba Minch irrigation scheme was very poor performance and low efficiency. To address these issues, farmers and irrigation authorities implement improved irrigation water management practices. Policymakers should promote sustainable water management and explore crops with higher water productivity for overall scheme improvement.

Cogent Engineering
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11 (2024)

Evaluation of land suitability areas for irrigation using GIS and AHP-based tools in the case of Zenti River Catchment, Gofa district, Ethiopia

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Abstract

Land potential assessment has enormous use for smallholder farmers for the sustainable utilization of scarce physical land resources. The study area is faced with a significant lack of available studies on irrigation land suitability due to limited information regarding soil and land resources. This scarcity of data poses a significant challenge in effectively assessing the suitability of land for irrigation purposes. The study aimed to assess the land suitability for irrigation in the case of the Zenti River Catchment, Ethiopia. To achieve the objectives, soil properties, land use/cover, slope, and proximity to a perennial river were used. This was accomplished by using the analytical hierarchical process (AHP) and GIS-based tools. Soil samples were collected and used as criteria for irrigation suitability analysis: soil salinity, soil reaction (pH), soil organic matter, soil cation exchange capacity, and soil moisture content. To evaluate the land suitability for irrigation potential, the weighted linear combination analysis of AHP and reclassified thematic layers were overlaid in the Arc GIS tool. The result showed that soil suitability and land slope factors shared higher weights of 40% and 30%, respectively. A large portion of the study area falls in a high (19%) to moderate (37%) irrigation potential zone. Decision-makers can utilize this information to plan and allocate resources for irrigation projects in the most suitable locations. Moreover, smallholder farmers can benefit from understanding, which areas are suitable for irrigation, allowing them to make informed decisions when selecting land for cultivation and adopting proper management.

Keywords: Irrigation potential, land suitability, ArcGIS, AHP, Zenti river catchment

Cogent Economics and Finance
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12 (2024)

Intellectual capital and economic growth: evidence from some selected countries

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Abstract

The aim of this study is to explain the output growth across countries as an effect of intellectual capital growth. Defining intellectual capital as an integral of all the various intangibles, it argued to resolve the conceptual complexities and empirical inconsistencies. For this, the study defined the flow of new ideas as a function of change in intellectual capital level. Thus, it developed a model in which broad ideas predetermine the quality of capital and labor necessary for final goods production. The model was estimated using dynamic common correlated effect estimators for a panel of 29 countries from all income levels and geographic regions from 1990 to 2020. The results show a positive and significant contribution of national intellectual capital to economic growth. Hence, policymakers must enhance innovation in all spaces and phases of learning.

Keywords: Intellectual capital, economic growth, innovation, ideas

Frontiers in Environmental Science
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Using global datasets to estimate flood exposure at the city scale: an evaluation in Addis Ababa

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Abstract

Introduction: Cities located in lower income countries are global flood risk hotspots. Assessment and management of these risks forms a key part of global climate adaptation efforts. City scale flood risk assessments necessitate flood hazard information, which is challenging to obtain in these localities because of data quality/scarcity issues, and the complex multi-source nature of urban flood dynamics. A growing array of global datasets provide an attractive means of closing these data gaps, but their suitability for this context remains relatively unknown.

Methods: Here, we test the use of relevant global terrain, rainfall, and flood hazard data products in a flood hazard and exposure assessment framework covering Addis Ababa, Ethiopia. To conduct the tests, we first developed a city scale rain-on-grid hydrodynamic flood model based on local data and used the model results to identify buildings exposed to flooding. We then observed how the results of this flood exposure assessment changed when each of the global datasets are used in turn to drive the hydrodynamic model in place of its local counterpart.

Results and discussion: Results are evaluated in terms of both the total number of exposed buildings, and the spatial distribution of exposure across Addis Ababa. Our results show that of the datasets tested, the FABDEM global terrain and the PXR global rainfall data products provide the most promise for use at the city scale in lower income countries.

Keywords: floods, cities, global datasets, rain-on-grid model, hydraulic model, risk

Afrika Focus
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37 (2024)

Sources of Economic Growth in African and East Asian Countries: A Panel Causality Analysis

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Abstract

This paper examines the sources of growth in selected African and East Asian countries, using the growth accounting framework on data from 1960 to 2016. We demonstrate the causal association between labour quantity, total capital service (tks), total factor productivity (tfp) and economic growth. The lower growth in gdp during the 1980s and 1990s in Africa matches with the slower growth in tks. The tfp growth does not explain the economic growth difference among countries; it contributed negatively to gdp growth in the two regions until the 2000s. However, in African countries, its positive contribution during the 2000s returned to negative in the 2010s, while Asian countries continued driving a positive contribution up to 28.9% as a result of tfp growth. In all East Asian countries, tks contributed more than half of their growth in gdp, which makes their growth capital-driven, while African countries' growth in gdp was more dependent on labour quantity growth. In Africa, we discovered bidirectional causality between labour quantity and gdp and between tks and gdp, as well as unidirectional causality running from gdp to tfp. In East Asia, we found only a one-way causality running from gdp to tks and to tfp. Policymakers in Africa should adopt policies aimed at increasing capital accumulation and efficient allocation of economic resources in order to sustain growth acceleration.

Indian Journal of Microbiology
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Optimisation of Aspergilus flavus-Mediated Biosorption Process for Removal of Cr (VI) and Mn (II) Ions by Response Surface Methodology Approach

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Abstract

In this study, soil samples from textile industries located in the Arba Minch region were collected and screened for the presence of heavy-metal-resistant fungi. Among the three isolates identified during the screening process, Aspergillus flavus exhibited the highest resistance to heavy metals such as Cr (VI) and Mn (II). Our results showed that A. flavus biosorbed Mn and Cr at concentrations of 80.5% and 68.4%, respectively, making it a promising biosorbing agent. Furthermore, our study demonstrated that pretreatment of A. flavus fungal biomass with NaOH enhanced the biosorption of Mn and Cr. To optimize the biosorption process, a study was conducted using A. flavus biomass with three independent variables: pH (2–10), biomass dosage (1–5 g/mL), and contact time (40–150 min). The Box-Behnken experimental design was used to determine the optimal biosorption values. Maximum biosorption was achieved at pH 10, biomass dosage (5 g/mL), and contact time of 150 min. These conditions resulted in 88 and 80.29% sorption efficiency for manganese and chromium ions, respectively, by A. flavus biomass. The scanning electron microscopic analysis of A. flavus biomass indicated the presence of large porosities on the microbial surface due to NaOH treatment, which assisted in the higher sorption of heavy metals.

Keywords: Aspergillus flavus**,** Biosorption**,** Heavy metal**,** Chromium**,** Manganese

Research in Mathematics
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Layer adapted finite element method for two-parameter singularly perturbed delay parabolic problems

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Abstract

A layer-adapted finite element method is applied to solve a singularly perturbed delay parabolic differential equation with two perturbation parameters. The numerical method involves two steps of discretization in the decoupled approach. First, the temporal variable is discretized uniformly and approximated by a finite element piecewise linear continuous function. The time derivative of this approximation in each mesh is constant in the time direction. It is a function of the space variable. Then, the time derivative term in the equation is approximated by the equivalent Crank-Nicholson finite difference method. Next, for the semi-discretized problem, a fitted mesh (layer-adapted) finite element method is applied using the Shishkin mesh for the spatial discretization. The solution in the spatial elements is approximated by piecewise quadratic polynomial functions. Finally, the finite element solution is presented as a linear combination of the piecewise linear temporal FE approximate functions and the piecewise quadratic spatial FE approximate functions. That is, a piece wise smooth continuous function in the given domain, which empowers finding an approximation solution at any desired point of the domain. It is proven that the numerical method is convergent with the second order of convergence in the temporal direction and with almost the second order of convergence in the spatial direction. Using the MATLAB software, some numerical experiments are performed to verify the applicability of the numerical method.

Keywords: Two-parameter singularly perturbed problem; delay differential equation; Shishkin Mesh; finite element; fitted mesh method

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The effect of mHealth on childhood vaccination in Africa: A systematic review and meta-analysis

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Abstract

Introduction: Vaccine-preventable diseases are the public health problems in Africa, although vaccination is an available, safe, simple, and effective method prevention. Technologies such as mHealth may provide maternal access to health information and support decisions on childhood vaccination. Many studies on the role of mHealth in vaccination decisions have been conducted in Africa, but the evidence needs to provide conclusive information to support mHealth introduction. This study provides essential information to assist planning and policy decisions regarding the use of mHealth for childhood vaccination.

Methods: We conducted a systematic review and meta-analysis for studies applying mHealth in Africa for vaccination decisions following the Preferred Reporting Items for Systematic and Meta- Analysis [PRISMA] guideline. Databases such as CINAHL, EMBASE, PubMed, PsycINFO, Scopus, Web of Science, Google Scholar, Global Health, HINARI, and Cochrane Library were included. We screened studies in Endnote X20 and performed the analysis using Revman 5.4.1.

Results: The database search yielded 1,365 articles [14 RCTs and 4 quasi-experiments] with 21,070 participants satisfied all eligibility criteria. The meta-analysis showed that mHealth has an OR of 2.15 [95% CI: 1.70-2.72; P<0.001; I2 = 90%] on vaccination rates. The subgroup analysis showed that regional differences cause heterogeneity. Funnel plots and Harbord tests showed the absence of publication bias, while the GRADE scale showed a moderatequality body of evidence. **Conclusion:** Although heterogeneous, this systematic review and meta-analysis showed that the application of mHealth could potentially improve childhood vaccination in Africa. It increased childhood vaccination by more than double [2.15 times] among children whose mothers are motivated by mHealth services. MHealth is more effective in less developed regions and when an additional incentive party with the messaging system. However, it can be provided at a comparably low cost based on the development level of regions and can be established as a routine service in Africa.

Cogent Social Sciences
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Impact of integrated land management technology adoption on rural livelihoods in the Goyrie watershed, Southern Ethiopia: Endogenous switching regression modeling estimation

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Abstract

Integrated land management (ILM) technology adoption is crucial for enhancing yield production and households' income, which are indispensable to sustainable development objectives. This research analyzes the impact of ILM technology adoptions on rural livelihoods by focusing on yield production and net farm income in the Goyrie watershed, southern Ethiopia. Deploying random sampling techniques, cross-sectional data was collected from 291 households. Quantitative data was analyzed using percent, mean, standard deviation and independent t-test, while qualitative data was presented in a narrative form. The Full Information Maximum Likelihood (FIML) methods and Endogenous Switching Regression Modeling (ESRM) were utilized to estimate the impact of ILM technology adoptions on yield production and net farm income. The result exhibited that the average treatment effect for technology adopters increased their yield production by 4.71% and net farm income by 2.81%. Under counterfactual scenarios, the average treatment effect on untreated control groups would increase yield production and net farm income by 5.73% and 3.71%, respectively, if they preferred to adopt the technology. The study found that adoption of ILM technologies significantly and positively impacts yield production and net farm income in Goyrie watershed. Thus, we suggest that agricultural experts and academics should assist early adopters to scale up and encourage the non-adopters to adopt combined technologies through training and enhancing extension services. Educational status, land size, livestock and membership had positive impacts on yield production and income, suggesting that policies that encourage livelihood asset indicators can enable households to boost their yield production and income.

Keywords: Integrated land management, technology adoption, impact yield production, incom, ESRM

Cogent Economics and Finance
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Sectoral allocations of domestic credit and their effects on economic growth in Ethiopia

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Abstract

Unplanned human population shifts in urban areas are expected to increase the prevalence of vector-borne diseases. This study aimed to investigate mosquito species composition, blood meal sources, and malaria vectors in an urban area. Indoor-resting adult mosquitoes were collected using Prokopack and host-seeking mosquitoes using Centers for Disease Control and Prevention light traps in Arba Minch town. Larval collection from artificial containers was done in those houses selected for adult mosquito collection. Anopheles adults collected and emerged from larvae were identified morphologically using a taxonomic key. ELISA was used to identify blood meal sources in freshly fed Anopheles and Culex mosquitoes, and CSP of Anopheles mosquitoes. A total of 16,756 female mosquitoes were collected. Of these, 93% (15,571) were Culex, 6% (1016) were Anopheles, and 1% (169) were Aedes mosquitoes. Out of the 130 adult mosquitoes that were raised from larvae collected from the containers, 20% were An. rhodesiensis, while the remaining 80% were Aedes mosquitoes. Out of 823 mosquitoes tested for blood meal origins, 86.3% (710/823) tested positive for human blood, 2.2% (18/823) tested positive for bovine blood, and 11.5% (95/823) were negative for human and bovine antibodies. Anopheles gambiae complex had a human blood meal index (HBI) of 50% (90/180; CI 42.3–57.5%) and a bovine blood meal index (BBI) of only 0.5% (95% CI 0.01–3.1%). Culex HBI was 96.7% (620/641), and its BBI index was 2.4% (15/641). While it was low (0.8%) in Culex, the proportion of An. gambiae complex with unidentified blood meal sources was 49.5% (95 CI% 41.9–56.9%). Among the 1016 Anopheles mosquitoes tested, a single An. gambiae complex (0.1%; 1/1016) was positive for P. vivax CSP. The high HBI indicates frequent contact between humans and vectors. To reduce human exposure, personal protection tools should be implemented.

Keywords Domestic credit; Sectoral panel; Allocation efficiencyCS-ECM; Economic growth

Parasitology Research
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123 (2024)

High human blood meal index of mosquitoes in Arba Minch town, southwest Ethiopia: an implication for urban mosquito-borne disease transmission

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Abstract

Unplanned human population shifts in urban areas are expected to increase the prevalence of vector-borne diseases. This study aimed to investigate mosquito species composition, blood meal sources, and malaria vectors in an urban area. Indoor-resting adult mosquitoes were collected using Prokopack and host-seeking mosquitoes using Centers for Disease Control and Prevention light traps in Arba Minch town. Larval collection from artificial containers was done in those houses selected for adult mosquito collection. Anopheles adults collected and emerged from larvae were identified morphologically using a taxonomic key. ELISA was used to identify blood meal sources in freshly fed Anopheles and Culex mosquitoes, and CSP of Anopheles mosquitoes. A total of 16,756 female mosquitoes were collected. Of these, 93% (15,571) were Culex, 6% (1016) were Anopheles, and 1% (169) were Aedes mosquitoes. Out of the 130 adult mosquitoes that were raised from larvae collected from the containers, 20% were An. rhodesiensis, while the remaining 80% were Aedes mosquitoes. Out of 823 mosquitoes tested for blood meal origins, 86.3% (710/823) tested positive for human blood, 2.2% (18/823) tested positive for bovine blood, and 11.5% (95/823) were negative for human and bovine antibodies. Anopheles gambiae complex had a human blood meal index (HBI) of 50% (90/180; CI 42.3–57.5%) and a bovine blood meal index (BBI) of only 0.5% (95% CI 0.01–3.1%). Culex HBI was 96.7% (620/641), and its BBI index was 2.4% (15/641). While it was low (0.8%) in Culex, the proportion of An. gambiae complex with unidentified blood meal sources was 49.5% (95 CI% 41.9–56.9%). Among the 1016 Anopheles mosquitoes tested, a single An. gambiae complex (0.1%; 1/1016) was positive for P. vivax CSP. The high HBI indicates frequent contact between humans and vectors. To reduce human exposure, personal protection tools should be implemented.

Keywords: Bovine blood meal index**,** Circum-sporozoite protein**,** Human blood meal index**,** Urban mosquitoes

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Effects of Qaxxee (Hermosa sidoides) and Dheekaa (Grewia tembensis) foliage supplementation on milk yield and milk quality of Somali goats fed a crop-residue-based diet

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Abstract

The purpose of this study was to examine at the chemical content of Hermosa sidoides and Grewia tembensis feeds and their impact on milk output and quality in Somali goats. A completely randomized block design, excluding the control treatment, was adopted with three treatment diets. T1 (600 g Hermosa sidoides, 200 g concentrate mixture, maize stover), T2 (600 g Grewia tembensis, 200 g concentrate mixture, maize stover), and T3 (300 g Hermosa sidoides and 300 g Grewia tembensis, maize stover), were the treatments. Hermosa sidoides had a greater crude protein (CP) content (28.7%), 40% neutral detergent fibre (NDF), and 18% acid detergent fibre (ADF), while Grewia tembensis had a lower CP content (27.1%), 47% NDF, and 21.91% ADF. The daily milk production for goats fed treatment food T1 (0.91 kg) was substantially greater (p0.05) than goats fed T2 (0.82 kg) and T3 (0.84 kg) after 90 days of feeding experiments. In general, this study found that supplementing nursing Somali goats' diets with Hermosa sidoides (Qaxxee) leaves (T1 Diet) considerably increases milk output and cost return. As a result, this study implies that goat feeds, which are often available in the study location, could be used as a suitable diet in the future.

Keywords: Hermosa sidoides, Grewia tembensis, milk yield, milk composition, feed composition

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10 (2024)

Determinants of Ethiopian sesame and coffee exports to its major trade partners: application of the gravity model

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Abstract

Using the gravity model as a theoretical framework and the two-step system generalized moment method (GMM) as an analytical model, this article investigated the drivers of Ethiopian sesame and coffee exports to its key trading partners for the period 2005–2021. The descriptive results revealed that few price, and income inelastic agricultural commodities, such as coffee, oilseeds, and pulses, account for more than half of Ethiopia's export revenues. On average, 33.7, 36.9, and 19.4% of Ethiopia's total exports were channeled to European, Asian, and African nations, respectively, in the period 2010–2021. The regression results of the two steps GMM showed that the foreign direct investment of Ethiopia, the gross domestic product of Ethiopia, and partner countries are positively and significantly related to the volume of Ethiopian sesame export. However, the official exchange rate, trade openness, and population of Ethiopia are negatively and significantly related to the volume of Ethiopian sesame and coffee exports. The weighted distance and the volume of Ethiopian sesame exports are negatively and significantly related in this study. The findings support the prediction of the gravity model. Ethiopian agricultural exports will be increased through encouraging domestic output growth, foreign direct investment, population control, and diversification of export destinations.

Keywords: Agricultural export, gravity model, generalized moment method, Ethiopia

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Part F3289 (2024)

Assessment of Rooftop Rainwater Harvesting as an Alternative Source of Water Supply for Higher Institutes in Ethiopia: The Case of Wachemo University, Main Campus

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Abstract

Rooftop rainwater harvesting has been used worldwide as an alternative source of water supplyWater supply for many people. In view of this, the aim of the study is to assess the potential of rooftop rainwater harvesting as an alternative source of water supplyWater supply for Wachemo University. Twenty years of rainfall data were analyzed to determine the average monthly and annual rainfall potential of the study area. The possible volume of water that could be harvested from selected rooftops at Wachemo University was quantified using the rational method. The Ripple Mass Curve method was also applied to determine the harvestable rooftop rainwater storage capacity for the study area. The water sampling points and building digitization were made using Google Earth and ArcGIS 10.3 tools. The quality of the rooftop rainwater was examined as per the standard method for the examination of water and wastewater quality. The results demonstrated that the maximum amount of water that could be harvested was 102,268 m3 per year from a 107,587 m2 rooftop area with an average annual rainfall of 1188.0 mm. The harvested rainfall from the rooftops could cover approximately 51% of the average annual water demand of the university. The Ripple Mass Curve analysis indicated that storage capacity of 8493.7 m3 was required to harvest rooftop water in the study area. The water qualityWater quality of the rooftop examination was found to be within the permissible limit for drinking water qualityWater quality requirements, except for the bacteriological parameters. The cost analysis demonstrated that a total of 6,937,200 ETB (128,466 USD) was required to install rainwater harvesting systems for 94 buildings inside Wachemo University main campus. The study concluded that rooftop rainwater harvesting is a promising alternative solution to solve the water scarcity problem and ensure a continual source of non-potable water at Wachemo University.

Keywords: Rooftops**,** ArcGIS**,** Water quantity and quality**,** Water management**,** Wachemo University

Microchemical Journal
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N/S-GQDs/KMnO4 hybrid as a colorimetric and fluorescent dual-signal readout probe for sensitive and selective detection of ascorbic acid

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Abstract

A nitrogen and sulfur co-doped graphene quantum dots (N/S-GQDs) and permanganate was employed to prepare a N/S-GQDs/KMnO4 dual-signal readout colorimetric and fluorescent probe for sensitive detection of ascorbic acid (AA). In the detection system, the addition of KMnO4 quenched significantly the fluorescence (FL) of N/S-GQDs, meanwhile, the transparent aqueous dispersion of N/S-GQDs changed into yellow–brown with new absorption peak (maximum absorption at 338 nm). Interestingly, introduction of AA into the N/S-GQDs/KMnO4 system could recover the quenched fluorescence and result in a decrease in the absorbance (at 338 nm) of the test solution in a concentration dependent manner, and hence demonstrated the potential practical use of the sensing system for AA detection. Based on various spectroscopic studies, it has been concluded that the static as well as inner filter effect was the main quenching mechanisms in the detection system. The dual-response sensor showed linear response in the concentration range between 0.01 and 30 μM with the limit of detection (LOD) of 8.3 nM and 100 nM, respectively, for the fluorescent and colorimetric detections. In addition, the proposed detection system has been successfully applied to the detection of AA in vitamin C tablets. Moreover, the proposed detection strategy is convenient and fast, prevents complex and tedious probe preparation procedure, and capable of visual detection of AA.

Frontiers in Materials
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11 (2024)

A review on algae-mediated adsorption and catalytic processes for organic water pollution remediation

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Abstract

Wastewaters consist of organic pollutants that have environmental concerns. Wastewaters are treated by different methods, but efficient, low-cost, and sustainable techniques still need to be developed. Algae-based water pollution remediation techniques are considered to be sustainable approaches. This review exclusively discusses the facets of macro and microalgae in the treatment of organic toxicants. The current trends of algae-mediated water treatments have been discussed under adsorption and degradation methods. A focus on algae fuel cell, algae mediated activation of oxidizing agents, Fenton-like reactions, and photocatalysis was given. The need of algae-based adsorptive and catalytic materials was mentioned. The role of algae in the synthesis of catalysts which were employed in pollutant removal methods was also explained. The integrated algae-mediated water treatment techniques were also highlighted. The toxicant removal performances of different algae-based materials in the water medium were summarized. The conclusion and future prospects derived from the literature survey were described. This review will be helpful for researchers who are working in the field of sustainable water pollution remediation.

Keywords: wastewater treatment, algae technology, nanomaterials, biosorption, bioremediation,
bio-catalysis, algae fuel cell

PLoS ONE
DOI: https://doi.org/10.1371/journal.pone.0296807
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Slope stability assessment in the seismically and landslide-prone road segment of Gerese to Belta, Rift Valley, Ethiopia

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Abstract

Slope instability on several sections of the Gerese-Belta route in Southern Ethiopia poses a major risk to infrastructure and safety. This research was aimed at evaluating certain areas of the road susceptible to slope instability. Through intensive fieldwork including geological analysis, surveys, and testing, three crucial slope portions were determined. Both limit equilibrium and finite element calculations demonstrated that these sections are problematic under different circumstances. The slope modification analysis shows that the safety factor increases as bench widths and the number of benches increase. In the slope section D1S3, this factor reached 1.222 when two benches measuring 5 meters in width were used on slide 2D. This initially showed an unstable safety factor of 0.26. Three benches of the same width were used under slide 2D. This resulted in a safety factor of 1.219. At the slope section (D1S2), flattening of the slope angle from initial 45° to 35°, 28°, 25° and 18° increases the factor of safety of the slope from initial 0.284 to 0.77, 0.89, 1.022, and 1.151 respectively under slide 2D analysis. At the slope section (D2S1), flattening the slope angle from initial 46° to 35°, 25°, 23°, and 20° increases the safety factor from initial 0.412 to 0.684, 0.920, 1.02, and 1.315 respectively. Based on the analysis of the study results, it can be concluded that the identified slope sections are susceptible to failure under actual field scenarios, depending on the conditions under which they are predicted to occur. According to this study, the Benching method is an economical method for mitigating soil slopes, as a result of which it was recommended to be used.

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19 (2024)

The role of mHealth intervention to improve maternal and child health: A provider-based qualitative study in Southern Ethiopia

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Abstract

Introduction: Maternal and child mortality remained higher in developing regions such as Southern Ethiopia due to poor maternal and child health. Technologies such as mobile applications in health may be an opportunity to reduce maternal and child mortality because they can improve access to information. Therefore, the main aim of this study was to explore the role of mHealth in improving maternal and child health in Southern Ethiopia.

Methods: This study employed a qualitative study design to explore the role of mHealth in improving maternal and child health among health professionals in Southern Ethiopia from December 2022 to March 2023. We conducted nine in-depth interviews, six key informants' in-depth interviews, and four focused group discussions among health professionals. This is followed by thematic analyses to synthesize the collected evidence.

Results: The results are based on 226 quotations, 5 major themes, and 24 subthemes. The study participants discussed the possible acceptance of mHealth in terms of its fitness in the existing health system, its support to health professionals, and its importance in improving maternal and child health. The participants ascertained the importance of awareness creation before the implementation of mHealth among women, families, communities, and providers. They reported the importance of mHealth for mothers and health professionals and the effectiveness of mHealth services. The participants stated that the main challenges related to acceptance, awareness, negligence, readiness, and workload. However, they also suggested strategic solutions such as using family support, provider support, mothers' forums, and community forums.

Conclusion: The evidence generated during this analysis is important information for program implementations and can inform policy-making. The planned intervention needs to introduce mHealth in Southern Ethiopia. Planners, decision-makers, and researchers can use it in mobile technology-related interventions. For challenges identified, we recommend solution-identified-based interventions and quality studies.

Hydrological Sciences Journal
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69 (2024)

Water availability identification from GRACE dataset and GLDAS hydrological model over data-scarce river basins of Ethiopia

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Abstract

The nature of the heterogeneity of terrestrial water storage in the main river basins of Ethiopia is poorly understood. In river basins, measurements of terrestrial water storage changes are exceedingly rare in all temporal dimensions. This study investigates the spatiotemporal variation of water storage in the main river basins of Ethiopia using the Gravity Recovery and Climate Experiment (GRACE) with Global Land Data Assimilation System (GLDAS). The results revealed significant variation in liquid water equivalents from GRACE and terrestrial water storage from GLDAS for each river basin, following a seasonal pattern. I found that GRACE and GLDAS datasets can be combined effectively to evaluate the long-term water storage in large-scale basins with limited hydrological data, and the obtained result provides a reliable outcome that will be essential for the establishment of climate change adaptation pathways in the future for essential water resource management and optimization.

Keywords: Liquid water equivalent, terrestrial water storage, climatic variable, spatiotemporal variation, GRACE, GLDAS

E-Learning and Digital Media
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The impacts of implementing e-blended learning approach (e-BLA) in communicative english language skills I course: Focused on Wolaita Sodo University, Ethiopia

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Abstract

This study dealt with the impacts of implementing an e-blended learning approach (e-BLA) in communicative English language skills 1 (CELS1) course to achieve English speaking skills (ESS). Hence, the pre & post-test design of a quasi-experimental study was employed. The informants were two sections' 102 students (50 & 52) who were categorized under comparison & treatment groups to pass through CMI & an e-BLA respectively. The tools were then tests, classroom observation & FGD. Six among the treatment group were selected for the FGD. The quantitative data of independent & paired samples t-tests were utilized to determine the significant differences of inter & intragroup between an e-BLA & CMI at 0.05 (5%) alpha level. The qualitative data of FGD & observations were thematically analyzed in a statement form. Hence, the mean comparison of pretest scores in independent samples t-test (53.02 & 54.19) reveals the absence of significant difference of scores between the two groups before intervention. However, after the intervention, the treatment group outscored (70.81) significantly higher ($p < .05$) than the comparison group (55.56) on SST. Similarly, the paired samples t-test indicated the magnitude of the posttest (70.81) over the pre (54.19) with the effect size −3.4. Likewise, the qualitative data revealed the informants achieved ESS better in e-BLA than CMI. Therefore, Ethiopian educational curriculum should consider e-integrated instructions in all subjects & all levels.

Keywords: Communicative english language skills 1 course**,** conventional modes of instruction**,** EFL instructors**,** e-blended learning approach**,** e-learning**,** speaking skills' achievement

Journal of Water and Climate Change
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Predicting the peak flow and assessing the hydrologic hazard of the Kessem Dam, Ethiopia using machine learning and risk management centre-reservoir frequency analysis software

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Abstarct

Flooding due to overtopping during peak flow in embankment dams primarily causes dam failure. The Kessem River watershed of the Awash basin in the Rift Valley of the Afar region in Ethiopia was studied intricately to predict the causes of the Kessem Dam safety using machine learning predictive models and risk management centre-reservoir frequency analysis. Recently developed recurrent neural network predictive models with hybrid Soil Conservation Service Curve Number (SCS-CN) were used for simulation of river flow. Peak daily inflow to the reservoir is predicted to be 467.72, 435.88, and 513.55 m3/s in 2035, 2061, and 2090, respectively. The hydrologic hazard analysis results show 2,823.57 m3/s and 935.21 m; 2,126.3 m3/s and 934.18 m; and 11,491.1 m3/s and 942.11 m peak discharge and maximum reservoir water level during the periods of 2022–2050, 2051–2075, and 2076–2100, respectively, for 0.0001 annual exceedance probability. The Kessem Dam may potentially be overtopped by a flood with a return period of about 10,000 years during the period of 2076–2100. Quantitative hydrologic risk assessment of the dam is used for dam safety evaluation to decide whether the existing structure provides an adequate level of safety, and if not, what modifications are necessary to improve the dam's safety.

Keywords: dam safety, hydrologic hazard analysis, Kessem Dam, machine learning, peak flow prediction

Open Geosciences
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16 (2024)

Monitoring of mangrove forests vegetation based on optical versus microwave data: A case study western coast of Saudi Arabia

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Abstract

Normalized difference vegetation index (NDVI) is one of the parameters of vegetation that can be studied by remote sensing of land surface with Sentinel-2 (S-2) satellite image. The NDVI is a nondimensional index that depicts the difference in plant cover reflectivity between visible and near-infrared light and can be used to measure the density of green on a piece of land. On the other hand, the dual-pol radar vegetation index (DpRVI) is one of the indices studied using multispectral synthetic aperture radar (SAR) images. Researchers have identified that SAR images are highly sensitive to identify the buildup of biomass from leaf vegetative growth to the flowering stage. Vegetation biophysical characteristics such as the leaf area index (LAI), vegetation water content, and biomass are frequently used as essential system parameters in remote sensing data assimilation for agricultural production models. In the current study, we have used LAI as a system parameter. The findings of the study revealed that the optical data (NDVI) showed a high correlation (up to 0.712) with LAI and a low root-mean-square error (0.0296) compared to microwave data with 0.4523 root-mean-square error. The NDVI, LAI, and DpRVI mean values all decreased between 2019 and 2020. While the DpRVI continued to decline between 2020 and 2021, the NDVI and LAI saw an increase over the same period, which was likely caused by an increase in the study area's average annual rainfall and the cautious stance of the Red Global (RSG) project on sustainability.

Keywords: DpRVI, NDVI, SAR data, Sentinel-2 vegetation monitoring

Springer Geography
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Part F3289 (2024)

Evaluation of the Hydraulic Performance of the Kombolcha Town Water Supply Distribution System, Ethiopia

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Abstract

In this study, the hydraulic performanceHydraulic performance of the existing water supplyWater supply and distribution network of Kombolcha town was analyzed by using WaterGEMS. The WaterGEMS model was used for automated calibration and analysis of the hydraulic parameters of water supplyWater supply distribution systems. At selected nodes, the developed model was calibrated to reduce the difference between the measured and simulated pressures. The water supplyWater supply coverage of the town was only 69.4%, which is extremely low when compared to the country's urban water supply coverage standard. The water demand was determined to be 50 L/day, which is less than the community's actual water consumption. The water balance analysis revealed that 67.1% of water production is billed quantity and 32.9% is nonrevenue water (NRW). The results from the simulation of the existing water supplyWater supply distribution system revealed that during peak hour demand, 23.1% of the junctions have low pressure (15 m H2O), and 67.4% of the junctions have high pressure (> 60 m H2O). The hydraulic performanceHydraulic performance analysis indicated that 83.5% and 24% of the total pipes have velocities below 0.6 m/s at minimum and peak demands, respectively. The study concluded that the hydraulic performanceHydraulic performance of Kombolcha's existing water supplyWater supply distribution systems is below expectations. As a result, high pressures in the distribution system should be managed with pressure-reducing valves. Furthermore, low pressure should be improved by making existing borehole rehabilitation more efficient to meet the town's peak water demand.

Keywords: Hydraulic performance**,** Kombolcha, WaterGEMS, Water balance

Social Sciences and Humanities Open
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10 (2024)

Perceived gender disparity issues in secondary schooling: Internal and external conditions

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Abstract

The study aims to investigate the impact of internal and external learning conditions on gender disparities in secondary education in the South Ethiopia Region (SER), highlighting the lack of documentation on the key elements contributing to these disparities. The author employed the theoretical framework of education production functions to investigate the sources of perceived gender imbalances in secondary school through a cross-sectional survey research design. Further, the study employed a random sampling technique to draw 550 subjects. Among the 550 questionnaires distributed, 507 (92%) were filled out and returned. The collected data was analyzed using SPSS-20. Lastly, the study investigated that quitting the classroom, detesting the teachers, and learning adaptability in cramped classroom settings were the gender influence variables in secondary school internal conditions. Rather, the external factors that had a detrimental influence on female students relative to male students were attitudes toward secondary school and early marriage. Subsequently, students' personal qualities are responsible for perceived gender inequality that exacerbates internal secondary schooling conditions, whereas, the socio-cultural norms, beliefs, attitudes, and values are considered peripheral circumstances that intensify perceived gender disparities in the secondary schooling process. To conclude, regarding gender disparity conditions in secondary schooling, school internal learning conditions are somewhat favorable for female compared to male students, whereas the external learning environments are conducive for male compared to female students.

Keywords: Gender, Gender disparity, Secondary schooling, School internal conditions, School external conditions

Lecture Notes in Civil Engineering
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526 LNCE (2024)

Evaluating the Performance of Reinforced Unpaved Roads Using Plate Load Tests

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Abstract

This study presents the strength of geosynthetic-reinforced unpaved road sections over soft subgrade utilizing plate load Test through a rectangular model box. Geotextile, geogrid, and geonet were used as a reinforcing component. The bearing capacity determined by the plate load test from the laboratory was compared with an analytical solution. The primary objective behind the reinforcement is to decrease the structural section without changing the traffic capacity and to increase the durability of the pavement. The test results showed the implications of a geosynthetic position on the strength of unpaved test sections, through a double reinforcement position always yielded the best improvement. It is seen from the results that there is a substantial increment in the Bearing Capacity of unpaved sections due to single reinforcements attaining a rate of about 34.60% with bi-axial geogrid, about 29.81% with geonet, and about 32.50% with nonwoven geotextile when reinforced within top one-third of subgrade layer.

Keywords: Bearing Capacity**,** Unpaved Roads**,** Geosynthetic Reinforcement**,** Soft Subgrade Plate Load Test

Frontiers in Public Health
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12 (2024)

Incidence and predictors of loss to follow-up among adult patients receiving antiretroviral therapy in Central Ethiopia: a multi-center retrospective cohort study

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Abstract

Background: Globally, loss to follow-up (LTFU) remains a significant public health concern despite the rapid expansion of antiretroviral medication programs. It is a significant cause of treatment failure and threatens the enhancement of HIV treatment outcomes among patients on antiretroviral therapy (ART). However, there is a paucity of evidence on its incidence and predictors in Ethiopia. Thus, this study aimed to examine the incidence and predictors of LTFU among adult HIV patients receiving ART at hospitals in Central Ethiopia. Methods: A multi-centered facility-based retrospective cohort study was conducted among 432 randomly selected adult patients who received antiretroviral therapy. Data were entered into EpiData version 3.1 and exported to Stata version 14 for analysis. The Kaplan–Meier failure function was employed to determine the overall failure estimates, and the log-rank test was used to compare the probability of failure among the different categories of variables. The Cox proportional hazard model was used to identify independent predictors of LTFU. Results: Overall, 172 (39.8%) study participants were lost to follow-up over the 10-year follow-up period with an incidence rate of 8.12 (95% CI: 7.11, 9.09) per 1,000 person-months. Undisclosed HIV status (AHR: 1.96, 95% CI: 1.14, 3.36), not able to work (AHR: 1.84, 95% CI: 1.13, 2.22), opportunistic infections (AHR: 3.13, 95% CI: 2.17, 4.52), CD4 < 200 cell/mL (AHR: 1.95, 95% CI: 1.18, 3.21), not receiving isoniazid preventive therapy (IPT) (AHR: 2.57, 95% CI: 1.62, 4.06), not participating in clubs (AHR: 1.68, 95% CI: 1.10, 2.22), side effects of drugs (AHR: 1.44, 95% CI: 1.02, 2.04), and high viral load (AHR: 3.15, 95% CI: 1.81, 5.47) were identified as significant predictors of loss to follow-up. Conclusion: In this study, the incidence of LTFU was high. The focus should be on creating awareness and prevention programs that aim to reduce loss to follow-up by continuing counseling, especially on the negative effects of loss to follow-up and the benefits of ART care.

Keywords: adults, incidence, antiretroviral therapy, LTFU, predictors

Sustainability and climate change
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17 (2024)

The Interplay Between Rainfall, Temperature Variability, and Food Security in Southern Ethiopia

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Abstract

This study investigates the intricate relationship between rainfall patterns, temperature variations, and food security in the Gibe III Dam watershed of southern Ethiopia. The study includes a household survey of 384 respondents, analysis of the standard rainfall anomaly index, and Mann-Kendall and Sen slope estimator tests, which were used to analyze the variability and trends in rainfall and temperature. Other instruments employed for the study include: the Household Food Balance Sheet (HFBS), Food Insecurity Access Scale (HFIAS), Household Dietary Diversity (HDD), Rasch model, and Foster-Greer-Torbeck Index (FGT). Ordered logistic regression was used to identify the determinants of food security. The data show that the mean annual temperature increased at a rate of 0.02°C/ year from 1990 up to 2021 with the largest positive anomaly (1 1.2) and negative anomaly (-0.7) in 2018 and 2021, respectively, indicating interannual variability in rainfall. The HFBS model showed that 74.7 percent of survey respondents were food insecure and 25.3 percent food secure. The HFIAS scale showed that 25.54 percent of households were food secure, while 36.45 percent had mild food security, 30.45 moderate food security, and 7.55 severe food insecurity. The HDD index shows a medium level of dietary diversity with a mean score of 7.75. The Rash model shows mean food security scores of 15.3 for Kindo Koisha Woreda and 13.2 for Loma Bosa Woreda. A unit increase in age and agronomic measures increases the probability of being food secure, with odds ratio of 1.1 and 17.9, respectively. The FGT index shows that 74.2 percent of households do not meet 2,100 kcal, with a food security gap of 36.6 percent. Food security is threatened by seasonal fluctuations in rainfall and temperature, indicating that livelihood diversification and conservation agriculture should be implemented.

Keywords: climate**,** food security**,** Foster-Greer-Torbeck index

Indigenous Storytelling and Connections to the Land: More-Than-Human Worlds
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2024

An Appraisal of the Aari People's Indigenous Connections to and Conceptions of their Land (Fäč'ekə) through their Indigenous Religious Beliefs, Myths and Rituals

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Abstract

This chapter draws on a research project aiming to discover how Aari people view and identify with their land (fäč'ekə). The findings reveal that they believe that the gods Sabi and Bäri descended from the sky and created their land/fäč'ekə, and from an element of it the first ancestor of every clan. There are sacred groves, giant trees, rocks, forests, animals, springs and mountains from which the first ancestors were created and in which Sabi, Bäri, ʾaka ancestral spirits, and s'oyəsi spirits reside and are worshipped. Godəmi, hereditary ritual specialists, and babitoyədə, family elders, have special connections to these and are their guardians. Wild animals in such places are considered kin and are ordered by godəmis to protect them and to punish trespassers. Some animals and old trees are given agency, respected and conserved. Aari people believe their spirits will return to this same land/fäč'ekə upon death and join the ancestors. The grace of gods and ancestors will stay with them and grant them blessed and prosperous lives if they keep the sacred places and trees. As this chapter will show, Aari people have an effective Indigenous environmental management system that is grounded on their traditional knowledges and values and that views the Land/fäč'ekə as a more-than-human animated world in which humans, plants, animals, spirits, gods, etc., reside in harmony, deeply interconnected. Endalkachew Hailu Guluma is the first author of this contribution. The chapter discusses a part of the findings of a small-scale postdoctoral research project funded by Arba Minch University and Africa Oxford Initiative (AfOx). Endalkachew Hailu Guluma and Temesgen Minwagaw Lemma made repeated trips to the different districts and counties of Aari people between February 2021 and August 2022. They interviewed many elders, ritual specialists and chiefs, and visited many sacred places. The roles of the co-researcher, Temesgen Minwagaw Lemma, consisted of assisting during data collection in the field, transcribing recorded interviews for the lead researcher Endalkachew Hailu Guluma and engaging in the review of the various drafts produced by the lead researcher/first author at different stages.

Keywords: Aari people**,** land (fäč'ekə)**,** Kinship**,** Indigenous environmental management system**,** Ecocriticism

Journal of Parasitology Research
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2024 (2024)

Prevalence and Risk Factors of Lungworm Infection in Small Ruminants in Selected Districts of Wolaita Zone, Southern Ethiopia

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Abstract

Among small ruminants, lungworms are important parasitic nematodes that infect the lower respiratory tract and are implicated in a high mortality and morbidity rate. However, the magnitude and its determinants of lungworm infection in the study districts are not known. The objective of this study was to estimate the prevalence of lungworm infection and assess associated risk factors in selected districts, Wolaita Zone, southern Ethiopia. A total of 742 fecal samples collected from 443 sheep and 299 goats were examined, using modified Baermann techniques, to recover first-stage larvae from fecal samples. Lungworms were detected in 271 (36.52%) samples infecting 192 (43.34%) sheep and 79 (26.42%) goats, respectively. Lungworm species Dictyocaulus filaria, Protostrongylus rufescens, and Muellerius capillaris were recovered in 114 (15.36%), 68 (9.16%), and 57 (7.68%) fecal samples, respectively. Mixed infection by two or more above species was noted in 32 (4.31%) of the samples. Among the determinants examined, agroecological environment, management system, and season showed statistically significant differences ($p<0.05$) with the prevalence of infection in small ruminants. On the other hand, lungworm infection among sexes, age groups, and body condition scores showed no statistically significant difference ($p>0.05$). The present study indicated that lungworm infection was a problem for sheep and goats in this study area. Thus, measures like deworming, early treatment, and improving animal husbandry should be practiced.

Advances in Condensed Matter Physics
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2024 (2024)

Structural, Electronic, Mechanical and Optical Properties of RhZrZ (Z = As, Sb) Half-Heusler Compounds: First-Principles Calculations

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Abstract

In this study, density functional theory (DFT) as it is implemented in the Quantum Espresso simulation package was employed to investigate the structural, electronic, mechanical and optical properties of RhZrZ (Z = As, Sb) half-Heusler compounds. Results reveal that both the two compounds are most stable in α phase. Analysis of mechanical properties shows that the compounds are ductile in nature and mechanically stable. Calculations of band structure and density of states indicated that they are semiconductors with RhZrAs direct and RhZrSb indirect band gap. Furthermore, the investigation of the optical properties reveals that there is a high absorption coefficient and low electron energy loss in visible and some ultraviolet energy spectrum indicating that these compounds are potential candidates for optoelectronic applications.

Frontiers in Microbiology
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15 (2024)

Advancements in biosurfactant production using agro-industrial waste for industrial and environmental applications

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Abstract

The adverse effects of waste generation on the environment and public health have raised global concerns. The utilization of waste as a raw material to develop products with enhanced value has opened up novel prospects for promoting environmental sustainability. Biosurfactants obtained from agro-industrial waste are noteworthy due to their sustainability and environmental friendliness. Microorganisms have been employed to generate biosurfactants as secondary metabolites by making use of waste streams. The utilization of garbage as a substrate significantly reduces the expenses associated with the process. Furthermore, apart from reducing waste and offering alternatives to artificial surfactants, they are extensively employed in bioremediation, food processing, agriculture, and various other industrial pursuits. Bioremediation of heavy metals and other metallic pollutants mitigated through the use of bacteria that produce biosurfactants which has been the more recent research area with the aim of improving its quality and environmental safety. Moreover, the production of biosurfactants utilizing agricultural waste as a raw material aligns with the principles of waste minimization, environmental sustainability, and the circular economy. This review primarily focuses on the production process and various types of biosurfactants obtained from waste biomass and feedstocks. The subsequent discourse entails the production of biosurfactants derived from various waste streams, specifically agro-industrial waste.

Keywords: biosurfactants, agro waste, green synthesis, waste to value, biomass, environmental
application

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34 (2024)

Metal distribution and human health risk assessment in legumes crops (chickpea, lentils and peas) from Belesa districts, Ethiopia

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Abstract

Accumulation of heavy metals in food is a major concern for humans' health. This study was aimed at determining the levels of Cu, Fe, Mn, Ni and Zn in chickpea, lentil and pea samples and evaluating the health risk for consumers. The concentrations (in mg/kg) of Cu, Fe, Mn, Zn, and Ni were varied from 23.6–48, 67.7–132.3, 15–26.5, 37.6–68.2, and 25.5–33.3 in chickpea, 39.8–80.5, 116.1–180.5, 12.1–21.6, 36.4–57.2, and 25.4–34.1 for lentil and 32–64.2, 51.6–100.0, 6.3–15, 25.3–42.5, and 25.5–48.5 for peas, respectively. Pearson correlation verified that strong positive correlations were observed between Cu and Zn in lentils, Ni and Mn, Fe with Cu and Mn in peas. Target hazard quotients (THQ) except Ni in all samples, Cu in lentil and pea were < 1 and the hazard index (HI) values of all heavy metals were greater than 1, thus an appropriate strategy is required to reduce exposure to heavy metals.

Keywords: Legume, health risk, heavy metal, Ethiopia

Journal of Advanced Transportation
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2024 (2024)

Machine Learning-Based Prediction of Parking Space Availability in IoT-Enabled Smart Parking Management Systems

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Abstract

Parking space management has become a critical challenge in urban areas due to increasing vehicle numbers and limited parking infrastructure. This paper presents a comprehensive study of machine learning (ML) models in IoT-enabled environments focusing on proposing an ML-based model for predicting available parking space. The study evaluates the performance of various models including K-nearest neighbors (KNNs), support vector machines (SVMs), random forest (RF), decision tree (DT), logistic regression (LR), and Naïve Bayes (NB) based on "precision, recall, accuracy, and F1-score performance metrics". The results obtained by implementing ML models on the data with 65% and 85% threshold values are compared to draw meaningful conclusions regarding their performance in predicting parking space availability. Among the evaluated models, random forest (RF) demonstrates superior performance with high precision, recall, accuracy, and F1-score values. It showcases its effectiveness in accurately predicting parking space availability in the IoT-enabled environment. On the other hand, models such as K-nearest neighbors (KNNs), decision tree (DT), logistic regression (LR), and Naïve Bayes (NB) show relatively lower performance in complex parking scenarios. The paper concludes that the use of advanced predictive models, particularly random forest, significantly enhances the accuracy and reliability of IoT-enabled parking management systems and also reduces the waiting time of the vehicles, leading to more efficient resource utilization, reduced traffic congestion in real-time scenarios, and better user satisfaction in the IoT-enabled environment.

Cogent Food and Agriculture
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10 (2024)

Effects of integrated land management technology adoptions on soil properties, evidence from the Goyrie watershed, Southern Ethiopia

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Abstract

Since 2008, integrated land management technology (ILMT) adoptions have been applied to minimize soil depletion and improve soil properties in the Ethiopian highlands, including the study watershed. However, the effect of combined technologies on soil properties was not investigated through standard laboratory procedures in the Goyrie watershed. Thus, the purpose of this study was to evaluate the effects of ILMTs on selected soil properties in the Goyrie Watershed of southern Ethiopia. A total of 27 composite soil samples (three replications, three farmlands per management category, and three slope positions) were randomly collected from the top soils at a depth of 0–20 cm. A one-way analysis of variance (ANOVA) was used to examine mean soil property variation between treated and non-treated farmlands and slope positions, while a two-way ANOVA was used to examine the interaction effects. The result showed that farmlands treated with soil bunds and desho grasses had significantly higher mean clay content (50%), total porosity (59.6%), soil pH (6.7%), soil organic carbon (SOC) (2,49%), soil organic matter (SOM) (4.29%), total nitrogen (TN) (.23%), available phosphorus (Av. P) (7.83%), cation exchange capacity (40.11%), and exchangeable basic captions compared to farmland treated with only single technologies and without conserved farmlands. Non-treated farmlands had higher sand (32.84%) and bulk density (1.38%) contents. Whereas lower landscape sites had higher mean value of clay (29%), K+ (.49%), Ca2+ (8.93%), and Mg2+ (2.23%) content than the middle and upper slope sites. Clay content, soil pH, SOC and SOM contents were statistically and significantly influenced by the interaction effects of management technologies and slope gradient. Overall, the three PCAs' contributed to 71.52% of the total variance. Adoption of soil bunds with multipurpose fodder species is a promising approach for improving soil properties and should be applied to the non-treated farmlands of the Goyrie Watershed.

Keywords: Integrated land management technologysoil propertyinteraction effectanalysis of varianceGoyrie watershed

Advances in Medical Education and Practice
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15 (2024)

Implementation of Problem-Based Learning in Undergraduate Medical Education in Ethiopia: An Exploratory Qualitative Study

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Abstract

Background: The poor quality of health professional education in Ethiopia, which was rooted in a traditional curriculum, has posed significant challenges for graduates in effectively addressing real-life health problems. In response, there has been curricular reform by adopting problem-based learning across Ethiopian medical schools. Given the dearth of literature on the topic and the significance of context in the effective implementation of problem-based learning, it is imperative to provide local institutional evidence to pinpoint critical intervention areas and support the effective implementation of problem-based learning. Methods: A qualitative design based on in-depth, individual, semi-structured interviews was used to explore medical educators, program coordinators, and educational leader's experiences and perspectives on the problem-based learning implementation in health sciences education. A total of 24 participants recruited from five undergraduate health science programs participated in the study. All sessions were audio recorded and transcribed verbatim. Results were analyzed following a qualitative thematic analysis method. Results: Analysis of the transcripts revealed three main themes, along with their corresponding subthemes. Within the first main theme, participants discussed the importance of integrating Problem-Based Learning into undergraduate medical programs and the educational benefits it brings to medical education. The second main theme explored issues related to challenges in implementing problem-based learning which include inadequate staff training, deficiencies in curricular design and governance, constraints in educational resources, and a lack of preparedness in the educational environment. The third theme deals with the strategic recommendations to address the challenges that contributed to the poor implementation of problem-based learning in undergraduate medical schools. Conclusion: Our study has addressed several issues related to the implementation of Problem-Based Learning in Ethiopian Health Sciences Colleges. The study's findings have the potential to provide educational stakeholders and policymakers with essential information to strategize successful problem-based learning implementation in undergraduate medical schools.

Keywords: implementation, problem-based learning, undergraduate, medical education Ethiopia

Heliyon
DOI: https://doi.org/10.1016/j.heliyon.2024.e24838
10 (2024)

Neonatal jaundice and associated factors in public hospitals of southern Ethiopia: A multi-center cross-sectional study

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Abstract

Background: Neonatal jaundice is one of the most prevalent problems, affecting over a million newborns globally every year. It increases the likelihood of hospitalization, lifetime disability, and death, particularly in low and middle-income countries. Despite its impact and diverse risk factors, neonatal jaundice remains underappreciated in developing nations such as Ethiopia. As a result, this study aimed to determine the magnitude and associated factors of jaundice in newborns admitted to public hospitals in south Ethiopia.

Methods: A facility-based cross-sectional study was conducted among 417 newborns from October 1, 2020, to April 30, 2021. The data was collected using pretested interviewer-administered questionnaire and checklist. Jaundice and its severity were assessed using the physician's diagnosis and the Kramer scale. Open data kit tools and Stata version 16.0 were used for data collection and analysis, respectively. Bivariable and multivariable analyses were used to identify factors associated with neonatal jaundice. An odds ratio with a 95 % confidence interval was used to assess the direction and strength of the association.

Results: Out of the newborns, 24.46 % [95 % CI: 20.42–28.88] encountered neonatal jaundice. Being male [AOR: 1.81, 95 % CI: 1.06, 3.12], birth injuries [AOR: 3.01, 95 % CI: 1.27, 7.12], perinatal asphyxia [AOR: 2.10, 95 % CI: 1.18, 3.76], hyaline membrane disease [AOR: 2.16, 95 % CI: 1.16, 4.00], sepsis [AOR: 3.30, (95 % CI: 1.67, 6.54], the combined effect of low birth weight and prematurity [AOR: 1.88, 95 % CI: 1.06, 3.35], and maternal alcohol abuse during pregnancy [AOR: 2.46, 95 % CI: 1.02, 5.94] were significantly associated with neonatal jaundice. **Conclusion:** The burden of neonatal jaundice was high in the hospitals studied. Early detection and treatment of neonatal problems, counseling pregnant women to avoid consuming any level of alcohol, strict monitoring of labor and delivery, improving antenatal care utilization, and pre-discharge universal bilirubin screening of newborns are essential to reduce the incidence and complications of jaundice. The findings of this study will be used as input to initiate interventions and conduct further studies.

Keywords: Neonatal hyperbilirubinemia**,** Incidence of jaundice**,** Predictors of jaundice**,** Ethiopia

Cogent Social Sciences
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10 (2024)

The effect of financial technology on financial inclusion in Ethiopia during the digital economy era

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Abstract

The digital economy is overwhelming the whole world and expected to help the socio-economic enhancement especially in the developing countries. The banking industry is significantly investing on introducing financial technologies especially in developing countries like Ethiopia ultimately to achieve financial inclusion goals. Hence, this study was aimed to investigate the effect of financial technology (Fintech) for financial inclusion in Ethiopia during this digital economic era. For this purpose, secondary data was collected from nine commercial banks (panel units) from the year 2015 to 2020. The random effect model was applied to estimate the effect of explanatory variables on the variable of interest based on Hausman test results and after testing all possible assumptions of the model. Accordingly, the finding revealed that ATM, mobile banking, POS, and agent banking were found to have statistically significant positive effect on financial inclusion. The authors suggested that increasing the adoption of digital financial technologies (Fintechs) in the rural and urban area would positively contribute for ensuring financial inclusion strategies of policy makers and banking practitioners.

Keywords: Financial inclusion, under banked, Fintech, financial services, banking

Geology, Ecology, and Landscapes
DOI: https://doi.org/10.1080/24749508.2024.2429212
9 (2024)

An investigation on the effect of soil erosion on the properties of soil adjacent to a road right of way (ROW)

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Abstract

Recently, soil erosion has been a significant and common issue along road right of way (ROW). This study was designed to identify the effect of soil erosion on the physical and chemical properties of soil across a ROW. Land use land cover (LULC) map, soil map, and field observation were adopted to ensure proper sampling. Moisture content, grain size analysis, soil texture, consistency test, organic content and matter, pH, and cation exchange capacity (CEC) were conducted on 10 representative soil samples collected from 14 km ROW. The laboratory results from moisture content, pH, and CEC revealed samples taken from the erosion fields (20.79% to 26.41%), (8.48 to 8.66), and (18.02 to 24.03) appeared to be higher than those taken from non-eroded fields (16.79% to 18.51%), (8.18 to 8.3), and (14.5 to 16.15), respectively. The organic content of the soil in the non-eroded areas was higher than that in the eroded areas. This variation in soil properties is primarily attributed to differences in LULC and soil composition. With regard to consistency properties, the soil was marked as highly erodible. Treatment of drainage structures, demarcating ROW, ROW stabilization, and awareness creation were proposed as feasible remedial measures. Finally, the soil along Sawla to Bulki ROW was identified as erodible soil as per experimental results and analysis.

Keywords: Soil properties, land use land cover (LULC), field observation, ArcGIS, Gofa Zone

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Architecture Education: Rubrics in Google Classroom as a Tool of Improving the Assessment and Learning

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Abstract

Blended learning has emerged as a promising approach in architecture education, combining face-to-face instruction with online tools such as Google Classroom, etc. for teaching and learning as well as assessment. The rubrics is a helpful grading tool that the instructors can use to rate the students' work in a more standardized, transparent, and easy way. The well-designed rubrics can enable the students in recognising their areas of strength and weakness and it will also help them to improve the quality of their work. Although the rubrics have some limitations, several studies show that they can help teachers communicate their expectations more effectively. In this paper, the researchers discussed the effect of using the rubrics in the Google Classroom in architecture education. The rubrics were developed in Google Classroom to evaluate the main task of the subject i.e., assignments for the students of Bachelor of Architecture. The data was collected from the students through a questionnaire that was developed using the web-based Google Forms platform. The marks obtained in the assignments and the data collected through the questionnaire were presented graphically for ease of understanding. Results indicate that rubrics using Google Classroom facilitate a clearer understanding of expectations, promote consistency in grading and feedback, increased transparency, and support student self-assessment and reflection. The integration of rubrics within Google Classroom enhances students' engagement, motivation, and overall learning experience.

Keywords: Rubrics**,** Assessment method**,** Architectural education**,** Google classroom

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Examining the status of school improvement program implementation in primary schools: a case study in South Ethiopia region

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Abstract

The implementation of a School Improvement Program (SIP) is a means to enhance the overall quality of education and ultimately improve students' academic outcomes. Hence, this study aimed to investigate the extent of SIP implementation with respect to its main domains in primary schools of Gamo Gofa Zone, South Ethiopia Region. Accordingly, the current study focuses on four key areas in schools, which include teaching-learning, school leadership and management, parent-community school relations, and healthy school environment. A descriptive survey research design was used with a quantitative research method. From 16 primary schools; 99 teachers, 32 principals, 44 school improvement committees and 396 students were selected using a simple random sampling technique. The research utilized close-ended questionnaires and document reviews as data-gathering instruments. Quantitative data were analyzed using mean, standard deviation, and one-way ANOVA, while qualitative data were analyzed using descriptive narration. The findings revealed that the implementation of SIP in the four main domains was moderate status. However, the domains of teac hing-learning and school leadership exhibited a high level of implemen tation. The study also identified significant differences among districts regarding the extent of implementation in the teaching-learning and community participation domains. Moreover, the results of grade four zonal and grade eight regional examinations indicated that SIP is not yet properly implemented and needs high consideration. Therefore, raising awareness about the revised school improvement Blueprint and framework through short-term training, establishing an incentive system to encourage best practices and implementing formal monitoring and evaluation tools are suggested to boost the status of SIP implementation in the study area.

Keywords: implementation, primary school, school improvement committees, school improvement program, status

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Effect of supplementation of local brewery by-products on feed intake, body weight change and economic efficiency of woyto-guji goats fed hay-based diets

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Abstract

Local brewery byproducts such as atella and tata, resulting from several fermented beverages, are used as animal feed in Ethiopia. However, there is no sufficient information on the nutritional value of those feed resources for animals. The objective of this study was to evaluate the effects of supplementing local brewery by-products on feed intake, body weight change, and economic profitability of Woyto–Guji goats fed on hay. Twenty-four yearling intact Woyto-Guji male goats were used. The experiment was conducted using a completely randomized block design. The goats were blocked into six groups of four animals based on initial body weight and randomly assigned to four different dietary treatments: hay alone (T1); hay combined with atella (T2); hay combined with tata (T3); and hay combined with an atella-tata mixture (1:1) (T4). The crude protein content of hay, atella, tata, and the atella-tata mixture used in this study were 7.35, 18.47, 17.51 and 17.86%, respectively. Dry matter intakes of 564.56 (T1), 810.27 (T2), 850.37 (T3), and 945.85 (T4) g/day, and crude protein intakes of 45.27 (T1), 104.18 (T2), 103.79 (T3), and 112.96 (T4) g/day were recorded. Total body weight gains were 2.76, 8.03, 6.15 and 9.72 Kg for the same treatments, respectively. Atella and tata, either supplemented alone or combined, increased body weight. The highest body weight gain was recorded in goats fed atella-tata mixture. All treatments had a positive net return.

Keywords: Tata; atella; intake; body weight

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12 (2024)

Financial development and economic growth: evidence from emerging African and Asian countries

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Abstract

The connection between financial development (FSD) and economic growth has been the focus of both theoretical and empirical research. However, the specific nature of this relationship depends on factors such as the level of economic development, the extent of financial activities, and integration into the global financial system. The aim of this study is, therefore, to investigate the link between FSD and economic growth in the context of 22 emerging African and Asian countries. And both descriptive and econometric analyses were conducted using panel data from 1981 to 2021. Besides, the study used the Dynamic Common Correlation Effect (DCCE) model, which takes into account cross-sectional dependency, allows for parameter variation, and combines the characteristics of both MG and PMG. The descriptive results indicate that emerging Asian countries have a relatively higher FSD level than emerging African countries, with the average FSD for the sampled emerging countries being 23.74 percent; for emerging Asian countries, it is 30.98 percent; and for emerging African countries, it is 17.71 percent. Furthermore, the econometrics results show that FSD has a positive but negligible influence on the growth of emerging Asian and African nations, suggesting that although there is rapid and sustainable growth, the current level of FSD is insufficient to sustain this trajectory. Thus, among the crucial policy options that policymakers should implement to improve financial sector development and sustain economic growth in emerging African and Asian countries are strengthening institutions, financial openness and liberalization, improving technologies, and digitalizing economies.

Keywords: Financial development, Economic growth, FSD Index, DCCE model, Emerging economies

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Performance evaluation of various hydrological models with respect to hydrological responses under climate change scenario: a review

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Abstract

Studies reviewed in this paper show anomaly for temperature pertaining to streamflow and rainfall showing different trends, especially in Ethiopia to support the research findings and interpretation. There are many hydrological models, including 54 physically distributed, lumped, and conceptual hydrological models, of which 28 have been used in Ethiopian river basins. The models include the most adaptable and commonly used SWAT model applicable from small areas up to large basins. It is indeed a challenge to use a single hydrological model as the data rely on consistency, limitation-free, and exactly fitted output. The overall performance of individual physically-based, conceptual, and machine learning (ML) models varied at different watersheds. Reasonably, ML performs very well, up to 0.99 for R2 and NSE and up to 0.001 for PBIAS. Inopportunely, using a single hydrological model has its limitations; ensemble multi-individual models, coupling or hybridization of physical or conceptual models with machine learning, combining evolutionary optimization algorithms with ML, and also comparisons of multi-single hydrological models, and selecting the best one are recommended options. No single hydrological model is indispensable and can be termed as better than the other for any watershed. Somewhat, ML outperforms SWAT but cannot be considered an absolute substitute. The size of the watershed, the number of data used, and the ratio between calibrations year to validation year do not have a clear correlation with the performance, particularly for the SWAT model accounted for in this review. Optimization algorithms explore multiple options and choosing the right one is a tedious task before a final decision is taken.

Keywords: Climate, hydrological models, machine learning, SWAT, watershed

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Solution analysis for non-linear fractional differential equations

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Abstract

In this research study, two new types of fractional derivatives, the Caputo-Fabrizio derivative that does not involve a singular kernel (like the Riemann–Liouville derivative), which helps in eliminating some drawbacks, such as non-locality, and the Atangana–Baleanu–Caputo ((Formula presented.)) derivative that uses a non-singular and non-local kernel, offering different characteristics from other fractional derivatives and often leading to more accurate models in certain physical systems, are used. The primary goal of the research is to analyze a non-linear fractional differential equation involving the fractional derivatives of Caputo–Fabrizio and (Formula presented.) admit at least one solution. Fixed point theory is a fundamental tool in mathematical analysis used to prove the existence of solutions to various equations. Hence, in this study, to achieve the desired results, we employ a novel fixed point theory known as the (Formula presented.) -contraction type. The study also includes required conditions and inequalities that need to be satisfied to ensure that a solution exists. One of these conditions is based on the Lipschitz hypothesis. Therefore, we provide the required conditions and inequalities, based on the Lipschitz hypothesis, to show that solutions to our problem exist. Furthermore, we provide two illustrative examples to support our primary findings.

Keywords: F-contraction type, existence of solution, Caputo-Fabrizio derivative, Atangana-Baleanu-Caputo derivative, non-linear fractional derivative

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Characterization and classification of soils in the irrigable land of Achewa small-scale irrigation area, Itang special district, southwest Gambella, Ethiopia

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Abstract

The characterization and classification of soils in irrigable areas are crucial for understanding soil types and nutrient status, which in turn help to optimize crop yield and to design soil management strategies. This research aimed to characterize and classify soils in the Achewa small-scale irrigation area in Itang special district of southwest Gambella, Ethiopia. Representative pits were excavated at three slope locations, and soil profiles were examined and described directly in the field. To classify soil types, the WRB for Soil Resources guidelines were used. Across horizons, texture classes varied from clay loam to clay, whereas bulk density was within acceptable limits for mineral agricultural soils. Additionally, soil pH ranged from neutral to moderately alkaline. Organic matter content varied among topography positions, with values of 3.78%, 2.96%, and 2.85% at pedons 2 and 3 in the study area. Total nitrogen content was classified as low in pedon 3 and medium on the other two pedons, whereas available phosphorus content was classified as very high in all slope positions. Soil CEC and PBS were high and very high across all slope positions, with the dominant soluble cations being Calcium followed by magnesium, potassium, and sodium and extractable micronutrients (Fe, Mn, Zn, and Cu) were high to medium. Based on morphological, physical, and chemical analysis three soil types were identified: Eutric Fluvisols (Loamic), Pellic Vertisols (Gilgaic, Hypereutric), and Haplic Vertisols (Gilgaic). Therefore, implementing site-specific soil management techniques is recommended to enhance and sustain soil fertility and optimize crop and vegetable production, for ensuring long-term soil productivity in the study area.

Keywords: characterization, irrigable land, soil classification, soil profile, slope

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Landslide vulnerability mapping using multi-criteria decision-making approaches: in Gacho Babba District, Gamo Highlands Southern Ethiopia

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Abstract

The landslide has been a life-threatening natural disaster in most districts of Gamo Highlands. This study was conducted to assess the status of landslide vulnerability in the Gacho Baba district of the Gamo zone in southern Ethiopia. The Geographic Information System Analytical Hierarchy Process and Weighted Linear Combination multi-criteria decision-making approaches were applied. Eight causative factors of landslide, namely, slope, elevation, aspect, distance from the stream, drainage density, soil type, distance from the road, and land use/cover were considered. The weight values of each causative factor were determined by previous studies, field observations, and experts' judgment. The calculated weight of each causative factor is the slope (23%), elevation (21%), aspect (8%), stream distance and drainage density each (12%), soil type and road length each (9%), and land use/cover (6%). Moreover, the Consistency Index (0.13) and Consistency Ratio (0.08%) were calculated with acceptable values for comparison to weighted overlay analysis to produce a landslide vulnerability map of the study area. The result shows that the vast majority of the study district (86.6%) falls within a very high to moderate landslide susceptibility class and only (13.4%) falls within a very low and low susceptibility. This indicates that almost all the 11 villages in the district, are found within the high to moderate landslide vulnerability class which alerts responsible community and zonal disaster risk prevention and related offices to take action on the identified causative factors to reduce the occurrences of landslide hazard in the study district.

Keywords: Analytical-hierarchy process**,** Causative-factors**,** Gamo-highlands**,** Landslide**,** Vulnerability

International Journal of Hydrology Science and Technology
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17 (2024)

Study rainfall intensity duration frequency relationships under climate change for design of efficient urban stormwater drainage systems in Dodola town, Ethiopia

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Abstract

The variability in rainfall intensity caused by climate change has an impact on the efficiency of urban stormwater drainage systems. Therefore, this study presents the relationships between rainfall intensity and climate change using the global climate models MIROC-ESM, HadGEM2-ES, and CanESM2 under two representative concentration pathway scenarios (RCP4.5 and RCP8.5). The future projected daily rainfall was extracted and bias-corrected using the python scripts. The results show that the highest intensity of rainfall for a 100-year recurrence period in a 5-minute duration is 201.2 mm/hr. The relative difference between the RCP4.5 climate change scenario and historic rainfall ranges between 25.1% and 36.3% for the 2030s, 3.0% and 81.4% for 2050s, and 1.5% and 58.6% for 2080s, respectively. Similarly, the difference between the climate change scenario and historic rainfall for the 2030s ranged from 13.9% to 49.8%, with an average value of around 25.1% in the case of RCP8.5. As a result, the investigation of rainfall intensity relationships due to climate change will be used to design efficient drainage systems.

Keywords: climate change, CanESM2, rainfall intensity, relative difference

Nutrition, Metabolism and Cardiovascular Diseases
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34 (2024)

Association between urbanization and metabolic syndrome in low- and middle-income countries: A systematic review and meta-analysis

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Abstract

Aims: The prevalence of metabolic syndrome (MetS) is on the rise in an increasingly urbanized world. The study aimed to review the association between urbanization and MetS in low- and middle-income countries (LMICs).

Data synthesis: A comprehensive search of five databases (MEDLINE, Web of Science, Scopus, EMBASE, and CENTRAL) was performed in January 2022 and updated in October 2022. Peer-reviewed studies that met the eligibility selection criteria were included. Search terms were used for the main concepts which are MetS, dietary patterns, and urbanization in LMICs. Study selection was done in two stages and in duplicate. Random effects models were used to calculate the overall pooled prevalence and main study-level characteristics. Out of 9,773 identified studies, nineteen were included in the systematic review and meta-analysis. The studies were done on 313,644 participants (149,616 urban and 164,028 rural). The pooled risk ratio (RR, 95% confidence interval) of MetS between urban and rural dwellers was RR = 1.24; 95%CI [1.15, 1.34] (I2 = 96.0%, P < 0.0001). A relatively higher prevalence of MetS among urban than rural residents has been observed, especially with the International Diabetes Federation criteria (RR = 1.54; 95%CI [1.21, 1.96]; I2 = 65.0%), and in the population in India (RR = 2.19; 95%CI = 1.24, 3.88, I2 = 85%). Overall, the role of dietary patterns in the development of MetS was inconsistent, and few studies showed a lower risk of MetS with adherence to recommended healthy dietary patterns.

Conclusions: There was an association between urbanization and the high prevalence of MetS. Interventions and policies to reduce the risk of MetS are needed.

Journal of Chemistry
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Response Surface Methodology Optimization for Extraction of Antioxidants from Moringa Stenopetala Leaf, Study of Its Phytochemical Screening, and DPPH Antioxidant Assay

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Abstract

Moringa stenopetala is a medicinal tree that originated in Africa and Asia. It has been used as a traditional medicine over centuries to treat diseases. Recent studies have shown that Moringa stenopetala is a rich source of antioxidants and other phytochemicals. This study investigated the extraction, phytochemical screening, and DPPH antioxidant assay of Moringa stenopetala leaf (MSL) extract. The study optimizes the process conditions to extract phytochemicals from the MSL. Using Design-Expert software, the experiments were designed and optimized the extract from MSL using the response surface methodology approach. The best optimal parameters for extracting MSL extract were established as the concentration of ethanol: 50%, time: 48 h, and pH 6.5, which resulted in the highest responses: the MSL extract yield (67.95%) and the total phenol content (4.47 mg GAE/mL) with a higher desirability value of 1.0000. The crude extract was then subjected to phytochemical screening to identify the presence of various secondary metabolites. The DPPH antioxidant assay was used to estimate the antioxidant activity of MSL extract. Phytochemical screening results proved that MSL extract contains flavonoids, phenols, saponins, and tannins. DPPH antioxidant assay showed that the 0.15 mg/L of MSL crude extract had a robust antioxidant activity with a maximum percent inhibition of 85.08 ± 0.49. Thus, the results of this study suggested that MSL extract is a better source of antioxidants to use as natural preservatives in food and pharmaceutical industries.

Keywords: DPPH antioxidant assay; Moringa stenopetala; optimization; phytochemical screening; ultrasonic-assisted extraction

Dialogue and Discourse
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Self-Repair in Tigrinya: Trouble Sources, Mechanisms and Solutions

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Absract

This paper analyzes conversational self-repair, which refers to reconstructing problematic portions of a prior oral discourse by oneself, in Tigrinya. Tigrinya is a Northern Ethio-Eritrean-Semitic language spoken by the inhabitants of the Tigray regional state of Ethiopia and Eritrea. This article relies on recorded oral data from speakers of the Rayya Tigrinya variety, particularly inhabitants of Neksege located to the West of Maichew. A conversational analysis (CA) approach is used to analyze the trouble sources, mechanisms (initiators), and results of self-repair. The article shows that pronunciation problems emanating from dialectal variation or tongue slip, wrong word order including focus misplacement, missing constituents, perceived misunderstandings, and using (totally) wrong constituents are some of the trouble sources that push speakers to repair portions of a prior oral utterance. On top of that, cut-offs, particles, and lexemes (one verbal noun and some predicates) are identified as self-repair initiators. Though cut-offs do not indicate a self-repair, particles and predicates may sometimes indicate a self-repair. Finally, the article posits that expanding, replacing, re-ordering, aborting and restarting, and inserting are some of the solutions set for the repairable segments in the repaired portions of the oral discourse. The author recommends for further investigation repair in the process of language acquisition and learning, and the relationship between self-repair and the demographic features of participants.

Keywords: Tigrinya, self-repair, trouble sources, repair mechanisms, repair solutions

Heliyon
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A spatio-temporal analysis of the magnitude and trend of land use/land cover changes in Gilgel Gibe Catchment, Southwest Ethiopia

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Abstract

Analyzing alterations in land use/land cover is crucial for water Scientists, planners, and decision-makers in watershed management. This examination enables the development of effective solutions to mitigate the adverse impacts resulting from such changes. The focus of this research was analyzing alterations in land use/land cover within the Gilgel Gibe Catchment in 1991 – 2021. LULC data of 1991-2021 were derived from multispectral Landsat images. Data were also gathered using field observations and key informant interview. Data of LULC classes (1991–2021) were generated utilizing supervised classification with maximum likelihood algorithm of ENVI 5.1 and ArcGIS 10.5. Change detection analysis and accuracy assessment were done where accuracy levels all the study periods were > 85 %, and the overall Kappa statistics of the periods were > 0.89. Built-up area and cultivated land of the catchment are increasing with increasing magnitude of change; whereas, while forest cover and grazing land of the catchment are shrinking with declining magnitudes of change, shrubland covers and water body are declining with increasing magnitude of change in the catchment. The net increase in degraded land is a reflection of the increasing degradation of natural resources in the catchment. Swift escalation of population and the subsequent raising demand for farmland and forest and shrub (e.g. fuel-wood and construction) products, decline yield, unemployment and lack of alternative income source, and open access and limited conservation of resources are the principal factors for the dramatic shrinkages of grazing, forest, water body and shrubland resources. Thus, concerned bodies should take rehabilitation measures to restore degraded lands, improve production and yield of farmland by increasing improved farm-inputs and irrigation, and create employment and alternative income sources for the youth, women and the poor so as to ensure sustainable rural livelihoods and to curb the impacts on forest, shrubland and other resources.

Keywords: Land use/land cover change**,** Forest depletion**,** Cultivated land expansion**,** Gilgel gibe

Heliyon
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10 (2024)

Multi-purpose reservoir operation concomitant with estimating hydropower potential using multifarious hydrological models

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Abstract

The research aims at determining the optimal release rule to increase the capacity of Rib reservoir. The reservoir inflow using HBV-light hydrological model embracing optimal reservoir operation through HEC-ResSim model were used to prepare an optimum operational plan. The potential of the river for hydropower generation prioritises the demand at a specified level regarding storage capacity (m3), level of reservoir (m), and the relation between inflow and outflow of the reservoir. From the model performance features, the coefficient of correlation (R2) and Nash Sutcliffe Efficiency (NSE) were determined to be, respectively, 0.77 and 0.73 for calibration and 0.72 and 0.70 for validation. The Sobol approach was used for detailed sensitivity analysis of DROP model parameters based on the performance of C2M on outflows and volumes. The results suggest that the threshold coefficient characterizing the demand-controlled release level is the most significant parameter. According to the simulation's findings, the reservoir's average regulated release is calculated to be 22.86 m3/s, and its average monthly hydropower output is 6.73 MW. Average annual hydropower energy was estimated as 58.955 GW h/year and mean annual inflow of reservoir volume of water to be 223.54 Mm3. This volume of water is adequate to accommodate total annual irrigation demand, environmental obligation, and other respective requirements in the downstream. The demand for hydropower and irrigation and supply from reservoir capacity can be counterbalanced from the simulated result without any hindrance.

Keywords: HBV-Light, HEC-ResSim**,** Hydropower**,** Rib watershed**,** Reservoir operation

Cogent Engineering
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11 (2024)

Assessment of power distribution system losses and mitigation through optimally placed D-STATCOM: (A case study: Gesuba town 15 kV distribution system)

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Abstract

In general, power distribution losses are a crucial issues in the power industry. Although this is a global concern however this study is conducted in a Gesuba town 15 kV power distribution system consisting of 19 distribution transformers with total demand of 2.522 MW. High loss factor and less voltage stability issues are one of the most challenging issues in the town. A backward/forward sweep load flow analysis was utilized to analyze the system with application of particle swarm optimization (PSO) algorithm to find the kVAR size and the location of distribution static compensator (D-STATCOM) for objective of reducing power loss and improving the voltage profile. From the assessment, the critical bus is found as bus #6 with the optimal size of about 986 kVAR. From the data analysis, the average load factor (LF) and loss factor (LSF) are found as 47.013% and 11.71%, respectively. The town's voltage-dependent load model is developed. A load flow analysis revealed that the average bus voltage magnitude before and after D-STATCOM integration is about 0.9148 pu and 0.9767 pu, respectively, with active power loss of 461.6203 kW and 179.2530 kW. It can be deduced from this analysis that the developed model appropriately represents the actual system, thus indicating that it would be advantageous for the utility to consider investing in implementing the proposed approach to achieve better performance.

Keywords: Backward/forward sweep distribution-STATCOM particle swarm optimizationpower lossesvoltage profile

Advances in Agriculture
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Current Prospects of Husbandry and Breeding Practices of Chicken Populations Rearing in Rural Communities: For Sustainable Improvement Interventions

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Abstract

This study aimed to investigate the present scenario of chicken husbandry and breeding practices in the rural districts of Sidama Region, southern Ethiopia. Four districts, namely Hula, Shebedino, Aleta Chuko, and Boricha were purposefully selected based on their chicken production potential and agroecological distinctiveness. The study data were collected from 161 chicken-keeping households through interviews, on-farm follow-ups, group discussions, and field observations. Descriptive statistics and indexed ranking procedures were applied to summarize the data using SAS software. The chicken farming system was predominantly free-scavenging, followed by slowly growing semi-intensive and few intensive farming systems. The majority of rural farmers were keeping chickens primarily to support family income and for home use. A decreasing flock size of indigenous chickens and an increasing trend of improved chicken distribution and rearing were observed. It has been noted that farmers have a good experience of selecting hatching eggs, breeding cocks, and hens. In highland districts, pure breeding is common, while in midland and lowland districts, crossbreeding is more common due to the high distribution of exotic breeds. In all study districts, chickens mainly rely on scavenging with minimal feed supplementation and sit on simple perches fixed in family houses and kitchens. More than 65% of farmers use various traditional medications that were known by farmers to cure sick chickens. Furthermore, the study identified seasonal feed shortages, disease outbreaks, unplanned breeding, limited management knowledge, predators, and drought as major bottlenecks to chicken production. Thus, these findings could raise guiding information to improve small-scale chicken husbandry and breeding practices, which help poor rural families, and the major bottlenecks to ensure sustainable poultry farming were identified. Moreover, the high mortality of chickens observed during peak dry and wet seasons in the Boricha and Hula districts, respectively, calls for further research on the adaptation potentials of chickens in their respective ecologies.

Keywords: breeding practice; husbandry; indigenous chickens; Sasso breeds; sustainable farming

Modeling Earth Systems and Environment
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10 (2024)

Modeling of watershed intervention techniques to rehabilitate sediment yield hotspot areas in Hare watershed, rift valley basin, Ethiopia

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Abstract

Soil erosion and sedimentation are broadly recognized as one of the major earth and environmental problems. Increase of agricultural activities, poor farming system, deforestation and overgrazing causing serious soil erosion and sediment yield in the watershed. Modeling watershed management practices play significant role on soil erosion reduction, increase soil moisture content and decrease sediment production. Thus, the main objective of this study was modeling of watershed intervention practices to rehabilitate the soil erosion and sediment hotspot areas. Twenty-four suspended sediment samples were collected from Hare River and its concentration was determined in laboratory. The sediment concentration was then converted into sediment load in ton per day and sediment-rating curve was developed. Eighteen years sediment data was generated using developed sediment rating curve. Monthly flow and sediment data calibrated and validated in Soil and Water Assessment Tool-Calibration and Uncertainty Program (SWAT-CUP). Model performance was checked and found very well. Spatial variability map of the sediment yield in the watershed was developed. Twelve sediment hotspots sub-watersheds which produce sediment from high to severe (20.38 to 61.99ton/ha/year) were identified. For those twelve-sediment hotspot sub-watersheds, four watershed intervention techniques were applied. After application of strip cropping, residue management, contouring and terracing, sediment production was reduced by 47.42%, 5.54%, 69.22%, and 84.88%, respectively. Among the intervention techniques terracing found to be the most watershed treatment approach in this study. The research finding is vital to environmental protection authority, decision makers and scientific community to undertake intervention techniques for soil erosion hotspot sub-watersheds.

Keywords: Hare watershed**,** SWAT**,** Sediment yield**,** Hotspot sub-watersheds**,** Intervention techniques

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Evaluating Teacher Education Materials for Effective Reading Pedagogy: Curricular Responses to Early-Grade Reading Instruction

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Abstract

The suitability of teaching resources for college students was the main emphasis of this study, which examined curricular responses to early-grade reading (EGR) instruction. The US National Reading Panel served as the theoretical basis for the study's evaluation of reading materials. The College English Language Teaching Methods II module, which includes lessons on teaching EGR, was the subject of the analysis. Using the reading curriculum evaluation checklist, the study gathered data through the directed qualitative content analysis approach. Six teacher educators were also interviewed in semi-structured interviews to learn more about their opinions of the course material's efficacy in preparing student teachers to teach reading instruction to younger grades. The data was analyzed using the content analysis technique. The results showed that while the material did not place enough attention on the fundamentals of EGR, it did concentrate primarily on lower-level reading skills. The study thus emphasizes the content's narrow focus on giving student teachers the information and abilities necessary for teaching EGR. The results have practical consequences for how educators develop and modify teaching materials for EGR as well as theoretical implications for implementing the EGR material evaluation theory that the study used. It is advised that the materials should be supplemented with suitable and research-based exercises to enhance the educational value of classroom instruction.

Keywords: Content Analysis, Curricular Responses, Early-Grade Reading Instruction, Material Analysis, Qualitative Study

Frontiers in Epidemiology
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4 (2024)

Awareness and infection prevention practices of hepatitis B virus among informal caregivers in public hospitals of Addis Ababa, Ethiopia, 2024

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Abstract

Background: Hepatitis B virus (HBV) infection poses a significant global health challenge, leading to approximately 1.1 million deaths annually. Informal caregivers of HBV patients face an increased risk of exposure, yet there is limited research on their awareness and infection prevention practices. This study aimed to evaluate the awareness and practices regarding HBV among informal caregivers in public hospitals in Addis Ababa, Ethiopia, in 2024.

Methods: An institutional-based cross-sectional study was conducted from May 15 to July 15, 2024, involving 422 informal caregivers selected through a systematic random sampling. Data were collected using structured, interviewer-administered questionnaires that were pretested. The data were analyzed using SPSS version 26, with logistic regression identifying factors influencing awareness and practices, set at $p < 0.05$.

Results: Out of 414 surveyed caregivers (response rate: 98.1%), the mean age was 34.31 years (±12), with 63% female and 47.6% single. Only 24.9% (95% CI: 20.7–29.1%) showed good awareness, and merely 11.6% (95% CI: 8.5–14.7%) demonstrated good practices. Key factors associated with better awareness included caregivers' positive attitudes (AOR: 2.54) and patient functional levels (AOR: 1.9). Good practices were linked to higher education levels (AORs: 4.84 and 5.3), acute disease status (AOR: 3.6), and positive attitudes (AOR: 4.37).

Conclusions: The study reveals inadequate awareness and practices among informal caregivers compared to national averages. Awareness was linked to caregivers' attitudes and patient activity levels, while education, awareness, attitudes, and disease type significantly influenced good practices.

Keywords: hepatitis B virus, awareness, practice, informal caregivers, Addis Ababa, Ethiopia

Frontiers in Oncology
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14 (2024)

Spiritual well-being and associated factor among adult cancer patients in Hawassa University Comprehensive Specialized Hospital, Oncology Center, Hawassa, Ethiopia

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Abstract

Background: Spiritual well-being has been shown to boost resistance to mental health crises in cancer patients during the diagnosis and treatment process, but there is a paucity of studies about spirituality in cancer patients, which may make it difficult for healthcare clinicians to assess spirituality and provide spiritual care. Objective: The aim of this study was to assess the level of spiritual well-being and associated factors among cancer patients in HUCSH Oncology Center in 2022.

Methods and materials: An institution-based cross-sectional study was done from May 30 to June 30, 2022 among 267 cancer patients, and the respondents were selected by a simple random sampling technique. Data was collected by using standardized interviewer-administered questionnaires (FACIT sp12). Data was entered using Epi data version 4.6, and analysis was carried out by using Statistical Package for Social Science version 25. Bivariate and multivariate logistic regression was conducted to determine the relationship between the independent and dependent variables. The strength of association was tested by using p-value at 95% CI. Ethical clearance was obtained from the Institutional Review Board of Hawassa University College of Medicine and Health Science. During data collection, the purpose of the study was clearly explained to the patients, and consent was obtained.

Result: A total of 267 cancer patients were included in the study. There was 100% response rate. Majority of the patients (80.5%) were in a poor spiritual well-being state. Mental distress (AOR = 0.246; 95% CI: 0.114–0.531) and religious education (AOR = 1.288; 95% CI: 1.438–9.142) were factors significantly associated with spiritual well-being among cancer patients.

Conclusion and recommendation: This study showed that more than two-thirds of patients had poor spiritual well-being. Mental distress and religious education were factors associated with spiritual well-being. Attention should be given by nurses of the center for spiritual well-being assessment in clinical practices favoring holistic care in the center.

Keywords: spiritual well-being, cancer, mental distress, oncology center, Hawassa, Ethiopia

Applied Mathematics in Science and Engineering
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32 (2024)

Parameter uniform hybrid numerical method for time-dependent singularly perturbed parabolic differential equations with large delay

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Abstract

In this study, to solve the singularly perturbed delay convection–diffusion–reaction problem, we proposed a hybrid numerical scheme that converges uniformly. Parabolic right boundary layer outcomes from the presence of the small perturbation parameter. To grip this layer behaviour, the problem is solved by Bakhvalov–Shishkin mesh for spatial domain discretization and uniform mesh for temporal domain discretization. A hybrid scheme consisting of a non-polynomial spline scheme for fine mesh and a midpoint upwind scheme for coarse mesh is used to discretize the spatial derivative, while an implicit Euler scheme is used to discretize the time derivative. To make computed solutions more accurate and increase rate of convergence of the scheme, we applied Richardson extrapolation technique. The stability and convergence of the scheme are established. The scheme has a second order of convergence in the discrete supreme norm and is parametric uniformly convergent. The scheme's application is demonstrated through two test problems.

Keywords: Non-polynomial spline; Bakhvalov–Shishkin mesh; hybrid numerical scheme; parametric convergent; Richardson extrapolation

Clinical Optometry
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16 (2024)

Prevalence of Visual Impairment and Associated Factors Among Older Adults in Southern Ethiopia, 2022

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Abstract

Background: Visual impairment is a functional limitation of the eye brought on by a disorder or disease that can make it more difficult to carry out daily tasks. Visual impairment causes a wide range of public health, social, and economic issues, particularly in developing nations, where more than 90% of the world's visually impaired people reside. Although many studies conducted in Ethiopia related with the topic, there were focused on childhood visual impairments.

Objectives: To assess the prevalence and factors associated with visual impairment among older adults.

Methodology: A community-based cross-sectional study design was conducted in Arba Minch Zuria District. Systematic sampling technique was employed to select 655 adults aged 40 and above. Data were gathered through face-to-face interviews and visual acuity measurements, and SPSS version 25 was used for analysis. Bivariate and multivariate logistic regression analyses were performed to identify factors associated with visual impairment.

Results: The overall prevalence of visual impairment was found to be 36.95% (95% CI=33.2–40.8%). Factors associated with a higher odds of visual impairment included aged 51–60 years (AOR=2.37,95%CI=1.29–4.44), aged 61 and above (AOR=8.9, 95% CI=4.86–16.3), low wealth index ((AOR=1.81, 95%CI: 1.14–3.2), divorced and widowed (AOR=4.67, 95%CI:2.77–7.86), no formal education (AOR=14.28, 95%CI: 2.82–71.46), not utilizing eyeglass (AOR=3.94, 95%CI (1.65–9.40). The most possible causes of visual impairment were found to be refractive error and cataract.

Conclusions and Recommendations: The prevalence of visual impairment among study population was relatively high, and more than three-fifths of participants had unilateral visual impairment. Age, marital status, occupation, educational status, wealth index, and not wearing of prescribed eyeglasses were significantly associated with visual impairment. Refractive error is the leading cause of visual impairment. Awareness of spectacle use and expanding cataract surgery coverage are urgently needed in this area.

Keywords: older adults, eyevisual system, visual impairment

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526 LNCE (2024)

Hydrogeology-Induced Retrogressive Slope Toe Failure Initiation: A Coupled Physical and Numerical Modeling Approach

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Abstract

The conceptual premise of the current study is that the chronological effect of geologic parameters and hydrologic variation has been enhancing the toe slope since then, and hence the natural slope has remained stable. To capture the phenomenon, in addition to an intensive literature review and the subsequent findings and rationales, comprehensive laboratory testing, physical flume experiments, and numerical modeling were performed. The flume experiments were extensively instrumented (pore pressure transducers, suction sensors, strain transducers, and tracer chemicals) to observe the retrogressive failure mechanism. The results show that the abrupt change in slope toe stress caused by an increase in slope angle, rise in pore water pressure, and dissipation of soil suction were responsible for radical change in strain and sudden failure. Findings show that the slope toe section was the spot of failure initiation and was subjected to sudden failure associated with accelerated retrogressions. Physical flume assessment and numerical simulations both show that modifying the slope toe could increase overall slope stability. Hence, slope toe contributes far more to slope stability than previously thought. Even though the soil type range and slope angle at which the retrogressive failure occurs remain a source of considerable ambiguity, proper slope toe treatment can be regarded as a critical remedy measure.

Keywords: Hydrogeology**,** Retrogressive Failure**,** Slope Toe**,** Stress**,** Flume Experiment**,** Soil Suction

Environmental Earth Sciences
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83 (2024)

Integrated impact of land use/cover and topography on hydrological extremes in the Baro River Basin

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Abstract

Hydrological extremes can be influenced by climatic inputs (e.g., rainfall), but are controlled by topographical and anthropogenic factors. Note that the combined effect of topography and land use/cover on hydrological extremes is not fully explored and requires further research. This study considered five watersheds in the Baro River basin with varying topographic and land use/cover combinations to investigate the integrated impacts of topography and land use/cover on the hydrological extremes. The selected watersheds were classified as forest-dominated (i.e., Uka, Sor, and Gumero watersheds) and agriculturally dominated (i.e., Meti and Keto watersheds), as well as flat-to-gently sloped watersheds (Uka and Gumero) and moderate-to-sloped watersheds (Sor, Meti, and Keto). Google Earth Engine (GEE) was used to analyze the land-use/land-cover change from 1990 to 2018, and the topographical variables were quantified using the GIS tool. Finally, the elasticity approach was used to estimate the sensitivity of low and peak flow to the individual and combined impacts of land use/cover and topography. Generally, the results revealed that both low and peak flows were more sensitive to sloped watersheds with forest land-cover types, with elasticities of 0–2.6% for low flow and 0–4.6% for peak flow, respectively.

Keywords: Topographic wetness index**,** Aspect**,** Slope**,** Land use/cover**,** Peak flow**,** Low flow

Operations Research and Decisions
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34 (2024)

Dynamic vehicle parking pricing. A review

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Abstract

Dynamic parking pricing refers to the adjustment of the price of parking to achieve the required occupancy rates. It plays a significant role in parking management systems to minimize traffic congestion and cruising time, as well as to maximize revenue. The optimization of parking pricing and supply through a time-varying pricing strategy is a crucial issue. This paper reviews academic work on approaches to parking pricing, giving emphasis to time-varying pricing strategies. Approaches based on game theory, dynamic and stochastic control, multiobjective and multilevel programming, queuing theory, artificial intelligence, statistics, among others, are reviewed. We categorize these techniques to examine various issues of dynamic parking pricing. The main contributions and methods used are summarized. Furthermore, a brief discussion of the strengths, limitations, and possible future work is given.

Keywords: parking pricing, dynamic pricing, parking management, optimization

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Optimal management of a prey-predator system in a polluted environment with effort shared between pollution reduction and harvesting

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Abstract

This paper is concerned with the optimal management of a prey-predator system in a polluted environment with effort allocated between pollution reduction and prey harvesting. The growth rates of species and, consequently, the economic gain from the resources are impacted by the pollutants released from external sources (such as in- dustrial wastes). We assume that both the prey and predator populations have economic value. While revenue due to the prey comes from it's harvesting, it is from tourism that the revenue due to the predator is realised. The aim is to determine the optimal alloca- tion of the total effort capacity between harvesting and pollution reduction to maximize the revenue. First, we study the qualitative behavior of the dynamical system and its de- pendence on the control parameter viz., effort, followed by an application of Pontryagin's maximum principle to solve an optimal harvesting problem. The results indicate that the system has three possible equilibrium solutions whose existence and stability heavily depend on the level of effort allocation made between harvesting and pollution reduc- tion. It underlines that the effort allocation plays vital role in determining the eventual state of the system viz., permanence or extinction of the species. The result also shows that the optimal harvesting policy under pollution reduction efforts (as compared to one under no pollution reduction) calls for employing a lower level of optimal effort, resulting in higher resource stock levels and increased income. On the other hand, when the stock benefft of the predator rises, the optimal harvest effort falls, leading to increased stock levels in both the species.

Keywords: Prey-predator, pollution, optimal harvesting, stock benefit, pollution-reduction

Advances in Meteorology
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Power Data Access Viewer-Based Meteorological Drought Analysis and Rainfall Variability in the Nile River Basin

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Abstract

Meteorological drought poses a frequent challenge in the Nile River basin, yet its comprehensive evaluation across the basin has been hindered by insufficient recorded rainfall data. Common indices like the standard precipitation index, coefficients of variation, and precipitation concentration index serve as pivotal tools in gauging drought severity. This research aimed to assess the meteorological drought status in the Nile River basin by using the Power Data Access Viewer product rainfall data. Bias correction procedures were implemented to refine the monthly rainfall data for Bahirdar, Markos, Nekemt, and Muger stations, resulting in notable improvements in the coefficient of determination (R2) that were increased from 0.74 to 0.93, 0.72 to 0.89, 0.71 to 0.96, and 0.69 to 0.84, respectively. The average spatial distribution of drought in the Nile basin was classified as extremely wet (3.81%), severely wet (9.01%), moderately wet (7.36%), near normal (9.97%), moderately drought (21.20%), severely drought (17.11%), and extremely drought (31.54%). Approximately 10.33% of the Nile River basin was situated in regions characterized by high rainfall variability, while around 21.17% was located in areas with a notably irregular precipitation concentration index. Overall, this study sheds light on the prevailing meteorological drought patterns in the Nile River basin, emphasizing the significance of understanding and managing these phenomena for the sustainable development of the region.

Frontiers in Microbiology
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Padina boergesenii mediated synthesis of Se-ZnO bimetallic nanoparticles for effective anticancer activity

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Abstract

Introduction: Evaluating the anticancer property of Padina boergesenii mediated bimetallic nanoparticles.
Methods: The present study focuses on synthesizing Se-ZnO bimetallic nanoparticles from an aqueous algal extract of brown algae Padina boergesenii. Synthesized Se-ZnO NPs were characterized by UV, FTIR, SEM-EDS and HRTEM for confirmation along with the anticancer activity by MTT assay.
Results: The UV gave an absorbance peak at 342 and 370 nm, and the FTIR showed functional groups involved in synthesizing Se-ZnO NPs. The TEM micrographs indicated the crystalline nature and confirmed the size of the Se-ZnO NPs to be at an average size of 26.14 nm. Anticancer efficacy against the MCF-7 breast and HepG2 (hepatoblastoma) cell lines were also demonstrated, attaining an IC50 value of 67.9 µg and 74.9 µg/ml respectively, which caused 50% cell death. **Discussion:** This work aims to highlight an effective method for delivering bioactive compounds extracted from brown algae and emphasize its future therapeutic prospects. The potential of Selenium-Zinc oxide nanoparticles is of great interest due to the biocompatibility and low toxicity aspects of selenium combined with the cost-effectiveness and sustainability of zinc metal. The presence of bioactive compounds contributed to the stability of the nanoparticles and acted as capping properties.

Keywords: Padina boergesenii, green synthesis, Se-ZnO nanoparticles, anticancer, hepatoblastoma cell lines, MCF7 breast cancer cell line

Frontiers in Public Health
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Prevalence of pulmonary hypertension and its associated factors among chronic obstructive pulmonary diseases patients at public hospitals of Addis Ababa, Ethiopia, 2024: a facility-based cross-sectional study

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Abstract

Background: Pulmonary hypertension (PH) is a serious medical condition characterized by elevated pressure in the lung blood vessels, with chronic heart and lung diseases being the most common causes worldwide. However, there is a dearth of studies on the prevalence of pulmonary hypertension and its associated factors among chronic obstructive pulmonary disease (COPD) patients in Ethiopia and the study area. Objective: This study aimed to assess the prevalence of pulmonary hypertension and its associated factors among patients with chronic obstructive pulmonary disease at public hospitals in Addis Ababa, Ethiopia, 2024. Methods: A facility-based cross-sectional study involving 422 COPD patients charted in Addis Ababa town, Ethiopia from May – June 2024 was conducted. Respondents' records were chosen using simple random numbers. Structured, and pretested questionnaires, were used to collect data. The data were coded and entered into EpiData 3.1 before being exported to SPSS version 25 for analysis. Logistic regression was employed to identify factors influencing the prevalence of pulmonary hypertension. Statistical significance was set at $p < 0.05$ with a 95% confidence interval. Results: The study found the prevalence of pulmonary hypertension was 52% (95% CI: 49, 54.4%). Aged above 55 years [Adjusted Odds Ratio (AOR): 2.45 (1.55–3.9), Being male (AOR): 2.5 (1.5–4.1)]. Furthermore, having a history of alcohol [(AOR): 5.5 (2.4–13)], a history of smoking [(AOR): 4.6 (2.7–7.8), and congestive heart failure (AOR): 2.65 (1.5–4.6)], all increase the likelihood of pulmonary hypertension. Conclusion: The study revealed a higher prevalence of pulmonary hypertension among COPD patients. Significant associations were found with being male, belonging to an older age group, and having a history of alcohol use, smoking, and congestive heart disease. Implementing screening programs, smoking cessation programs, educational initiatives, and counseling patients on lifestyle modifications were recommended.

Keywords: pulmonary hypertension, chronic obstructive pulmonary disease, adults, Addis Ababa, Ethiopia

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Nutrtional and Phytochemical Characterstics of Fruits and Vegetable Wastes as Livestock Feed: A Case Study in Gamo Zone, Southern Ethiopia

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Abstract

Fruit and vegetable producers were creating a large amount of waste in homes, cafeterias, and agroprocessing units. The majority of this waste is composted and disposed in landfills and waterways. Recycling these wastes as animal feedstuffs will lessen food-feed competition and minimize environmental hazards. This study was carried out in the Gamo zone of southern Ethiopia, in the heart of the southern rift valley, to ascertain the nutritional profiles of fruit and vegetable by-products in relation to livestock feed potentials. All fruit and vegetable waste (FVW) samples were collected from homes, marketing facilities, restaurants, and waste disposal facilities. Proximate, detergent fiber component, minerals, and antinutritional factors were among the analyses performed on the collected samples. The results showed that, highest CP values recorded from banana leaf, 15.8 ± 0.8 (%DM) followed by avocado peel (14 ± 0.8) among fruit by-products and that of highest values of vegetable components were obtained from Moringa oleifera strip (20.6 ± 1.25) sweet potato (18.5 ± 1.55), respectively. The highest ME (MJ/kg DM) contents obtained from avocado and mango by-products among fruit wastes, while that of highest values recorded for cassava and potato peel (12.2 ± 0.4) and (11.3 ± 0.1) among vegetable components, respectively. The antinutrients included in FVW, namely, tannin, oxalate, and phytate, did not exceed the maximum permissible level for animal needs, which is less than 5% of DM. The macro- and micromineral profiles of these by-products also show encouraging results that contribute to maintaining the mineral needs of farm animals. FVW can be a viable and alternative source of supplemental feed for farm animals that primarily rely on low-quality natural pasture and crop residues, and can partially replace more expensive feedstuffs and their efficient reuse would minimize environmental impacts associated with the disposal of such wastes.

Keywords: antinutritional factors; food-feed competition; fruit and vegetable waste; macromineral; micromineral

Environmental Science: Water Research and Technology
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10 (2024)

Environmentally friendly TDS removal from waste water by electrochemical ion exchange batch-type recirculation (EIR) technique

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Abstract

The increasing prevalence of total dissolved solids (TDS), Cl−, SO42−, total suspended solids (TSS), BOD and COD in industrial effluent necessitates pioneering electrochemical approaches for their efficient removal. Synthetic industrial wastewater (SWW) and tannery industrial processing wastewater (TWW) were collected, and studies were performed to explore the synergistic optimization of the current density (CD), anolyte, and cathode compartment effluent volume ratio selection to enhance TDS and other toxic effluent removal efficiencies, where the time did not exceed 8 h. The electrochemical ion exchange batch-type recirculation reactor (EIR) approach was examined with the help of ruthenium oxide-coated titanium (Ru2O/Ti) as the anode and stainless steel (SS) as the cathode, which were separated by a middle compartment. Utilizing a three-compartment setup as an electrochemical cell batch-type recirculation design, we investigated the impact of varying the current density on the TDS removal rate and power consumption. In these compartments, we have fixed an anion exchange membrane (AEM-NEOSEPTA) and a cationic exchange resin (CER-AMBERLITE IR 120), where SWW/TWW were allowed to recirculate during the operating time of the reactor. The SWW was treated at various current densities, including 20, 40, 60, 80 and 90 mA cm−2. The maximum removal of Cl− (93%), SO42− (93%), TSS (93%), TDS (93%), BOD5 (93%), and COD (93%) was achieved at a 1 : 2 volume ratio and an optimum low current density of 40 mA cm−2. Our findings reveal an optimal current density range, balancing the removal efficiency and energy consumption of 0.9682 kW h kg−1. These findings indicated that under optimized conditions, the maximum removal efficiencies of Cl−, SO42−, TSS, TDS, BOD5 and COD were 95%, 89%, 89%, 83%, 92% and 89%, respectively from TWW. The optimized system demonstrates superior efficiency in reducing TDS levels, highlighting the significance of parameter tuning in the electrochemical TDS removal process in tannery high saline effluent. This research contributes to the development of sustainable water treatment strategies by presenting a comprehensive approach for enhancing TDS removal through the systematic optimization of key operational parameters. The insights gained from this study will inform the design and implementation of electrochemical systems for TDS-laden effluent treatment, offering a practical pathway toward more efficient and environmentally conscious water remediation practices.

Advances in Meteorology
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Identifying the Moisture Sources in Different Seasons for Abaya-Chamo Basin of Southern Ethiopia Using Lagrangian Particle Dispersion Model

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Abstract

Understanding the sources of precipitation and their impacts is crucial for basin-wide water balance research. Previous research concentrated on the sources of moisture in Ethiopia. The southern part's moisture sources, however, were not investigated. The primary objective of this study is to trace the source of atmospheric moisture in the Abaya-Chamo sub-basin of southern Ethiopia using numerical water vapor tracers like Hybrid Single Particle Lagrangian Integrated Trajectory (HYSPLIT) model. Exploring the possible regions of atmospheric vapor roots and the path of moist air initiating rainfall that reaches the basin was feasible for the year 2018-2020. The anticyclone from the Arabian High, which is positioned in the Arabian and Mediterranean seas, was the primary source of moisture supply in the study area during the Belg (March to May) season, according to the back trajectory cluster analysis results. Additionally, the Indian Ocean adds moisture resulting from Mascarene highs brought by equatorial easterlies. Furthermore, during Kiremt (June to September), air masses from the Congo basin were the potential moisture source region for the study areas in combination with air masses originating from the Mascarene highs, located in the South Indian Ocean, and the St. Helena high, centered in the subtropical southern Atlantic Ocean. This study primarily focuses on the complex dynamics of atmospheric moisture sources around Abaya-Chamo sub-basin of southern Ethiopia, offering insight into seasonal fluctuations and contributing various components. These findings contribute to basin-specific water balance research by filling gaps in the previous studies.

Asian Dyer

https://www.researchgate.net/publication/378795386_Development_and_evaluation_of_hydrophobic_antimicrobial_face_mask_fabric#:~:text=Development%20and%20evaluation%20of%20hydrophobic,Authors%3A

21 (2024)

Development and evaluation of hydrophobic antimicrobial face mask fabric

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Abstract

Coronaviral disease (COVID-19) is an infectious disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)1 . It is spread from aerosols (tiny viral particles); we breathe in aerosols in crowded places and touch our faces inadvertently numerous times with potentially infected hands. Masks will protect against this and will be even more crucial when we ease the lockdown to prevent a resurgence of cases. The use of a face covering is recommended for those who suspect they have the virus and their caregivers2-5. Water repellency is the capability of a textile material resist the transfer of water. The tendency of a water droplet to spread out over the fabric surface mainly depends on the contact angle of the water droplet and the fabric surface. Water repellent textiles have many uses including clinical, industrial, consumer and general garment purpose11. Water repellency can be accomplished by employing a thin surface layer of water repellent chemical compounds on textile materials. Water repellency can be imparted by the modification of surface vitality of textiles with nominal changes on other functional properties

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Agronomic performances, yield and nutritional values of lupin grain varieties at Gircha research center, Gamo Highlands

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Abstract

Lupin is a multipurpose legume used for food and feed. However, its production is limited to the northern and northwest highlands of Ethiopia. It is important to evaluate productivity of different varieties in different locations of the country. Therefore, this experiment aimed to evaluate agronomic performances, yield and nutritional values of lupin grain varieties in Gamo Highlands, southern Ethiopia. The field experiment consisting of three treatments (varieties) with five replications arranged in randomized complete block design (RCBD). The experiment was carried out for two consecutive rainy seasons. Data on plant height, days to flowering, days to maturity, number of tillers and pods (plant-1), pod length, seeds per pod, grain yield and thousand grains mass (g) was collected. Plant height (cm) at maturity for sanabor variety (86) was significantly higher ($p < 0.05$) than plant height of the local (79.7) and vitabor (78.9) varieties. Days to flowering was significantly different ($p < 0.001$) between varieties. Number of tillers per plant was higher ($p < 0.05$) for sanabor (7.79) as compared to Vitabor (6.11) and local variety (4.74). Straw dry matter yield (t/h) of the local (4.06) and sanabor (3.85) varieties were higher than Vitabor (3.41). Grain yield (t/h) of 4.74, 4.08 and 3.75 were recorded for local, sanabor and Vitabor varieties. The cost benefit analysis indicated that growing sanabor variety has the highest net return and profitable. From the biomass perspective/feed value, growing the local variety is recommended.

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Modelling malaria vulnerability hotspot by using geospatial techniques: the case of Kindo Koysha Woreda, Wolaita Zone, Ethiopia

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Abstract

Malaria is a serious, acute disease spread by female Anopheles mosquito bites. Malaria is an epidemic in the Wolaita Zone, affecting 85% of the population despite the implementation of effective prevention and control measures in the area's public health services. The main objective of this study is to apply geospatial techniques to environmental, socioeconomic, and epidemiological parameters that increase certain conditions for malaria incidence to identify malaria vulnerability hotspots using a multi-criteria evaluation method. The malaria vulnerability hotspot map is identified by using AHP and the malaria hotspot identification algorithm. The findings show that the research area is 51% very high and highly vulnerable (224.14 km2), 26% moderate (116.560 km2) and 23% low vulnerable (103.600 km2). The western part of the area, which is near the Omo River and has low elevation, is highly vulnerable to malaria incidence. Reliable malaria vulnerability hotspot maps are critical for estimating the scope of the problem and, consequently, the resources required to combat malaria.

Keywords: Epidemiology; healthhazards; hotspot; malaria; environment

Frontiers in Veterinary Science
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11 (2024)

Hematological parameters of sheep and goats fed diets containing various amounts of water hyacinth (Eichhornia crassipes)

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Abstract

A major global barrier to increased animal output is nutrition. The use of aquatic plants, which were previously considered to be waste and needed a lot of labor to eliminate, has recently come to light due to the lack of feed during the dry season in the majority of tropical regions of Africa. The objectives of this study were therefore to see how different dietary Eichhornia crassipise inclusion rates affect the hematological indicators of Ethiopian Doyogena sheep and Woyto-Guji goats. Blood samples were taken from the jugular veins of 12 Doyogena sheep and 12 Woyto-Guji goats in a 2 × 4 randomized crossover design with two animal species, four diets, and four random periods (15 - day adaption period followed by a 7- day experimental diet in each period). The dietary inclusion rates E. crassipise were 0, 25, 50, and 75% that was used as a replacement for commercial concentrate mix diet in the treatment groups. The data was analyzed using the SAS software programme PROC GLM, and Pearson's correlation coefficient was calculated between hematological markers. The hemoglobin (Hb), red blood cell count (RBC), packed cell volume (PCV), mean corpuscular volume (MCH), and mean corpuscular hemoglobin (MCHC) results revealed substantial, RDW-SD, and WBC differences between animal species ($P < 0.001$). Sheep had greater WBC, Hb, RBC, PCV, RDW-SD, and RDW-CV levels, while goats had higher MCH and MCHC values ($P < 0.001$). For the analyzed hematological measures, the Pearson's correlation coefficient ranged from low to strong in terms of positive and negative associations ($P < 0.05$). Since all hematological indicators were closer to those of clinically healthy native Ethiopian sheep and goat breeds, feeding water hyacinth to sheep and goats up to a 75% inclusion level in diets without producing sickness may provide a remedy for adverse feed shortages.

Keywords: hematological indices, goat, nutrition, sheep, water hyacinth

Advances in Civil Engineering
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2024 (2024)

Estimation of Annual and Seasonal Groundwater Recharge by Using Wetspass-M and Chloride Mass-Balance Methods, Upper Bilate Catchment, Rifty Valley Basin, Ethiopia

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Abstract

A major global barrier to increased animal output is nutrition. The use of aquatic plants, which were previously considered to be waste and needed a lot of labor to eliminate, has recently come to light due to the lack of feed during the dry season in the majority of tropical regions of Africa. The objectives of this study were therefore to see how different dietary Eichhornia crassipise inclusion rates affect the hematological indicators of Ethiopian Doyogena sheep and Woyto-Guji goats. Blood samples were taken from the jugular veins of 12 Doyogena sheep and 12 Woyto-Guji goats in a 2 × 4 randomized crossover design with two animal species, four diets, and four random periods (15 - day adaption period followed by a 7- day experimental diet in each period). The dietary inclusion rates E. crassipise were 0, 25, 50, and 75% that was used as a replacement for commercial concentrate mix diet in the treatment groups. The data was analyzed using the SAS software programme PROC GLM, and Pearson's correlation coefficient was calculated between hematological markers. The hemoglobin (Hb), red blood cell count (RBC), packed cell volume (PCV), mean corpuscular volume (MCH), and mean corpuscular hemoglobin (MCHC) results revealed substantial, RDW-SD, and WBC differences between animal species ($P < 0.001$). Sheep had greater WBC, Hb, RBC, PCV, RDW-SD, and RDW-CV levels, while goats had higher MCH and MCHC values ($P < 0.001$). For the analyzed hematological measures, the Pearson's correlation coefficient ranged from low to strong in terms of positive and negative associations ($P < 0.05$). Since all hematological indicators were closer to those of clinically healthy native Ethiopian sheep and goat breeds, feeding water hyacinth to sheep and goats up to a 75% inclusion level in diets without producing sickness may provide a remedy for adverse feed shortages.

Keywords: CMB; groundwater recharge; season; water balance; wetSpass-m model

PeerJ
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12 (2024)

Spatiotemporal dynamics of land use land cover change and its drivers in the western part of Lake Abaya, Ethiopia

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Abstract

Understanding the dynamics of land use/land cover (LU/LC) changes and what drives these changes is essential for creating effective strategies for sustainable land management. It also helps to monitor the impact on ecosystems and biodiversity, which is crucial for policy-making. This study focused on assessing the trends, rates, and extent of LU/LC change and its causes in the western part of Lake Abaya in Ethiopia. To achieve this, we used a supervised classification method with a maximum-likelihood algorithm to map different land use land cover types. Additionally, we gathered information through field observations, focus group discussions (FGDs), and key informant interviews (KIIs) to identify the factors driving LU/LC change and its consequences between 1990 and 2022. The study findings revealed that vegetation and wetlands significantly decreased over this period, while water bodies, agricultural land, and settlements expanded at the expense of other land uses. The average normalized difference vegetation index (NDVI) values decreased from 0.368 in 1990 to 0.135 in 2022, indicating declining vegetation health. Local communities point to several factors responsible for these changes, including the expansion of agricultural land, increased settlement, firewood collection, and charcoal production (as proximate/immediate drivers), as well as population growth, poverty, unemployment, climate change, and policy-related issues (as underlying causes). Thus, it needs the development and implementation of an integrated and sustainable land management system, and strong land use and restoration policies in order to halt or reduce the rapid expansion of agricultural land and settlement areas at the expense of vegetation and wetlands.

Keywords: ArcGIS, Ethiopia, Lake Abaya, LU/LC, Rift Valley

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32 (2024)

Anticipating Soil Erosivity of Kulfo Watershed in the Southern Main Ethiopian Rift in Response to Changes in Land Use and Land Cover

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Abstract

This study evaluates the land use and land cover (LULC) dynamics that play an indispensable role in the degradation and deterioration of soil and water quality affecting the natural resources throughout the Kulfo watershed in Ethiopia. Directed image classification is initiated for satellite images to study the watershed. The image classification is categorized into ten different LULC classes with validation of ground control points. A Revised Universal Soil Loss Equation (RUSLE) model was used to generate the average soil loss of the watershed. The model involves the Rainfall Erosivity factor (R), Soil Erodibility factor (K), Length and Slope factor (LS), Cover Management factor (C), and Support Practice factor (P). The dynamics of LULC change and rainfall erosivity over the past 30 years have been interpreted using maps from 1990, 2005, and 2020 using the C-factor and R-factor. The remaining factors, like K-factor, LS-factor, and P-factor, were kept constant over the period. The results reveal that the average annual soil loss rate (A) of the watershed is estimated to be 138.8 t ha-1, 161.2 ha-1, and 173.25 t ha-1 per year, for the selected period intervals. During the past three decades, the soil loss rate in the watershed has increased by 34.4 t ha-1 per year. The watershed and sustainable soil and water conservation practices need special attention to mitigate the severity of soil erosion risks to avoid disaster.

Frontiers in Psychiatry
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Factors associated with perceived social support among adolescents in Gamo Zone, Southern Ethiopia: a community-based cross-sectional study

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Abstract

Introduction: Perceived social support plays a crucial role in adolescent development, health, well-being, and resilience. Understanding the factors associated with perceived social support among adolescents is essential for designing effective interventions. However, research in this area, particularly within specific contexts, remains limited. Therefore, this study aims to identify the factors associated with perceived social support among adolescents in the Gamo Zone, South Ethiopia Regional State.
Method: A community-based cross-sectional study was conducted, involving 1172 adolescents selected through a stratified multi-stage sampling method. Structured face-to-face interviews were employed for data collection. Summary statistics were utilized for data presentation. Multiple linear regressions were then performed to identify factors associated with perceived social support. The strength and direction of associations were presented using β coefficients and 95% confidence intervals (CIs). The level of statistical significance was set at alpha 5%.
Result: The total mean for perceived social support among adolescents was 57.02 ± 12.68. Adolescents living with their biological parents reported significantly higher levels of perceived social support (β = 4.17, 95% CI: 2.00 to 6.34) compared to their counterparts. Similarly, adolescents engaged in paid work within the last 12 months reported higher perceived social support (β = 3.43, 95% CI: 1.39 to 5.46). Higher levels of parental monitoring were also associated with increased perceived social support (β = 3.03, 95% CI: 1.23 to 4.82). Additionally, adolescents who perceived risks for sexual and reproductive health (SRH) problems reported higher levels of perceived social support (β = 2.76, 95% CI: 0.84 to 4.69). Moreover, adolescents with good knowledge about SRH rights exhibited increased perceived social support (β = 2.46, 95% CI: 0.89 to 4.02). Furthermore, adolescents residing in rural areas reported higher levels of perceived social support compared to those in urban areas (β = 1.56, 95% CI: 0.16 to 3.11). **Conclusion:** The findings of this study reveal that factors such as living arrangements, employment status, parental monitoring, perceived risks for SRH problems, knowledge about SRH rights, and geographical context emerged as important predictors of perceived social support. Therefore, implementing interventions and initiatives to address these identified factors holds promise for nurturing resilient adolescent social support networks.

Keywords: perceived social support, adolescents, cross-sectional study, community-based, mental well-being, Gamo Zone, Southern Ethiopia

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Knowledge towards health impacts of climate change among Amhara Sayint community, Northeastern Ethiopia

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Abstract

Purpose: This study aims to assess the knowledge of Amhara Sayint district community in Northeastern Ethiopia towards the health impacts of climate change.
Design/methodology/approach: A community-based cross-sectional study was conducted from 20 July to 5 September 2022, involving 605 randomly selected households in Amhara Sayint district, Northeastern Ethiopia. Data were collected through face-to-face interviews using a pilot-tested and content-validated questionnaire administered via Kobo Collect survey tool. The data were then exported to STATA for management and analysis. A proportional odds approach of ordinal logistic regression model was fitted with a 95% confidence level to identify factors associated with the community's knowledge towards the health impacts of climate change. **Findings:** Of the total respondents, 3.47% (95% confidence interval [CI]: 2.1, 5.3) and 42.98% (95% CI: 38.9, 47) had inadequate and medium levels of knowledge towards the health impacts of climate change, respectively. Proportional odds model analysis result indicated that gender (female) (adjusted odds ratio [AOR] = 1.49; 95% CI: 1.053, 2.13), wealth status (poorest) (AOR = 1.97; 95% CI: 1.01, 3.83), educational status (unable to read and write) (AOR = 4.13; 95% CI: 1.25, 13.68) and participation status in environmental protection activities (not) (AOR = 1.78; 95% CI: 1.17, 2.71) were factors that significantly associated with inadequate and medium levels of knowledge towards the health impacts of climate change.
Research limitations/implications: The result of this research is not supported by qualitative methods.
Practical implications: Residents of the study area know the climate is changing; however, they lack adequate knowledge towards the health impacts of climate change.
Social implications: Significant number of people have inadequate level of knowledge about health impacts of climate change so relevant health education is needed.
Originality/value: This research is original in its focus on assessing public knowledge about the health impacts of climate change in the Amhara Sayint district, northeastern Ethiopia, a perspective often overlooked in existing studies. Its findings are crucial for guiding future research and developing targeted public health strategies and educational initiatives.

Keywords: Climate change, Awareness, Proportional odds model, Amhara Sayint, Ethiopia

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4 (2024)

Intimate partner violence is independently associated with poor utilization of antenatal care in Arba Minch town, southern Ethiopia: A cross-sectional study

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Abstract

To ensure the best possible health conditions for both mother and fetus throughout pregnancy, skilled healthcare professionals provide antenatal care (ANC) to expectant mothers. Even though the introduction of antenatal care has reduced maternal mortality by 34% since 2002, some atypical behaviors, such as intimate partner violence, have had a significant impact on how often women seek out expert medical treatment during pregnancy. Hence, early identification of such risk factors is very important to decrease maternal mortality from preventable causes. To assess the prevalence and factors of intimate partner violence and associated factors among pregnant women at Arba Minch town, southern Ethiopia. An institution-based cross-sectional study was conducted among 403 mothers who were enrolled from December 1, 2022, to January 30, 2023. The total sample size was allocated proportionately to the number of women attending antenatal care at each public health facility. Thus, systematic sampling was applied. Kobo Toolbox was used for data collection and cleaning, which was then analyzed using IBM SPSS Version 26. Statistical significance was determined at a p-value of less than 0.05. In this study area, the prevalence of intimate partner violence among pregnant women was 35% (95% CI: 30.5–39). The associated factors of intimate partner violence were late initiation of antenatal care (AOR = 3.81, 95% CI: 1.7, 6.04), non-autonomous women (AOR = 1.8, 95% CI: 1.18, 3.14), inadequate antenatal utilization (AOR = 3.41, 95% CI: 1.8, 6.2), and a husband with an extra wife (AOR = 6.0, 95% CI: 4.2, 10.57).This study showed that more than one-third of pregnant women in this study area were facing intimate partner violence. Having extra wife, lack of women's autonomy, less antenatal care utilization and late initiation of antenatal care were associated with Intimate Partner Violence (IPV). Therefore, it is essential to greatly empower women and provide them significant prestige in the home.

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Malaria Prevalence and Risk Factors in Outpatients at Teda Health Center, Northwest Ethiopia: A Cross-Sectional Study

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Abstract

Background. Despite extensive efforts and achievements made in prevention and control, malaria is still a public health problem in Ethiopia. Currently, the case number has been climbing, even changing the epidemiology to the previously low-burden reporting locations. Therefore, our study is aimed at assessing malaria prevalence and associated risk factors in outpatients, Northwest Ethiopia.

Methods. A facility-based cross-sectional study was conducted among 318 malaria-suspected outpatients from October 22 to December 15, 2022, at Teda Health Center, Northwest Ethiopia. Sociodemographic characteristics and malaria risk factors were assessed by a face-To-face interview using a pretested questionnaire. Plasmodium parasites were detected by using microscopy on a blood film stained with 10% and 3% Giemsa stain. The data were analyzed using Statistical Package for Social Sciences software version 25, and statistical significance was reported at a p value < 0.05.

Results. Of the 318 study participants, 124 (39.0%; 95%CI=33.6%-44.6%) tested positive for Plasmodium infection. Plasmodium vivax, P. falciparum, and mixed infections were identified in 71 (57.3%), 47 (37.9%), and 6 (4.8%), respectively, among positive study participants. Individuals above the age of 15 (AOR=2.704, 95% CI 1.370-5.336) were more likely to be infected with Plasmodium than under-five-year-old individuals. Rural residents (AOR=2.56, 95% CI 1.281-5.098), those who sleep or work outside at night (AOR=1.99, 95% CI 1.020-3.875), and individuals who did not use long-lasting insecticide-Treated net (AOR=3.26, 95% CI 1.633-6.499) and had a family member with a history of malaria (AOR=2.902, 95%CI=1.671-5.041) had higher odds of acquiring Plasmodium infection than their counterparts.

Conclusion. In our study area, malaria was a major health problem, with P. vivax being the dominant species. Multiple environmental and behavioural factors were associated with the infection acquisition. Therefore, urgent holistic intervention is required.

Journal of Parasitology Research
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Health-Related Quality of Life Among Type 2 Diabetes Mellitus Patients Using the 36-Item Short Form Health Survey (SF-36) in Central Ethiopia: A Multicenter Study

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Abstract

Introduction: Diabetes, one of the major global health emergencies of the 21st century, can affect a patient's quality of life. A compromised quality of life has adverse effects on self-care practices, resulting in inadequate glycemic control and an increased susceptibility to complications. In Ethiopia, there is a paucity of information regarding the quality of life of patients with type 2 diabetes mellitus. Therefore, this study aimed to assess health-related quality of life in type 2 diabetes mellitus patients.

Methods: A cross-sectional study was conducted among type 2 diabetes mellitus patients attending diabetes follow-up clinics in selected public hospitals in Addis Ababa using short form-36 (SF-36) health survey measures. Descriptive statistics were used to summarize the characteristics of the study participants. Simple and multiple linear regressions were done to identify significantly associated factors with health-related quality of life.

Result: A total of 309 patients participated in this study. The mean scores of the physical and mental component summaries were 40.15 (SD = 7.27) and 48.11 (SD = 8.87), respectively. Being old, being overweight or obese, living with type 2 diabetes mellitus for more than fifteen years, taking combined medication, having diabetes-related complications, and having comorbidities were factors that reduced the mean score of the physical component summary (p-value<0.05). Being obese and diabetes related complication were factors that negatively affect mental component summary (p-value <0.05). On the other hand, being married was factors that positively affect mental component summary (p-value <0.05).

Conclusion: Older age, being married, obesity, overweight, longer duration of diabetes, using combined medications, diabetic-related complications, and co-morbidities were factors associated with health-related quality of life. Healthcare providers should strengthen counseling patients on lifestyle modifications such as diet modifications, and weight reduction.

Keywords: health-related quality of lifetype 2 diabetes mellitusshort-form-36 health survey

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Factors associated with dietary patterns (DPS) and nutritional status among pregnant women in AM-HDSS, South Ethiopia

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Abstract

Background: Malnutrition during pregnancy increases the risk of chronic illness later in life and adverse birth outcomes in subsequent generations. In this regard, consumption of diets rich in adequate energy, protein, vitamins, and minerals from a variety of foods is essential. Evidence on the status of maternal dietary pattern is very crucial. Hence, the aim of this study was to assess factors associated with dietary patterns and nutritional status of pregnant women in South Ethiopia.

Methods: A community-based cross-sectional study was conducted among 638 randomly selected pregnant women using a validated, a pre-tested, contextualized food frequency questionnaire using interviewer-administered structured questionnaire by digital open-source toolkit. Principal component factor analysis was employed to determine dietary patterns. Bivariable and multivariable ordinal logistic regression analyses were used to identify factors associated with dietary patterns and nutritional status, using STATA version 16.

Result: The dietary habits of pregnant women were best explained by three distinct dietary patterns. Urban dwellers (AOR = 2.18; 95% CI: 1.33, 3.59), from high socio-economic status (AOR = 2.43; 95% CI: 1.68, 3.51), from middle socio-economic status (AOR = 1.72; 95% CI: 1.19, 2.48), primigravida mothers (AOR = 1.72; 95% CI: 1.07, 2.78), and multigravida mothers (AOR = 2.08; 95% CI: 1.39, 3.10) were high likelihood to consume the highest tercile of "Cereals-Pulses and Dairy" compared to rural dwellers, from low socio-economic status and grand multigravida, respectively. Attending formal education (AOR = 1.60; 95% CI: 1.02, 2.51), from higher socioeconomic status (AOR = 1.56; 95% CI: 1.02, 2.38), not having food aversion (AOR = 1.98; 95% CI: 1.16, 3.39), and had good dietary knowledge (AOR = 2.16; 95% CI: 1.08, 4.32) were associated with a higher tercile consumption of "Nutrient-Dense" food compared to those without formal education, having food aversion and had poor dietary knowledge, respectively. Not attending formal education (AOR = 2.22; 95% CI: 1.48, 3.36), had decision-making autonomy (AOR = 1.91; 95% CI: 1.26, 2.90), and had good dietary knowledge (AOR = 1.86; 95% CI: 1.13, 3.08) were found to consume the highest tercile of "Leafy local food" compared to their counterpart. Consumption of lower terciles "Nutrient-Dense" food (AOR = 1.63; 95% CI: 1.07, 2.47) and "Leafy local food" (AOR = 2.32; 95% CI: 1.54, 3.51) were found to be factors associated with under nutrition during pregnancy.

Conclusion: Three distinct dietary patterns were identified. Factors associated with these major dietary patterns included place of residence, socio-economic status, educational level, dietary knowledge, food aversion, number of pregnancies, and maternal decision-making autonomy. Under nutrition among pregnant women was found to be high and associated with the consumption of 'Nutrient-Dense' and 'Leafy local' foods. Therefore, concerned health authorities should strengthen dietary counseling during pregnancy, provide family planning services, and promote women's education.

Keywords: associated factor, dietary patterns, dietary practice, nutritional status, pregnant women

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23 (2024)

Assessing the impacts of climate change on streamflow in the upper Omo Gibe basin of Southwest Ethiopia using MIKE NAM

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Abstract

Climate change affecting the rainfall-runoff processes in the upper Omo Gibe River basin was articulated using bias-corrected ensemble simulations of the CORDEX-Africa under RCP4.5 and RCP8.5 climatic scenarios. CMhyd was used to downscale the ensembles statistically followed by bias-adjustment using distribution mapping. MIKE NAM model was used (1980-2005) to project streamflow for three time periods; the near future (2023-2048), the middle future (2049-2074), and the far future (2075-2100). The average temperature of the basin will rise by 1.59°C and 2.56°C, respectively, under RCP4.5 and RCP8.5, respectively, while, the precipitation for wet and dry seasons decreases by 7.97% and 23.67%, respectively. MIKE NAM has demonstrated a strong correlation between simulated and observed runoff with coefficients of determination (R2) and NSE of more than 0.75. It has been predicted that the mean dry season, wet season, and annual streamflow will decline by 15-27%, 4-13%, and 8-24%, respectively. Intricate study of climate change followed by judicious and timely precautionary measures if not taken today, will decrease in streamflow and put negative consequences on long-term irrigation and hydropower development in the river catchment of upper Omo Gibe basin.

Keywords: Climate changestreamflowCORDEX-AfricaRCP scenarioMIKE NAM model

Frontiers in Reproductive Health
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6 (2024)

Adolescent utilization of sexual and reproductive health services in Gamo Zone, Southern Ethiopia. Insights from multilevel and latent class analysis

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Abstract

Introduction: Adolescents face unique challenges related to their sexual and reproductive health (SRH), with access to timely services being critical for positive outcomes. However, SRH service utilization among adolescents remains low. This study aimed to identify factors influencing SRH service use among adolescents in Gamo Zone, Ethiopia.
Methods: A community-based cross-sectional study involved 1172 adolescents selected through stratified sampling. Structured face-to-face interviews were employed for data collection. Multilevel mixed logistic regression was fitted to identify factors and latent class analysis was conducted to understand population heterogeneity.
Results: The findings of this study reveal that 198 (16.89%) adolescents (95% CI: 14.8%-19.2%) utilized SRH services within the past 12 months. Factors significantly associated with SRH service utilization included good knowledge about SRH rights (AOR = 4.65; 95% CI: 2.68, 8.07), belonging to one-parent families (AOR = 4.13; 95% CI: 2.39, 7.12), engaging in parental discussions regarding SRH issues (AOR = 3.17; 95% CI: 1.89, 5.29), high family support (AOR = 1.96; 95% CI: 1.09, 3.51), and enrolling in school (AOR = 0.19; 95% CI: 0.11, 0.33). Additionally, access to social media was associated with increased SRH service utilization among adolescents (AOR = 1.98; 95% CI: 1.25, 3.15). Latent class analysis identified four groups: rural school-enrolled adolescents living with parents, urban school-enrolled adolescents with both parents, urban disadvantaged female adolescents, and early adolescents with limited social media access.
Conclusions: In conclusion, our study sheds light on the utilization of SRH services among adolescents, revealing that 16.89% of the participants accessed these services within the past year. Significant factors associated with SRH service utilization included good knowledge about SRH rights, belonging to one-parent families, engaging in parental discussions regarding SRH issues, high family support, and enrollment in school. Interestingly, access to social media was also linked to increased utilization of SRH services among adolescents. Furthermore, our latent class analysis identified four distinct classes of adolescents based on socio-demographic indicators, highlighting the heterogeneity within this population. These findings underscore the importance of tailored interventions and targeted approaches to address the diverse needs of adolescents in accessing and utilizing SRH services. 2024 Sidamo, Abebe Kerbo, Gidebo and Wado.

Keywords: adolescent health, sexual and reproductive health services, utilization, multilevel analysis, latent class analysis, health services access, Gamo Zone, Southern Ethiopia

Frontiers in Psychiatry
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Prevalence of postpartum post-traumatic stress disorder and associated factors among postnatal mothers in West Arsi zone, South West Ethiopia, 2024: a community-based cross-sectional study

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Abstract

Background: Up to one-third of women globally experience giving birth as traumatic, which can lead to postpartum post-traumatic stress disorder. Postpartum post-traumatic stress disorders have significant health consequences for the mother, child, and other family members. Although it has tragic health impacts, little is known about this problem in the study area. Objectives: The study aimed to assess the prevalence of postpartum posttraumatic stress disorder and associated factors among postnatal mothers. Methods: A community-based cross-sectional study was employed among 635 mothers in the first year after childbirth by using simple random sampling techniques from March 20 to April 20, 2024 in West Arsi zone, Ethiopia. Face-to-face interviewers administered structured questionnaires that were used to collect the data. The collected data were cleaned, coded, and entered into Epidata and exported to Statistical Package for Social Sciences for further analysis. Both bivariate and multivariable analyses were done by using binary logistic regression. Result: Out of 635, 624 postnatal mothers participated in the study, for a response rate of 98.27%. The prevalence of postpartum post-traumatic stress disorder was 21.60% (95% CI: 18.40%, 24.87%). Primiparous mothers (AOR = 2.26, 95% CI: 1.38, 3.70), have no antenatal care follow-up (AOR = 2.48, 95% CI: 1.47, 4.20), cesarean section delivery (AOR = 2.86, 95% CI: 1.50, 5.61), instrumental delivery (AOR = 3.06, 95% CI: 1.75, 5.34), maternal morbidity (AOR = 2.94, 95% CI: 1.71, 5.05), and postpartum intimate partner violence (AOR = 7.43, 95% CI: 4.53, 12.20) were the identified factors. Conclusion and recommendation: As identified, one out of five mothers had postpartum posttraumatic stress disorder. Thus, healthcare providers should focus on identified factors like cesarean section and instrumental deliveries while counseling, as this enhances the mothers' psychological readiness. In addition, the West Arsi Zonal Health Office should develop effective strategies to alleviate the problem by focusing on the identified factors.

Keywords: posttraumatic stress disorder, postpartum, mothers, West Arsi, Ethiopia

Nonlinear Studies
https://www.researchgate.net/publication/390231581_Existence_of_solutions_for_Nonlinear_Caputo-Fabrizio_fractional_differential_equations
31 (2024)

Existence of solutions for Nonlinear Caputo-Fabrizio fractional differential equations

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Abstract

We examine the solution to a nonlinear fractional differential equation in this research work that involves the Caputo-Fabrizio fractional derivatives. We extend our analysis to the Caputo-Fabrizio fractional derivative in a coupled system of nonlinear fractional differential equations. We use the Banach contraction principle, Schauder's fixed point theorem, and Babenko's approach to get the intended results. Furthermore, we provide the required conditions and inequalities, based on the Lipschitz hypothesis, to show that solutions to our problem exist and are unique. We provide three instances to further support our primary findings.

Keywords: Nonlinear Caputo-Fabrizio fractional equations; Method of Babenko's; Schauder's fixed point theorem; Banach's contraction principle; existence and uniqueness of solution.

Frontiers in Public Health
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Practice of key essential nutrition action messages and associated factors among mothers of children aged six months to two years old in Karat town, Konso zone, South Ethiopia, 2024: a community-based cross-sectional study

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Abstract

Background: Key essential nutrition actions (ENA) messages are a comprehensive and evidence-based nutritional package designed to improve the nutritional status during the critical first 1,000 days of life. The poor practice of ENA contributes significantly to mortality and morbidity related to malnutrition in young children. However, there is a dearth of studies focusing on the practice of key ENA messages among mothers and the factors associated with their practice. Therefore, this study aimed to assess the practice of key ENA messages among mothers of children aged 6 months to 2 years in Karat town, Konso zone, South Ethiopia in 2024.

Methods: A community-based cross-sectional study involving 421 mothers of children aged 6 months to 2 years was conducted in Karat town, Konso zone, South Ethiopia from January 15 to February 29, 2024. Respondents were chosen using computer-generated random numbers. A structured, pretested, and interviewer-administered questionnaire was used to collect data. Following coding and entry into EpiData 3.1, the data were exported to SPSS version 25 for analysis. Logistic regression (bivariate and multivariable) was employed to identify factors influencing mothers' practice of key ENA messages, and statistical significance was set at $p < 0.05$ with a 95% confidence interval.

Results: The study found that 47.6% (95% CI: 42.8, 52.42%) of mothers demonstrated good practices. Having secondary education or higher, institutional delivery, receiving nutritional counseling during antenatal care (ANC), receipt of postnatal care (PNC) services, having good knowledge, and having a good attitude towards ENA all increase the likelihood of good practice.

Conclusion: This study emphasizes the need for multifaceted interventions to improve ENA practice among mothers residing in Karat town. To effectively address this issue, it is crucial to implement targeted education programs, strengthen postnatal care services, and nutritional counseling into routine antenatal care, promote institutional deliveries, and enhance awareness.

Keywords: essential nutrition action, practice, mothers, children, Konso zone, Ethiopia

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12 (2024)

Intimate partner violence and associated factors among married adolescent girls and young women in the pastoralist community of South Ethiopia: is intimate partner violence associated with cultural phenomena?

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Abstract

Background: Violence against women is a major public health problem that affects the physical, sexual, mental, and social wellbeing of more than one-third of all women worldwide. Hence the purpose of this study was to determine the prevalence of physical and sexual intimate partner violence (IPV) and associated factors among married adolescent girls and young women (AGYW) belonging to the pastoralist community of Dassenech district, South Omo Zone, South Ethiopia.

Methods: A community-based cross-sectional survey was conducted among married AGYW in the Dassenech district from March 1, 2022, to April 1, 2022. A multi-stage sampling technique was adopted to select 545 participants. The data were collected using pre-tested and standardized WHO multi-country study tools. A binary logistic regression model was fitted to identify the independent predictors of physical and sexual intimate partner violence. The adjusted odds ratio (AOR) with a 95% confidence interval (CI) was used to measure the effect size, and finally, a p-value<0.05 was considered statistically significant.

Results: The prevalence of physical IPV among AGYW belonging to the pastoralist community of Dassenech district was 44.1% (95% confidence interval (CI): 40%, 48%) and that of sexual IPV was 39.3% (95% CI: 35%, 43%). The husband only deciding for the household (AOR = 11.36; 95% CI: 6.97, 18.53), the father performing the Dimi cultural ceremony (AOR = 3.70; 95% CI: 2.22, 6.14), and frequent quarrels (AOR = 2.06; 95% CI: 1.07, 3.99) are significantly associated with physical IPV. Both partners drinking alcohol (AOR = 3.47; 95% CI: 1.94, 6.20), the husband only deciding for the household (AOR = 11.23; 95% CI: 6.91, 18.27), and frequent quarrels (AOR = 2.29; 95% CI: 1.15, 4.56) were factors significantly associated with sexual IPV.

Conclusion: Physical and sexual intimate partner violence is a significant public health problem in the study area. Therefore, interventional measures to change the attitude of cultural leaders, providing education to married men and women on risky sexual behavior, and empowering women need to be prioritized to prevent the occurrence of this problem.

Keywords: intimate partner violence, adolescent girls, young women, pastoralist community, South Ethiopia

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Association of Chronic Malnutrition, and Not Anemia, with Cognitive Development in Ethiopian Schoolchildren: A Cross-Sectional Study

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Abstract

This study assesses the associations between nutritional status and cognitive development of schoolchildren. A unit increase in height-for-age Z-score was associated with 0.12 SD, 0.08 SD and 0.12 SD increase in standardized digit span, Raven's colored progressive metrics, and performance index of visual search task, respectively. A unit increase in body-mass-index-for-age Z-score was associated with 0.11 SD increase in standardized digit span. Hemoglobin concentration was not associated with any of the cognitive outcomes. Chronic malnutrition was associated with cognitive development in schoolchildren while thinness and hemoglobin concentrations were associated with selected or no cognitive outcomes, respectively.

Keywords: Cognition, nutritional status, Schoolchildren

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Analysis and Optimization of Thermoplastic Polyurethane Infill Patterns for Additive Manufacturing in Pipeline Applications

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Abstract

Process parameter optimization and selection play a crucial role in additive manufacturing, particularly in determining the quality and characteristics of the final product. Among these parameters, the infill pattern holds significant importance as it directly influences the structural integrity, production time, and material usage efficiency of the printed object. This research focuses on identifying the most suitable 3D printing infill pattern process parameters for thermoplastic polyurethane (TPU) material, specifically for applications in pipeline construction. The criteria considered for process parameter selection include printing time, ultimate tensile strength, ultimate flexural strength, and surface defect minimization. Various infill patterns, including hexagonal, line, solid, triangle (35°), triangle (55°), and line patterns, are evaluated as alternatives. Utilizing the multi-criteria decision-making technique known as analytical hierarchy process (AHP), a systematic approach is employed to determine the optimal printing pattern. The findings of this study reveal that the hexagonal infill pattern outperforms other selected patterns in terms of meeting the criteria set forth for pipeline construction using TPU material. This research contributes to enhancing the efficiency and quality of additive manufacturing processes in pipeline applications, emphasizing the importance of informed parameter selection for achieving desired performance outcomes. © 2024 Benjamin Lazarus S. et al.

Keywords: analytical hierarchy process; hexagonal; line; material extrusion; pipeline application; printing pattern; solid infill; Triangle

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Factors associated with self-reported medical errors among undergraduate health science students in southern Ethiopia

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Abstract

Introduction: Medical errors are not uncommon, but they are seldom reported. Patient safety practices are among the key areas for service improvement. This study aimed to assess factors associated with self-reported medical errors among undergraduate health science students in southern Ethiopia.

Methods: A facility-based cross-sectional study was conducted among health science students of Arba Minch University in 2018. The sample size was calculated using a single population proportion formula. A total of 287 medical students in their fourth year and above, nursing and midwifery students in their second year and above, and other health science students in their third year and above were included.

Results: The majority (82.1, 95%CI: 77.63–86.67) of the study participants had a 'good' knowledge score on patient safety. Approximately 62.5% (95%CI: 56.8–68.2) of the participants had a 'favorable' patient safety attitude. Only 38.6% (95%CI: 32.8–44.3) of the study participants had 'good' patient safety practices. At adjusted analysis, the practical attachment unit, having ever managed a patient independently, having ever witnessed harm to patients by colleagues or other healthcare workers, and having ever witnessed harm to a close friend or family member were statistically significantly associated with self-reported medical errors. Participants who were doing their practical clinical attachment in the surgical and obstetric units were three times more likely to self-report medical errors as compared to those practicing in the pediatrics, internal medicine, and other units (AOR = 2.72, 95%CI: 1.16–6.39.97). Students who had never managed a patient independently were less likely to self-report medical error (AOR = 0.24, 95%CI: 0.08–0.72). The odds of self-reporting medical errors were less among among participants who had not ever witnessed harm to patients by colleagues or other healthcare workers (AOR = 0.12, 95%CI: 0.05–0.29) and participants who had not ever witnessed harm to a close friend or family member (AOR = 0.36, 95%CI: 0.16–0.80).

Conclusion: One in five of the participants reported having harmed patients while practicing. Most of the students had good patient safety knowledge, while approximately two-thirds of the participants had a favorable attitude toward patient safety. Only 38.6% of the study participants had good patient safety practices. Having worked in surgical and obstetrics units, having managed a patient independently, and having witnessed harm to a patient were associated with self-reporting of medical errors.

Keywords: patient safety, knowledge, attitude, practice, health science students, healthcare workers, medical errors, Ethiopia

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Prevalence of depressive symptoms and its associated factors among the aging population in Gamo zone, Southern Ethiopia: a community-based cross-sectional study

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Abstract

Background: Depression in the elderly is becoming a major public health problem worldwide. It is a major public health problem associated with increased morbidity, mortality, and healthcare costs in low- and middle-income countries, including Ethiopia. However, especially in developing countries, they usually go undetected and untreated. There is little evidence of depressive symptoms among older people in Ethiopia. Therefore, this study aims to determine the prevalence of depressive symptoms and associated factors among the elderly population in the Gamo zone of southern Ethiopia.

Methods: A community-based cross-sectional study was conducted among 840 randomly selected elderly individuals. A multi-stage sampling technique was employed to recruit participants. Depressive symptoms were assessed using the 15-item Geriatric Depression Scale (GDS) screening tool. Data collection was performed through face-to-face interviews. Descriptive statistics were initially computed. Subsequently, logistic regression analysis was conducted to identify independent factors associated with the outcome variable.

Result: The finding of the study showed that the prevalence of depressive symptoms among older people living in the Gamo zone was 424(50.48%) (95% CI=47.09-53.86). Age 70–74 years [AOR=2.81, 95% CI 1.64-4.81], 75 years and above [AOR=5.09, 95% CI 3.00-8.64], age 65–69 years [AOR=2.43, 95% CI 1.62-3.66]; being widowed [AOR=2.73, 95% CI 1.69-4.42], ever chewing khat [AOR=5.89, 95% CI 1.17-29.53], being poor economic status [AOR=9.35, 95% CI 3.58-24.45], being average economic status [AOR=5.36, 95% CI 2.15-13.37], having 1–2 stressful life events [AOR=5.13, 95% CI 3.35-7.86], having 3 and above stressful life events [AOR=11.02, 95% CI 6.59,18.41], living alone [AOR=2.65, 95% CI 1.43-4.93] and those who lived with children [AOR=3.16, 95% CI 1.70-5.88] were significantly associated with depression.

Conclusion: Half of the study participants exhibited depressive symptoms. Urgent interventions are essential to enhance psychological well-being and mitigate the impact of various modifiable risk factors associated with depression symptoms in elderly individuals. This includes increasing social support, particularly for those who have experienced stressful life events, live alone, or have low economic status. Healthcare providers should implement routine screening for depressive symptoms and offer supportive counseling. Policymakers and stakeholders should prioritize improving access to mental health services.

Keywords: depressive symptoms, associated factors, aging population, community based crosssectional, Gamo zone, Southern Ethiopia

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Antimicrobial, Antiradical Activity, and X-Ray Fluorescence Spectroscopy Analysis of Aloe otallensis Plant Used in Traditional Medicine in Southern Ethiopia

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Abstract

Medicinal plants have a long history of treating diseases in animals and humans in Ethiopia. Nevertheless, not enough research has been done on the antibacterial properties and possible bioactive components of the majority of medicinal plants. Therefore, this study was concerned with the evaluation of the percentage yield, phytochemical, antimicrobial, antifungal, MIC, antiradical activities, phenolic content, and X-ray fluorescence spectroscopy (XRF) analysis of A. otallensis plant extracts. The mean values of antimicrobial, antifungal, MIC, antiradical, phenolic content, and XRF analysis were reported as mean ± standard deviation. The solvent methanol showed a higher degree of yield in leaf and root extract which was 8.45 (22.27%) and 3.12 g (15.58%), respectively, while distilled water extract of leaf and root showed less degree of yield which was 0.22 g (1.10%) and 0.42 g (2.1%), respectively. Qualitative phytochemical analyses of the plant parts have revealed the presence of various components of metabolites like alkaloids, flavonoids, phenol, saponins, tannins, steroids, steroids, terpenoids, triterpenoids, glycosides, anthraquinones, diterpenes, phytosterols, and phlobatannals. A. otallensis gel extracts had shown significant antibacterial and antifungal activity against the test bacterial and fungus, respectively. Moreover, the methanolic gel extracts of A. otallensis demonstrated notable antiradical activity than the leaf and the root. The highest value of phenolic content was obtained in A. otallensis; gel, leaf, and root extract which was 61.9 ± 0.5 mg/g, 53.6 ± 0.3 mg/g, and 51.6 ± 0.6 mg/g, respectively. In this study, twelve elements in the plant parts of A. otallensis were determined using XRF spectroscopy. Overall, this research contributes to the understanding of the pharmacological potential of A. otallensis and highlights the importance of further research into its medicinal properties. The results provide valuable insights into the use of medicinal plants to treat diseases and support the development of natural therapeutics.

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How can solar panels collectors enhance energy efficiency? Utilization of the novel optimization techniques

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Abstract

Solar energy, which is widely acknowledged for its economic feasibility and sustainable nature, functions as a critical substitute for finite fossil fuels, effectively alleviating ecological consequences. The purpose of this study is to investigate the implementation of solar collectors as a means of harnessing the ample and unaltered solar radiation in Iran, specifically in locations situated within the solar belt. The incorporation of solar energy not only aids in the expansion of energy sources through diversification but also mitigates the rising expenses linked to fossil fuels. The preservation of natural resources, coupled with limited renewable energy options, further accentuates the importance of solar energy. The optimization of solar panel collector angles in photovoltaic systems assumes paramount importance for maximizing energy efficiency. This study, conducted in Yazd, Iran, utilized innovative mathematical and particle swarm optimization (PSO) models to assess ideal inclination angles. Results indicate peak solar energy absorption during June and July, contrasting with minimal absorption in January. The Klein model prescribes inclination angles based on γ values, while the PSO algorithm determines optimal slope and azimuth angles across various periods. Significant enhancements in energy generation, ranging from 23.24 to 25.02% across optimization models, were observed compared to a horizontal surface. These findings underscore the imperative of optimizing solar panel placement in urban settings to augment energy generation. Utilizing the optimal orientation for the photovoltaic power supply system can result in an annual reduction of 1169.6 kg of CO2 emissions in the building, emphasizing the positive environmental impact achievable through strategic solar panel configurations.

Keywords: solar panel; collector; novel optimization; energy efficiency; electricity production; CO2 emission

International Journal of Information Science and Management
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Intelligent Phishing Website Detection before and after Multiple Informative Feature Selection Techniques: Machine Learning Approach

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Abstract

Individuals and Organizations that rely on the Internet for communication, collaboration, and daily tasks regularly encounter security and privacy issues unless interventions of intelligent Cybersecurity defense systems have been made to counter them. The existing pieces of evidence reveal that phishing website attacks have drastically increased despite the scientific communities' best efforts to combat them. Based on the key research gaps explored, the study has made significant attempts to answer the following research questions: RQ#1: Which cross-validation techniques and model optimization parameters are appropriate for given datasets and classifiers? RQ#2: Which Classifier(s) yielded a superior Accuracy, F1-Score, AUC-ROC, and MCC value with acceptable train-test computational time before and after applying the Informative Feature Selection Techniques? RQ#3: What are the strengths and weaknesses of each Classifier after being applied with multiple Informative Feature Selection Techniques? RQ#4: Could the results of the top-performed Classifier and Informative Feature Selection Technique on Dataset one (DS-1) be consistent on Dataset two (DS-2)? The study used a Google Co-Lab environment and Python Code to conduct rigorous experiments. Our experimental findings reveal that the CAT-B Classifier demonstrated a superior phishing website detection performance in terms of (Accuracy, F1-Score, AUC-ROC, and MCC value with acceptable train-test computational time both before and after applying the UFS Feature Selection Technique by scoring 0.9764 accuracies, 0.9762 F1-Score, 0.996 AUC-ROC, and 0.9528 MCC Value with 6 Seconds train-test computational time. The study practically demonstrated implementing the CAT-B-UFS technique using a Python Code so that upcoming researchers can easily replicate their results and learn more. In future work, the study proposed implementing deep learning algorithms with proper feature selection techniques on Individual and Hybrid approaches to obtain more promising results.

Keywords: Machine Learning, Feature Selection Technique, Cat-Boost Classifier, Phishing

Cogent Social Sciences
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10 (2024)

The dynamics between soil erosion, nutrient variability, land use, topography, and implications for food security in Southern Ethiopia

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Abstract

Understanding the complex interplay between soil erosion, nutrient variability, land use and topography is crucial for sustainable agriculture. However, attempts to link these environmental factors with food security got less attention. This study examined the relationship between soil erosion, nutrient variation and the effects on food security in Gibe III dam area. Data were collected using structured questionnaire from 384 households, focus group discussion and Key informant interviews. A logit and food balance sheet models were employed for survey data analysis. Twenty-seven soil samples were taken from three land uses. Two-way Anova was used for statistical analysis of soil data. Results showed that 84% of the farmers perceived soil erosion. Food security had significantly associated with family size, extension services and slope at 5%. Food-secure and insecure households consumed 3102.922 and 1072.995 kcal on average, respectively. CEC was highest in grazing land (31 C mol kg−1) followed by forestland (26.4 C mol kg−1) and lowest in crop land (24.2 C mol kg−1). AP was highest (5.4 mg kg−1) in forest land followed by crop land (2.9 mg kg−1) while lowest (2 mg kg−1) in grazing land. The interaction effect of land use and slope on soil organic matter was significant [F(4, 18) = 93, p =.05], with partial eta squared of 0.95, total nitrogen [F(4, 18) = 47.4, p =.05] (partial eta squared = 0.91) and bulk density [F(4, 18)= 4.7, p =.05] (partial eta squared = 0.5). Sand varied in cropland (65.33%) followed by grazing land (62.67%) compared to forestland. Sustainable land use management should be implemented.

Keywords: Agriculture, Food security, Land use, Soil erosion, Soil management, topography

Air, Soil and Water Research
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Remote Sensing-Based Long-Term Assessment of Water Dynamics and Influencing Factors in Abaya and Chamo Lakes, East African Rift Valley, Ethiopia

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Abstract

Lakes are essential to global freshwater systems, supporting ecosystem services and ecological processes, but they are increasingly impacted by climate change and human activities. This study examined the long-term dynamics of Lakes Abaya and Chamo in the Ethiopian Rift Valley using Landsat images, altimetry-derived lake level data, and a machine learning method within Google Earth Engine, specifically a multi-index-based Random Forest (MIRF) classifier. The MIRF classifier achieved high accuracy, ranging from 97.58% to 99.13%, in extracting lake surface water. Substantial fluctuations in lake areas and lake levels were observed: Lake Abaya's area decreased from 2000 to 2005 at a rate of 6.67 km²/year, then expanded until 2022 at the same increasing rate; Lake Chamo's area decreased from 2000 to 2010 at a rate of 1.62 km²/year, then expanded until 2022 at a rate of 2.88 km²/year. The correlation analysis between lake areas and environmental factors such as Rainfall (RF), Temperature (TEMP), Normalized Difference Vegetation Index (NDVI), Groundwater Storage (GWS), Terrestrial Water Storage (TWS), and Soil Moisture (SM) revealed important associations. For Lake Abaya, strong correlations were identified with NDVI and TWS, suggesting that vegetation cover and terrestrial water significantly influence its area changes. In contrast, for Lake Chamo, NDVI emerged as the key driver, indicating that vegetation dynamics play a crucial role in the lake's fluctuations. Furthermore, higher-order polynomial regression models were developed to better capture the complex relationships between lake area and water levels for both lakes. In general, this study integrates remote sensing, machine learning, and cloud computing, offering valuable insights into the lakes' long-term characteristic and providing critical information for future water resource management strategies.

Keywords: Lake Abaya and Chamo, Ethiopia, East African rift valley, Google Earth Engine, Random Forest, lake water dynamics, Landsat image, remote sensing

Frontiers in Public Health
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From burnout to breakthrough: understanding the work-related stress-motivation Nexus in medical imaging professionals

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Abstract

Background: Work-related stress is a pervasive issue in the global occupational health landscape, ranking as the second-most common problem after low back pain. In Ethiopia, the healthcare sector is particularly affected by low staff motivation and stressed workers, which can significantly impact the functioning of health systems. However, when it comes to medical imaging professionals (MIPs), there is a lack of substantial evidence regarding the relationship between work-related stress and motivation. Therefore, this study aimed to address this gap by assessing the connection between work-related stress and motivation among medical imaging professionals in the study area.

Materials and methods: To assess the relationship between work-related stress and motivation among medical imaging professionals in Addis Ababa, a facility-based cross-sectional study was conducted. The study included a sample of 420 medical imaging professionals, who were randomly selected using a simple random sampling technique. The data collected from the participants were entered into Epi Data 3.1 and analyzed using STATA 14.2. Bivariable and multivariable analyses were performed to explore the associations between work-related stress and motivation, taking into account various factors. To determine statistical significance, a p-value of less than 0.05 was used as the threshold.

Results: This study found that 57.4% of the participants experienced workplace stress and 46.4% reported being motivated. We observed a negative relationship between work-related stress and job motivation. The findings indicated that sex (adjusted odds ratio (AOR) = 1.819, 95% confidence interval (CI): 1.125, 2.94), age (AOR = 0.186, 95% CI: 0.04, 0.78), radiation (AOR = 2.21, 95% CI: 1.377, 3.57), leadership (AOR = 2.54, 95% CI: 1.475, 4.385), financial incentives (AOR = 1.78, 95% CI: 1.052, 3.022), and profession category (AOR = 2.57, 95% CI: 1.006, 6.561) were significantly associated with workplace stress. In addition, profession category (AOR = 0.22, 95% CI: 0.78, 0.63), smoking (AOR = 0.262, 95% CI: 0.08, 0.77), permanent workplace (AOR = 4.321, 95% CI: 1.988, 9.39), monthly income (AOR = 4.589, 95% CI: 1.37, 15.288), and financial incentives (AOR = 3.39, CI: 2.093, 5.51) were significantly associated with job motivation.

Conclusion: Based on the results of the current study, it can be inferred that work-related stress is substantial, whereas job motivation is lacking among medical imaging professionals. The study found that several factors, including sex, age, radiation, leadership, financial incentives, and profession category, were significantly associated with workplace stress. In addition, factors such as profession, smoking, permanent workplace, monthly income, and financial incentives were found to be significantly associated with job motivation. Notably, a negative relationship was observed between work-related stress and motivation.

Keywords: motivation, medical, imaging, professionals, work, stress

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13 (2024)

Enhancing clean technology's dynamic cross technique using value chain

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Abstract

Numerous Indian economic sectors have been impacted by the COVID-19 epidemic, with many being forced to the verge of extinction. As a result, this essay analyses the importance of supply chains for grapes and the manufactured goods made from them, including beverages and currants, in a specific state that happens to be India's top grape-producing region. In order to identify the sites of rupture brought on by the pandemic and to recommend policy changes to create a resilient system, a value chain analysis is performed. Value chain management has emerged as one of the key strategies businesses use today to boost productivity and costs when they are up against greater rivalry in the marketplace, however, with several new challenges, such as concerns over security, environmental protection, compensation, and business accountability. According to the value chain study, the level of value addition for intermediary agents, such as pre-harvest contractors, has increased after COVID-19 at the expense of farmers. Various policy approaches are explained to enhance the grape value chain using the knowledge gained from Porter's value chain results and supply and demand shocks. Copyright

Keywords: fruit and vegetable cycle, system efficiency evaluation, fresh produce warehouse, innovative design, COVID-19

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Health-related quality of life and associated factors in heart failure with reduced ejection fraction patients at University of Gondar Hospital, Ethiopia

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Abstract

Introduction: Living with heart failure poses challenges due to its poor prognosis and impact on quality of life, making it crucial to assess how it affects patients for better patient-centered management. This study aimed to assess quality of life and associated factors in heart failure with reduced ejection fraction patients at University of Gondar Comprehensive Specialized Hospital in Ethiopia, 2023.

Methods: An "institution-based" cross-sectional study was conducted at the University of Gondar Comprehensive Specialised Hospital. The data were collected using an interviewer-administered questionnaire. Health-related quality of life was measured using the Minnesota Living with Heart Failure Questionnaire. Sociodemographic, behavioral, clinical, biochemical, and echocardiographic characteristics were included in the questionnaire. The collected data were entered into EpiData version 4.6 and exported into SPSS version 25 for analysis. Multiple linear regression analysis ($p < 0.05$) was used to measure the degree of association between quality of life and independent variables.

Results: A total of 240 patients with heart failure and reduced ejection fraction participated in the study. The health-related quality of life scores for the physical, emotional, and total were 17.60 ± 10.33, 10.58 ± 6.33 and 46.12 ± 26.06, respectively. Health-related quality of life was significantly associated with age, marital status, occupation, income, heart failure duration, recent hospitalization, New York Heart Association functional class, heart failure etiology, atrial fibrillation comorbidity, systolic blood pressure, heart rate, heart failure medications, severe left ventricular systolic dysfunction, and severe or moderate pulmonary hypertension.

Conclusion: This study found that patients with heart failure and reduced ejection fraction had poor health-related quality of life, influenced by identified factors. These findings aid professionals in assessing and identifying interventions that improve these patients' quality of life.

Keywords: quality of life, heart failure, reduced ejection fraction, associated factors, Ethiopia

Frontiers in Public Health
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Spatial mapping and predictors of ever-tested for HIV in adolescent girls and young women in Ethiopia

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Abstract

Background: Adolescent girls and young women (AGYW) are expected to be healthy in life. However, the unique health challenges faced by AGYW include unsafe sex practices and substance abuse. Only 46.3% of AGYW in Africa are aware of their HIV status, and difficulties are underlined in HIV testing among adolescents and young people. To demarcate the areas with low and high HIV testing, this study aimed to map predictors of ever-tested for HIV among adolescent girls and young women in Ethiopia.

Methods: Secondary data analysis was conducted using the dataset from the 2016 Ethiopia Demographic and Health Survey (EHDS). We conducted spatial autocorrelation and Moran's I statistics to investigate the regional variance of HIV being ever-tested in AGYW. In addition, spatial regression analyses such as ordinary least squares (OLS) regression and geographically weighted regression (GWR) were carried out to determine the predictors of being ever-tested for HIV among AGYW.

Results: Addis Ababa, some parts of Amhara, Dire Dawa, Gambela, and Tigray were the primary regions and city administrations for being ever-tested for HIV among AGYW. A lesser proportion of AGYW being ever-tested for HIV was found in Somalia, Afar, Benshangul Gumuz, and southern nations. Spatial regression analyses identified an age range of 15–19 years, being Muslim, having no formal education, having no knowledge about HIV, and experiencing severe stigma as predictors of being ever-tested for HIV among AGYW.

Conclusion: The proportion of AGYW being ever-tested for HIV was high in Addis Ababa, some parts of Amhara, Dire Dawa, Gambela, and Tigray. Spatial regression analyses identified that AGYW aged 15–19 years, having no formal education, having no knowledge about HIV, and experiencing severe community stigma as predictors negatively affecting the proportion of being ever-tested for HIV, while being Muslim was a predictor that positively affected the proportion of being ever-tested for HIV. The governments and other stakeholders should focus on increasing HIV testing among these special groups of the population.

Keywords: mapping, ever tested for HIV, adolescent girls, young women, Ethiopia

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A review on emerging pharmaceutical residues in Ethiopia: occurrence, ecotoxicological aspects, and regulatory concerns

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Abstract

Background: Pharmaceuticals are expected to improve human and animal health, but improper management and regulation have led to adverse effects such as reproductive disorders, antibiotic resistance, and biodiversity loss in ecosystems. Their presence in the environment poses significant risks, including a reduction in biodiversity, reproductive issues, and the development of antimicrobial resistance. This review aims to examine the occurrence and sources of pharmaceuticals in the environment and their ecotoxicological and regulatory aspects, with a focus on Ethiopia.

Methods: A narrative review of relevant studies conducted in Ethiopia was undertaken. The review included findings on the occurrence, sources, contributing factors, ecotoxicological impacts, and regulatory concerns related to pharmaceutical residues in the environment. Literature was sourced from Google Scholar, Scopus, PubMed, and institutional repositories.

Result: The findings revealed the detection of pharmaceutical residues in wastewater treatment facilities, aquatic environments (e.g., lakes and rivers), and commercially available animal products. Aquatic samples also showed significant concentrations, with sulfamethoxazole and fluconazole detected at 0.15 μg/L and 0.012 μg/L, respectively. Antimicrobial resistance genes were identified in wastewater and treatment plant samples, which correlate with the presence of pharmaceutical residues. An ecological risk assessment based on the risk quotient (RQ) revealed ciprofloxacin as a major concern, with an RQ of 8.58, indicating high ecological risk. Sulfonamides exhibited moderate risk, with RQ values ranging from 0.1 to 1.

Conclusion: The study highlights the significant presence of pharmaceutical residues in the environment and underscores the inadequacy of regulatory enforcement in addressing this public health issue. Urgent measures are required to prevent environmental contamination and mitigate public health risks, including antimicrobial resistance. Strengthened regulatory measures and proactive interventions by relevant organizations are essential to control and prevent pharmaceutical residues in the environment, offering a critical solution for the country.

Keywords: pharmaceutical residues, ecosystem disruption, wastewater treatment, drug use, regulatory oversight, sustainable drug practices

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Assessment of emissions and exposure in 3D printing workplaces in Taiwan

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Abstract

Three-dimensional (3D) printing is an emerging and booming industry in Taiwan. Compared to traditional manufacturing, 3D printing has various advantages, such as advanced customization, additive manufacturing, reduced mold opening time, and reduced consumption of precursors. In this study, the real-time monitoring of particulate matter (PM) and total volatile organic compound (TVOC) emissions from various filaments is investigated using fused deposition modeling with material extrusion technology, a liquid-crystal display, a stereolithography apparatus based on vat photopolymerization technology, and binder jetting for occupational settings. An exposure assessment for nearby workers using the 3D printing process was performed, and improvement measures were recommended. Nine 3D printing fields were measured. The generation rate of ultrafine particles ranged from 1.19 × 1010 to 4.90 × 1012 #/min, and the geometric mean particle size ranged from 30.91 to 55.50 nm. The average concentration of ultrafine particles ranged from 2.31 × 103 to 7.36 × 104 #/cm3, and the PM2.5 and PM10 concentrations in each field ranged from 0.74 ± 0.27 to 12.46 ± 5.61 μg/m3 and from 2.39 ± 0.60 to 30.65 ± 21.26 μg/m3, respectively. The TVOC concentration ranged from 0.127 ± 0.012 to 1.567 ± 0.172 ppm. The respiratory deposition (RDUFPs) dose ranged from 2.02 × 1013 to 5.54 × 1014 nm2/day. Depending on the operating conditions, appropriate control and protective measures should be employed to protect workers' health.

Keywords: 3D printing-induced emissionsparticulate matteroccupational assessmentvolatile organic compoundsrespiratory deposition dose

Cogent Engineering
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Comparative evaluation of the accuracy of mapping irrigated areas using sentinel 1 images in the Bilate and Gumara watersheds, Ethiopia

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Abstract

Precise estimation of irrigated areas is essential for effective water management, increased production, environmental conservation, and conflict resolution. Nonetheless, discrepancies frequently exist between estimated and actual irrigated areas. To address the data gaps in actual irrigation areas within Ethiopia, we utilized high-resolution remote sensing imagery. However, the accuracy of these images under varying climatic and landscape conditions was not fully substantiated. We conducted a comparative analysis between global irrigation map and local irrigated region maps within two distinct watersheds. Field data was gathered to both train and assess by employing random forest supervised classification algorithm. This algorithm was then applied to create accurate irrigation maps using high-resolution Sentinel-1 data for the Bilate and Gumara watersheds. During the irrigation seasons, maps of irrigated regions were produced using time-series imagery. Additionally, we employed maps indicating lands suitable for surface irrigation and applied post-processing techniques to refine the actual irrigated areas. The resulting accuracy was comparably high for both watersheds, with values of 88% and 87%. The kappa coefficients were 0.74 and 0.73, respectively, indicating a very good level of agreement. However, there were significant discrepancies between the global irrigation map and the local irrigated regions map in terms of spatial distribution and the extent of irrigation. This discrepancy necessitates further analysis of both products to decipher the underlying causes of their differences. We recommend for additional studies encompassing diverse watershed characteristics to improve irrigation area mapping via remote sensing. Our findings also validate the effectiveness of post-processing techniques in remote sensing applications.

Keywords: Accuracy, Bilate, Gumara, irrigation area, random forest, Sentinel

SAGE Open Medicine
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Reported self-care practice toward prevention of puerperal sepsis and associated factors among postnatal mothers: Community-based cross-sectional study

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Abstract

Introduction: Puerperal sepsis is a leading cause of maternal morbidity and mortality in low-income countries, which can affect sustainable development goals. Even though it is a preventable problem through maternal self-care practices, maternal-reported self-care practices regarding puerperal sepsis were under-researched in Ethiopia. Therefore, this study aimed to assess the maternal reported self-care practice and associated factors among postnatal mothers for the prevention of puerperal sepsis.
Objective: The study aimed to assess the reported self-care practice of postnatal mothers in Arba Minch town toward the prevention of puerperal sepsis and its associated factors.
Methods: A community-based cross-sectional study was employed from 1st to 30th May 2022. Study participants were selected using a simple random sampling technique. Data was collected by the Open Data Kit tool and exported to SPSS version 26 for further analysis. Both crude and adjusted odds ratios with a 95% CI were calculated, and a p-value of less than 0.05 was used to declare statistically significant factors.
Results: Of a total of 423 postpartum mothers, 417 participated, making a response rate of 98.5%. The study revealed that 45.6% (95% CI: 41.2%, 50.1%) of postnatal mothers had good reported self-care practices toward the prevention of puerperal sepsis. Tertiary educational level (AOR: 2.56; 95% CI: 1.43, 4.59), multiparity (AOR: 0.44; 95% CI: 0.26, 0.74), and having a good awareness of puerperal sepsis prevention (AOR: 2.17; 95% CI: 1.40, 3.37) were significantly associated at a p-value less than 0.05.
Conclusion: This study revealed that less than half of postnatal mothers reported good self-care practices. Healthcare providers and all stakeholders should focus on strategies to improve self-care practice during antenatal and postnatal care and at a community level, with a special focus on postnatal mothers with no formal education and multiparous mothers.

Keywords: Postnatal, puerperal sepsis, self-care practice

Applied and Environmental Soil Science
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2024 (2024)

Hydrogeochemical and GIS Analysis of Groundwater Quality for Drinking and Irrigation Purposes in Kuzhithuraiyar Sub-Basin, Kanniyakumari District, Tamil Nadu, India

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Abstract

A hydrogeochemical analysis was conducted to find the suitability of the groundwater for drinking and irrigation purposes in the Kuzhithuraiyar sub-basin, Kanniyakumari district, Tamil Nadu, India. 48 groundwater samples were collected from the different locations of the study area during both the pre- and postmonsoon periods. This study assesses the groundwater quality for drinking and irrigation purposes based on the analytical results, water quality index, Wilcox plot, and irrigation parameters such as electrical conductance, Kelly's ratio, sodium absorption ratio values, magnesium hazards, bicarbonate, and the residual sodium carbonate index. The pH values ranged from 8.5 to 6.5, suggesting generally acceptable conditions. TDS concentrations range from 24 to 1277 mg/L, whereas EC values range from 37.50 to 1996 μS/cm. It is observed from the collected samples that the pre-monsoon water samples TDS' values were exceeded the recommended TDS limits than postmonsoon samples. Water quality indices indicate that 50% of premonsoon samples and 48% of postmonsoon samples are suitable for drinking. In total, 10% of samples are admissible to a doubtful category before and after the monsoon, 6% are good to permissible during the monsoon, and 84% are good to permissible. Kelly's ratio shows that 56% and 48% of samples collected during the post- and premonsoon are suitable for irrigation, respectively, whereas the remaining samples are not. Due to magnesium hazards, 40% and 44% of pre- and postmonsoon samples are not suitable for irrigation. Overall, the postmonsoon samples exceeded the permissible TDS limit (1000 mg/L) by 10% and the premonsoon samples by 6. 13% of samples obtained after the monsoon and 19% collected before the monsoon have a potential salinity greater than three, indicating that these samples are unacceptable. The sustaining water quality and mitigating possible hazards in the Kuzhithuraiyar sub-basin require continuous monitoring and focused measures.

Frontiers in Global Women's Health
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Length of stay and determinants of early discharge and extended stay after cesarean delivery in a resource-limited setting: southern Ethiopia, 2023

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Abstract

Background: For mothers and newborns to obtain the recommended postnatal care follow-up and package, the healthcare facility has to provide a minimum length of stay following delivery. Early discharge may result in a shortened recovery time, less access to resources and support, and a prolonged stay, resulting in a greater risk of postpartum depression and financial constraints. In Ethiopia, there has been no study conducted on the length of hospital stays following a cesarean delivery. Therefore, this study aimed to determine the average length of stay and identify factors influencing both early discharges and prolonged stays after cesarean delivery in southern Ethiopia.

Methods: A facility-based cross-sectional study was conducted between November 23, 2022, and March 23, 2023. A systematic sampling method was used to select 367 participants, and data were collected using the Kobo Toolbox mobile application. The mean length of stay was calculated in hours, and descriptive statistics were used to summarize the data. Multinomial logistic regression was employed to analyze the determinants of length of stay, with significance set at a p-value of <0.05.

Results: The mean duration of the length of stay of mothers in health facilities after cesarean delivery is 65 h or approximately 2.71 days (SD ± 0.77). Determinants of shorter stay included women aged 20–24 years [AOR = 5.19; 95%CI 1.51–8.23], distance from hospital 30–60 min [AOR = 2.51; 95% CI 1.12–5.73], first antenatal booking [AOR = 0.16; 95%CI 0.05–0.25], monthly income <2,000 birr [AOR = 3.11; 95%CI 1.18–6.05], had health insurance [AOR = 0.35; 95% CI 0.26–0.37] and had counseled [AOR = 0.09; 95%CI 0.07–0.154]. Extended stays were associated with severe pre-eclampsia [AOR = 2.80; 95%CI 2.41–3.27], multiple births [AOR = 2.51; 95%CI 1.34–4.71], and postoperative complications [AOR = 3.52; 95%CI 1.35–5.01].

Conclusion: The average post-cesarean hospital stay is 2.71 days, with duration influenced by factors such as age, distance to the hospital, access to antenatal care, income, insurance, and the presence of complications. Targeted interventions, such as improving access to antenatal care, providing financial support, and proactively managing complications, can improve outcomes.

Keywords: Arba Minch Town, cesarean delivery, health facility, length of hospital stay, southern Ethiopia

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Utilizing Additive Manufacturing for Fabricating Energy Storage Components From Graphene-Reinforced Thermoplastic Composites

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Abstract

The quest for efficient and sustainable energy storage solutions has prompted exploration into advanced materials that meet stringent mechanical and thermal requirements. This study investigates graphene-reinforced thermoplastic polymers specifically polyether ether ketone (PEEK), polyethylene terephthalate glycol (PETG), and polylactic acid (PLA) fabricated through additive manufacturing techniques. Traditional materials often suffer from limitations in structural integrity, flexibility, and thermal stability, presenting challenges for their application in energy storage. This research aims to evaluate the mechanical properties of these graphene-reinforced polymers to assess their suitability for energy storage components. Using additive manufacturing, test samples were fabricated, and mechanical testing was conducted to evaluate tensile, flexural, and compression strengths. The results indicate that graphene-reinforced PEEK (G-PEEK) exhibits superior mechanical performance, with an ultimate tensile strength of 120 MPa, Young's modulus of 1700 MPa, ultimate flexural strength of 160 MPa, and ultimate compression strength of 200 MPa, making it an ideal candidate for applications requiring high structural integrity. Graphene-reinforced PETG (G-PETG) offers a balance of strength and flexibility, with an ultimate tensile strength of 55 MPa, while graphene-reinforced PLA (G-PLA) serves as a cost-effective option, despite lower mechanical properties (ultimate tensile strength of 45 MPa).

Keywords: additive manufacturing; composite filament; energy application; fused deposition modeling; mechanical property; surface metamorphosis; sustainable materials

Cogent Social Sciences
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10 (2024)

Firm-specific and institutional factors as export performance catalysts: Insights from a developing economy

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Astract

This study advances a resource-based theory and institutional based view integrative theoretical model which contends that the export performance of firms will depend upon both firm-specific factors and their home institutional environments. Specifically, the study hypothesizes that firm capital structure (CS), competition from informal sector (IC), and political instability (PI) in home countries will directly and negatively affect their export performance (EXP). Furthermore, we hypothesizes that availability of cash (CA) will have direct and positive effect on EXP. Using partial least square structural equation model (PLS-SEM), the researchers test the hypotheses based on a dataset of 161 firms from Ethiopian manufacturing sector (i.e., Leather industry, textile industry, and Food & Beverage industry). The study confirms that CS, IC in home countries, and PI in home countries have significant negative effects on the EXP of the firms. On the other hand, there is no statistically significant direct relation exists between CA and firm's EXP as measured by sales volume and sales revenue. Nonetheless, aside from the insignificant relation between CA and EXP, we can conclude that CS has negative impact on firm's EXP.

Keywords: Capital structure, cash, informal sector, political instability

Nations and Nationalism
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32 (2024)

Shared identity, an integrative component of Ethiopian federalism: Informing shared society in the Konso-Alle-Derashe Area

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Abstract

This study explores a shared identity framework for inclusive ethnic relationships under Ethiopian federalism. Decades of the federal experiment show mixed results. On the one hand, it enabled nationalities to exercise extensive rights and freedoms. On the other hand, however, it coincided with pervasive conflicts and state fragility. Contrary to the view that ethnic federalism is fundamentally flawed, this study argues that the problems are epiphenomenons that can be improved. Using an exploratory research approach, the study has taken the Konso-Derashe-Alle area to show how shared identity helps to resolve the contradiction in Ethiopian federalism. According to the findings, maturing ethnicity and existing political consciousness suggest ethnic federalism as a viable system for the study area but it should be supplemented by a framework of shared spaces such as the shared society system that capitalizes on the extensive shared sociocultural values of the area to overturn the growing exclusive ethnicity.

International Journal of Food Properties
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Exploring Vernonia amygdalina's leaf extracts for phytochemical screening and its anti-bacterial activities

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Abstract

The aim of this study was to screen the phytochemicals and assess the antibacterial properties of crude extracts from Vernonia amygdalina leaves against specific pathogenic bacteria. Qualitative and qauntitave analysis was performed on both ethanol and ethyl acetate crude extracts using standardized techniques. The analysis revealed the presence of alkaloids, phenol, flavonoids, terpenoids, saponins, tannins, and cardiac glycosides in the ethanol extract, while saponins and glycosides were absent in the ethyl acetate extract. The quantities of phenols, flavonoids, and alkaloids were determined using Gallic acid, quercetin, and atropine assays, respectively. The ethanol extract contained 154.7 ± 3.6 (mg GAE/g) of total phenols, 33.3 ± 1.8 (mg QE/g) of flavonoids, and 2.4 ± 0.08 (mg AE) of alkaloids, whereas the ethyl acetate extract contained 93.7 ± 3.9 (mg GAE/g) of total phenols, 30.7 ± 8.3 (mg QE/g) of flavonoids, and 1.57 ± 0.3 (mg GAE/g) of alkaloids. This study identified 44 components in the ethanol crude extract and 10 components in the ethyl acetate crude extract. The presence of alkanes, alkenes, amines, carboxylic acids, and alcohols was confirmed by FT-IR analysis. Each crude extract was tested at concentrations of 500 mg/mL, 250 mg/mL, 125 mg/mL, and 62.5 mg/mL using the same method. A concentration of 0.001 mg/mL of Penicillin capsule standard drugs and dimethyl sulfoxide were used as positive and negative controls, respectively. Overall, the results of the study indicated that both crude extracts exhibited antibacterial activity at higher concentrations. © 2024, Published with license by Taylor & Francis Group, LLC.

Keywords: Vernonia amygdalina traditional medicine, phytochemical, anti-bacterial activity

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Mapping landslide susceptibility in the Debretabor-Alember road sector, Northwestern Ethiopia through geospatial tools and statistical approaches

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Abstract

This study aimed to locate areas along the Debretabor-Alember route segment in northern Ethiopia that are susceptible to landslides. Geospatial tools, specifically frequency ratios (FR) and information values (IV), were used to develop landslide susceptibility maps (LSMs). A comprehensive on-site investigation and analysis of Google Earth imagery were conducted, resulting in the detection and analysis of 89 landslides, including current and historical events. The dataset used for validation comprised 78% of the previously documented landslides, whereas the remaining 22% was used for training. Several factors were considered in this study to determine landslide susceptibility, including "slope, aspect, curvature, elevation, lithology, distance from streams, land use and cover, precipitation, normalized difference vegetation index (NDVI)", and the FR and IV models. Based on the results obtained using the FR approach, specific areas exhibited different levels of susceptibility, ranging from very low to moderately high, medium, high, and very high. These areas covered a total of 18.4 km2 (19.9%), 18.9 km2 (20.5%), 19.7 km2 (20.3%), 17.7 km2 (20%), and 17.7 km2 (19%), respectively. The LSMs generated by the IV model indicated multiple susceptibility classes in the study area, varying from very low to very high. These maps revealed that 18.4 km2 (19.8%), 18.8 km2 (20%), 18.9 km2 (19.5%), 18.8 km2 (20.5%), and 18.3 km2 (19.8%) of the area fell into these susceptibility classes. The landslide density indicator method was employed to validate the LSMs. The FR and IV models demonstrated that a significant proportion of confirmed past and current landslide records (72.16% and 73.86%, respectively) occurred in regions with a high or very high susceptibility to landslides. Overall, the IV model, which utilized latent variable structural modeling (LSM) in the independent variable model, outperformed the fixed effects regression model (FR).

Keywords: frequency ratiogeospatialinformation valuelandslide susceptibility Northwestern Ethiopia

Frontiers in Medicine
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11 (2024)

The evaluation of prothrombin time and activated partial thromboplastin time among diabetic and healthy controls in Africa: systematic review and meta-analysis

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Abstract

Introduction: Diabetes Mellitus (DM) is a disorder of multiple etiologies characterized by chronic hyperglycemia resulting from defects in insulin secretion and/or insulin action. DM patients have a disturbance of hemostasis, leading to a prothrombotic state characterized by platelet hypersensitivity, coagulation factor disorders, and hypo-fibrinolysis. Therefore, the primary goal of this systematic review and meta-analysis was to determine the pooled Standard Mean Difference (SMD) of prothrombin time (PT) and activated partial thromboplastin time (APTT) of DM patients in Africa.

Methods: This systematic review and meta-analysis was conducted based on the guidelines of the PRISMA. PubMed, Google Scholar, Science Direct, Dove Press, Cochrane Online, and African journals online were searched systematically. The qualities of the included studies were assessed by two independent reviewers using the JBI critical appraisal tools. Data were extracted in an Excel sheet and then exported to STATA version 11 for analysis. A Random-effect model was fitted to estimate the pooled SMD and Higgins I-square test statistics were done to test the heterogeneity of studies. Funnel plots analysis and Egger-weighted regression tests were done to detect publication bias.

Results: The pooled SMD of PT among DM patients in Africa was −0.18, (95% CI: −0.72, 0.36). The pooled SMD of APTT among DM patients in Africa was −0.48, (95% CI: −1.18, 0.21). There was no statistically significant difference in the SMD of PT and APTT among DM patients in Africa compared to healthy controls. The pooled SMD of APTT among Type 1 DM patients in Africa was 0.86 (95% CI: 0.04, 1.69) whereas the SMD among Type 2 DM was −0.42 (95% CI: −1.24, 0.40). The SMD of APTT in Type 1 DM and controls showed a statistically significant difference compared with Type 2 DM and controls ($p = 0.041$). The SMD of APTT in Africa that is determined using a case–control study design showed a statistically significant difference compared to the SMD that is determined using a comparative cross-sectional study design.

Conclusion and recommendations: Even though different studies conducted across African countries showed the presence of coagulation abnormality in DM, this systematic review and meta-analysis revealed that there is no statistically significant SMD of PT and APTT in DM patients compared to healthy controls. However, it is recommended that physicians routinely check APTT levels in Type I DM patients in order to evaluate coagulation status.

Keywords: prothrombin time, activated partial thromboplastin time, diabetes mellitus, systematic review and meta-analysis, Africa

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Utilization of fungal and bacterial bioremediation techniques for the treatment of toxic waste and biowaste

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Abstract

The escalating accumulation of toxic wastes and biowastes constitutes a critical environmental crisis that demands immediate and effective solutions. Traditional waste treatment methods, predominantly chemical and physical, are increasingly viewed as unsustainable, burdened by high operational costs and the risk of generating secondary pollutants. Against this backdrop, bioremediation emerges as a crucial and sustainable alternative, utilizing the natural detoxifying capabilities of microorganisms. This review article focuses on the use of fungal and bacterial strategies in bioremediation, emphasizing their vital role in the degradation, stabilization, or detoxification of pollutants. We provide an in-depth analysis of the mechanisms by which fungi and bacteria break down various contaminants, presenting a current snapshot of the field's state of knowledge. The article highlights recent innovative advancements that improve the effectiveness and expand the applicability of bioremediation technologies. Moreover, it discusses the practical challenges of scaling these solutions to meet global environmental needs and suggests directions for future research and implementation. This synthesis not only underscores the significance of microbial bioremediation in addressing pressing environmental problems but also acts as a call to action for continued innovation in the sustainable management of hazardous wastes.

Keywords: fungi, bacteria, bioremediation, pollutants, toxic waste, biowaste, detoxification, Lessharmful

Petroleum and Coal
https://www.researchgate.net/publication/380759293_Potential_Assessment_of_Coal_Deposits_in_Gamo_Zone_Kucha_Woreda_Ethiopia
66 (2024)

Potential Assessment of Coal Deposits in Gamo Zone, Kucha Woreda, Ethiopia

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Abstract

The present study was conducted to assess the potential occurrence of coal deposited in the Gamo zone, Kuccha woreda, Daho Kebele. It also aims to determine the quality and quantity of coal through field and laboratory techniques. Nineteen coal samples and five rock samples were collected from outcrops, test pits and trench sites and analysed for major and minor oxides of rock units and coal samples to determine the percentage of moisture, volatile matter, fixed carbon content, ash and calorific value in the laboratory of the Geological Survey of Ethiopia using AAS, adiabatic caloric matter, gravimetric and proximate analyses, respectively. The geologic setup of the study area is predominantly characterized by basaltic rocks and rhyolite interbedded/intercalated with coal seams of different thicknesses ranging from 0.3 m to 2.62 m. A geological map with a 1:25,000 scale and three potential coal occurrence maps with a 1:10,000 scale were prepared based on field surveys and laboratory results. Analysis of the coal samples revealed that the moisture content ranged from 1.62-12.84%, the volatile matter content ranged from 6.53-32.98%, the fixed carbon content ranged from 0.04-55.78%, the ash content ranged from 10.34 to 90.06%, and the calorific value ranged from 1007.24 to 6873.76Cal/gm. This indicates that compared with the ASTM international standards, the rank of kucha coal lies on the lignite to subbituminous. Fifteen test pits were dug in all potential coal sites, and the average thickness of the coal seams ranged from 1.06 m to 1.14 m. According to the geophysical survey of the vertical electrical sounding results, a coal layer with an average thickness ranging from 0.62 m to 2.62 m was identified. Based on the log results of pits, geophysical results and areal coverage of coal deposits, the study area is estimated to have 744,174.96 tons of coal.

Hyperautomation in Precision Agriculture: Advancements and Opportunities for Sustainable Farming
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Cereal crop yield prediction using machine learning techniques

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Abstract

The agriculture sector in Ethiopia plays a crucial role in the country's economic development, as a significant portion of the population resides in rural areas and relies heavily on crop productivity. To make informed policy decisions and plan effectively, it is important to predict crop yields accurately. However, traditional data collection methods are commonly used in countries like Ethiopia. In this study, we aim to develop a cereal crop yield prediction model based on agricultural inputs using machine learning (ML) techniques. To achieve this, we collected raw data related to crop yields, average rainfall, pesticides, average temperature, and the year of the crop. After preprocessing and merging the dataset, we obtained a final dataset with 12 features, initially occupying 20kB of space. Through feature importance analysis, we identified the most relevant features and reduced the dataset size to 7 features, occupying 8kB. We then applied various ML algorithms, including gradient boosting regression, random forest regression, support vector machine, and decision tree regression, to predict crop yields. By comparing their performance using different train/test data splits, we found that the gradient boosting regression algorithm outperformed the others, achieving 93% accuracy in crop yield prediction.

Food Science and Nutrition
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Enhancement of nutritional quality and shelf life of fish products (powder & chapatti) via fortifying with orange-fleshed sweet potato

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Abstract

Despite its high protein, fat, and mineral contents, fish contains trace amounts of carbohydrates and vitamins, notably vitamin A. The perishable nature of fresh fish makes it challenging to store for a prolonged time, necessitating the use of additives to enhance its shelf life, nutritional, and other quality aspects. Sweet potatoes are the preferred option to blend with fish due to their cost and abundance. This study aims to prepare fortified fish powder and make food products (chapatti) using it. Fish powder and sweet potato powder were prepared by drying them in an oven at 60°C and 45°C, respectively. The two dried samples were then ground and mixed in various ratios, followed by analyzing their nutritional and other parameters using standard methods. Vitamin A and beta-carotene levels were analyzed using HPLC and UV–Vis spectroscopy techniques, respectively. The findings indicated that the outcomes displayed enhanced nutrition and extended storage capacity. The amount of beta-carotene (876.12 ± 14.76 to 3182.4 ± 123.1 μg/100 g) and carbohydrates (4.49 ± 1.02 to 52.31 ± 0.21) increased. The packed fortified flour is safe for human consumption for up to 90 days, as per the International Commission for Microbiological Specifications for Foods. The chapatti made from fortified flour was also deemed acceptable by the panelists.

Keyword: Sbeta-carotene, chapatti, fish powder, fortification, sweet potato

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45 (2024)

Dangers associated with assuming robustness of scale reliability and validity: Psychometric properties of the Barkin Index of Maternal Functioning with Ethiopian mothers

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Abstract

This study was conducted to assess the psychometric properties of the Barkin Index of Maternal Functioning (BIMF) in an Ethiopian context. Data were obtained from 202 women with a child less than 1 year of age. Narrow standard deviations characterized responses to most BIMF items, but a handful of items had wider standard deviations associated with bimodality. Most interitem correlations were < |.15|, and 13 of the 20 BIMF items did not load satisfactorily on any factor in exploratory factor analyses. Two factors emerged from the remaining items, one with three items and the other with four. Although poor reliability results relating to internal (interitem) and temporal consistency could be attributed to limited variability in the data, a number of concerns are raised about the BIMF itself, including its content validity, instructions, response options, and usefulness in healthcare settings. Suggestions are made for improving the assessment of maternal functioning in Ethiopia and other contexts. More generally, this research demonstrates that researchers should not assume that the psychometric properties and appropriateness of scales will remain robust when those scales are used in contexts that differ from the contexts in which they were created.

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48 (2024)

Joint EASPS-AAPS conference in Tanzania 2023: a beginning of the pragmatic efforts to promote physiology education, research, and practice in East Africa

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Abstract

The East African Society of Physiological Sciences (EASPS) identified many problems associated with the practice and impact of physiology training and graduates within the region. The EASPS, in conjunction with the African Association of Physiological Sciences (AAPS), resolved to tackle those identified problems in the region by organizing a regional conference in Tanzania between November 29, 2023, and December 1, 2023. The conference was successful with remarkable achievements, including production of Physiology Curriculum for African Universities (PhysioCAFUN); launching of the International Union of Physiological Sciences (IUPS) African Physiology Mentoring Program; educational workshops on physiology teaching and skills acquisition; plenary sessions on various inspiring scientific topics for advancement of research capacities and current trends in physiological sciences; presentation of abstracts by authors and publishing of the abstracts as edited conference proceedings in the Journal of African Association of Physiological Sciences; presentation of awards to the top 10 abstracts and 7 other key Local Organizing Committee members and partners; first annual general meeting of the EASPS members; networking of participants within and beyond Africa; and recognition of the formation processes of national physiological societies in Rwanda, Kenya, Uganda, and Tanzania.

New & noteworthy: The joint East African Society of Physiological Sciences (EASPS)-African Association of Physiological Sciences (AAPS) conference in Tanzania was a successful event where we launched the Physiology Curriculum for African Universities (PhysioCAFUN) and the International Union of Physiological Sciences (IUPS) Physiology Mentoring Program in Africa. We also organized educational workshops on physiology functional tests that equipped participants with practical skills. Authors presented their peer-reviewed abstracts, which have now been published in the Journal of African Association of Physiological Sciences. Participants attended from 24 countries across Africa, Europe, Asia, and United States.

Keywords: curriculum**,** EASPS conference**,** mentorship**,** physiology education**,** workshop

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Prevalence and associated factors of self-medication among pregnant women in Sodo Town, Southern Ethiopia

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Abstract

Background: Self-medication is a widespread practice among pregnant women worldwide, with 44.55% practicing it. However, it may lead to incorrect diagnosis, inappropriate treatment, and failure to recognize contraindications. The adverse effects of self-medication are often unknown, and they pose potential risks to maternal and fetal health. This study aimed to address the gap in research on the prevalence and associated factors of self-medication among pregnant women in Southern Ethiopia, and to promote effective strategies and interventions.

Methods: A community-based cross-sectional study was conducted among 425 pregnant women in Sodo Town from April to June 2021. Participants were enrolled using a two-stage sampling technique. Data were collected using a structured questionnaire and face-to-face interviews. The association between the outcome and independent variables was assessed through bivariate logistic regression analysis. Additionally, multivariable logistic regression analysis was carried out, including variables with an adjusted odds ratio (AOR) accompanied by a 95% confidence interval (CI) and a p-value of less than 0.05, which was considered statistically significant.

Results: In this study, pregnant women aged 18–39 years participated with a 100% response rate. The study found that the prevalence of self-medication during pregnancy was 20.5%, with 8.2% using herbal medicine and 12.3% using conventional medicine. A history of self-medication and first-and second-trimester pregnancy were significantly associated with self-medication. A history of self-medication (AOR = 6.31, 95% CI: 4.89, 9.91) and being in the first trimester of pregnancy (AOR = 3.47, 95% CI: 1.63, 7.38) or second trimester of pregnancy (AOR = 2.14, 95% CI: 1.12, 4.08) were associated with a higher likelihood of self-medication.

Conclusion: The study found that 20.5% of pregnant women engaged in self-medication. It also identified that a previous history of self-medication and gestational age were factors associated with self-medication. These findings underscore the need for targeted educational programs and policy interventions to mitigate the risks associated with self-medication during pregnancy, particularly in the early stages of gestation.

Keywords self-medication practice, magnitude, associated factors, pregnant women, Ethiopia

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32 (2024)

Inundation Mapping and Flood Frequency Analysis using HEC-RAS Hydraulic Model and EasyFit Software

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Abstract

Conducting a flood frequency analysis and mapping of the inundated area in rivers are important for river flow modeling. The main purpose of this research is to estimate the peak flow, model the inundated area using HEC-RAS, and conduct an analytical hierarchy process for the upper Baro Akobo basin in Ethiopia. The inundation area and river depth for 25, 50 and 100 years are considered while contemplating several factors which contribute to flooding. The downstream of the basin has experienced numerous floods that occurred in 2006, 2007, 2010, 2011, and 2012. Flood frequency analysis with stream flow data from 1990–2009 at the Baro-Gambella gauging station was carried out to estimate the expected peak floods of the watershed. The analysis was conducted using the Gumbel, Normal, and Log Pearson Type III distribution methods. The peak floods with return periods of 25, 50, and 100 years with a minimum statistical value calculated using the Normal distribution method resulted in 1739.586 m3/s, 1820.872 m3/s and 1893.974 m3/s, respectively. The HEC-RAS model results indicated that the flood inundation areas under different land use changes for 25-, 50-, and 100-year return periods were 446.2 km2 (annual crop cover), 404.4 km2 (built area cover), 323.3 km2 (flooded vegetation), and 93.58 km2 (forest area), respectively, whereas the inundation depth ranged from 0–2.6 m, 0–2.9 m, and 0–3.2 m depth at the upstream and downstream of the river, respectively. The outcome of this study could be used to reduce temporal and permanent flood risk.

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Incidence and Predictors of Diabetic Nephropathy among Type 2 Diabetes Mellitus Patients, Southern Ethiopia

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Abstract

Background: Diabetic nephropathy is the most common cause of end-stage renal disease, and it brings high morbidity and mortality. Globally, the predominant rise in type II diabetes prevalence significantly increases the incidence of diabetic nephropathy. Therefore, timely diagnosis and prompt management of diabetic nephropathy and early identification of predictors are essential. Thus, this study aimed to determine the incidence and predictors of diabetic nephropathy among type II diabetes mellitus patients.

Methods: A retrospective follow-up study was conducted among 532 type II diabetes patients who enrolled at Hawassa University Comprehensive Specialized Hospital from January 1, 2012, to December 31, 2021. A simple random sampling technique was used to select the study participants. The extracted data were entered into EpiData version 3.1 and analyzed by Stata version 14. A bivariate and multivariable Cox proportional hazard regression analysis was fitted to identify predictors of diabetic nephropathy. The Cox proportional hazards assumption was checked using the Schoenfeld residual test, and the goodness of fit of the model was checked using the Cox-Snell residual test. An adjusted hazard ratio with a 95% confidence interval and P values were used to identify statistically significant predictors.

Results: The overall incidence rate of diabetic nephropathy was 2.71 cases (95% CI: 2.12, 3.47) per 1,000 person-months of observation. Age (AHR = 1.027; 95% CI = 1.005, 1.049), fasting blood sugar (AHR = 1.010; 95% CI = 1.007, 1.013), and systolic blood pressure (AHR = 1.050; 95% CI = 1.031,1.069) were significant positive predictors of diabetic nephropathy, whereas the duration of diabetes longer than five years (AHR = 0.20; 95% CI = 0.09, 0.44) was a protective predictor for the development of diabetic nephropathy.

Conclusion: The incidence rate of diabetic nephropathy was high. Age, fasting blood sugar, systolic blood pressure, and duration of diabetes were found to be independent predictors of diabetic nephropathy. To overcome this public health problem, prompt and effective strategies should be designed based on identified predictors to prevent the development of diabetic nephropathy.

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Failure factors of building construction projects in Ethiopia

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Abstract

Construction projects encounter considerable failure, and the case is worse in developing countries. Improving this situation needs an understanding of the failure factors; hence, this study is aimed at identifying critical failure factors of building construction projects in the Ethiopian construction industry. Sixty-four project failure attributes were identified through a literature review and categorized under eight groups of sources. Using a questionnaire survey, one hundred seven valid responses were collected from professionals affiliated with contractors, consultants, clients and regulatory bodies. For the analysis, factor analysis was conducted to identify the underlying dimensions of each group, and multiple regression analysis was conducted to identify critical failure factors. The findings indicate that: (i) unfavourable socio-economic and climatic conditions; (ii) owners' incompetence, change orders and bureaucracy in public clients; (iii) political interferences and inflation; (iv) contractors' incompetence; (v) progress payment, defective works, and staff quality challenges; and (vi) poor productivity, shortage of labour and escalation of material costs are the critical project failure factors in the context of the Ethiopian construction industry. These critical failure factors emanate from four group of sources: client, contractor, project input, and project external environment. The stakeholders need to devise appropriate strategies to mitigate these critical failure factors to ensure project success.

Keywords: construction projects, competence of stakeholders, Ethiopia, failure factors, project management

Women's Health
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20 (2024)

Completion of the maternal continuity of care and associated factors among women who gave birth in the last 6 months in Kena District, southern Ethiopia: A community-based cross-sectional study, 2023

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Abstract

Background: The maternity continuum of care includes attending at least four antenatal care (ANC) visits, delivering in a health facility, and receiving postnatal care. However, in many developing nations, including Ethiopia, completion of this continuum is low, contributing to high maternal mortality. So far, no studies have assessed this issue in the study area.

Objective: To assess the completion of maternity continuum of care and associated factors among women who gave birth in the last 6 months in Kena district, southern, Ethiopia, 2023.

Design: Cross-sectional study using quantitative data collection method.

Methods: The study was conducted among 592 women in southern Ethiopia from April to June 2023. A study participant was selected by a simple random sampling technique. Data were collected using a structured, pretested, interviewer-administered questionnaire. Then, data were entered into EpiData 3.1 and analyzed using statistical package for social science software (SPSS version 26). Logistic regression was used to identify factors related to the maternity continuum of care, with statistical significance set at $p < 0.05$.

Results: The mean age of the enrolled women was 28.78 ± 4.6 years. Of these, 11.8% (95% confidence interval (CI): 9%–14%) of women completed the entire maternity continuum care. Women with secondary education and above (adjusted odds ratio (AOR) = 5, 95% CI: 2.5–11), autonomy in healthcare decision-making (AOR = 2.4, 95% CI: 1.3–4.6), having information on maternal health (AOR = 2.4, 95% CI: 1.3–4.6) Early initiation of ANC (AOR = 4, 95% CI: 2.27–7.1) and birth preparedness (AOR = 2.7, 95% CI: 1.5–5) were significantly associated with completion.

Conclusions: Completion of the maternity continuum of care in study area is very low. Targeted interventions should promote women's autonomy in healthcare decision-making, early ANC initiation, and birth preparedness to improve outcomes.

Keywords: completion, continuum, maternity care, Kena district, Ethiopia

Cogent Education
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Exploring the links between emotional intelligence and writing performance among Ethiopian high school learners

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Abstract

Emotional intelligence (EI) refers to the ability to recognize, understand, and manage emotions, which has been found to play a crucial role in academic achievement. However, there is limited research on the impact of EI on writing performance, particularly in the Ethiopian context. Therefore, this study aims to address this gap by examining the correlation between EI and writing performance among Ethiopian high school students. To achieve this objective, a correlational research design was used. A sample of 11th-grade students (aged between 17 and 24; 69 male and 107 female) from high schools in Ethiopia was selected using a simple random sampling method. The participants completed a standardized EI questionnaire, providing quantitative data. Additionally, a writing task was assigned to the participants, and their written compositions were analyzed to assess their writing performance. The collected data were analyzed for validity and reliability using Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) statistics. Pearson's correlation coefficient was used to analyze the relationship between EI and writing performance, univariate analysis and ANOVA test was used to determine the difference in EI among participants. The findings of this study showed a statistically significant relationship between EI and writing performance. Furthermore, the results provided insights into the specific relationship between EI and writing performance among high school learners in Ethiopia. The implications of this study may extend to educational policy and practice, as it can inform the development of interventions and strategies to enhance students' EI and improve their writing skills.

Keywords: Emotional intelligence, writing performance, high school learners, Ethiopian context

Applied Mathematics in Science and Engineering
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32 (2024)

Existence and stability of solution for time-delayed nonlinear fractional differential equations

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Abstract

The objective of this study is to analyze the existence and stability of solutions for a mathematical model of nonlinear systems of time-delayed fractional differential equations involving Atangana-Baleanu-Caputo ((Formula presented.)) fractional derivatives with vaccination. The epidemiological states of the total population are classified as susceptible individuals (Formula presented.), infected individuals (Formula presented.), quarantined individuals (Formula presented.), recovered individuals (Formula presented.), vaccinated individuals (Formula presented.) and insusceptible/protected persons (Formula presented.). By considering coordinate transformation, we linearize our system and obtain a matrix coefficient for the proposed time-delayed fractional differential equation. We establish sufficient requirements and inequalities using the generalized Gronwall inequality and Krasnoselskii's fixed-point theorem to prove the existence of solution for our problem. Additionally, we construct sufficient requirements for stability analysis by employing the Laplace transform and matrix measure theory. We also investigate criteria for the local stability of the epidemic and disease-free equilibrium points. Finally, we provide a numerical illustration to validate the effectiveness of our results.

Keywords: Time-delayed fractional differential equationAtangana-Baleanu-Caputo fractional derivativeexistence and stability analysis

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Financial and marketing approach to export performance: the mediation role of promotion and research and development

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Abstract

The current study investigates the direct and indirect effects of firm-specific and environmental factors on export performance. Specifically, the study investigates the direct and indirect (mediation role of promotion (PR) and research & development (RD) activities) effect of capital structure (CS), availability of cash (CA), competition from informal sector (CI), and political instability in home countries (PI) on export performance (EXP). Partial least square structural equation model (PLS-SEM) is used to analyze a year data (2022) from sample of 161 firms in Ethiopian manufacturing industry (i.e. Leather industry, textile industry, and Food & Beverage industry), to find the relation between independent (CS, CA, CI, and PI), mediating (PR and RD), and dependent (EXP) variables after controlling for factors like firm size, and industry category. The result indicates that CS has robust direct and indirect effects on EXP while PI has only direct effect. However, CA needs the intermediation of other variables (i.e. RD) to affect EXP. This finding supports the argument that assessments of direct relationships should not be the primary concern in marketing studies; rather, the sum of the direct and indirect effects of a particular variable must be evaluated for more interpretation.

Keywords: Capital structure, cash, promotion, research & development

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2024 (2024)

Quantifying Soil Erosion in Drought-Impacted Central Odisha, India, through Geospatial Mapping with RUSLE

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Abstract

Soil degradation in Odisha poses a significant conservation concern for the local environment. The present research focused on a region in central Odisha State, India, affected by drought conditions. Several models have emerged to assess soil loss, with the Revised Universal Soil Loss Equation (RUSLE) standing out as the most suitable option. The erosion computation process entails utilizing the digital elevation model (DEM), Landsat-9 imagery, and soil data from several sources accessible in different forms and scales. The present analysis took into account various elements, namely, crop management factor (C), practice management factor (P), slope length factor (LS), steepness factor of the slope (S), and rainfall factor (R). Multiplying these factors yielded the average rate of soil erosion. Areas with a high slope length factor, such as those in Kandhamal, Kalahandi, and Nuapada, have a high erosion rate. The study reveals that 57% of the land in the study area experiences very low to moderate soil erosion at a rate of 2-10 tons per hectare per year, while 43% faces moderately to very severe erosion at a rate of 10-25 tons per hectare per year. Erosion hotspots, covering 32,205 square kilometers, are mainly identified in agricultural and forested hilly areas where slopes exceed 10°, such as those in Kandhamal, Kalahandi, and Nuapada, which have a high erosion rate. These districts are especially vulnerable to soil loss and resulting climate action (Sustainable Development Goals-13) because of frequent and severe rainfall, shifting agricultural practices, a thin surface soil covering, natural erosion, and barren hills. The research emphasizes the urgent need for implementing conservation and management measures to protect high-risk areas from further degradation. In conclusion, the study underscores the effectiveness of the RUSLE-GIS model in conducting quantitative and spatial assessments of soil erosion on a river watershed scale. The model is deemed crucial in formulating conservation strategies to address the identified erosion issues in the tropical highlands of the area.

PLoS ONE
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19 (2024)

The distribution of insect pests and the associated loss of stored sorghum in the Kena district of Konso Zone, South-Western Ethiopia

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Abstract

Sorghum is a staple crop grown in the poorest and most food-insecure regions of Ethiopia. But storage insect pests are its key constraints that have been causing considerable loss. Accordingly, an assessment of the prevalence of insect pests and the associated loss of sorghum stored under farmers' traditional storages was done in randomly selected major sorghum-growing kebeles of Kena District using a nested design between November 1, 2019 and December 30, 2020. It was conducted through the sampling of one kg of grain from a total of 360 randomly selected farmers' storages. Pests' abundance was determined by dividing the total number of individual species by the total number of samples. A count and weight method was used to estimate percent grain damage and weight loss by pests. Sitophilus zeamais, Sitophilus oryzae, Sitotroga cereallella, Tribolium castaneum, Tribolium confusum, Cryptolestes ferrugineus, Cryptolestes pusillus, Rhyzopertha dominica, and Plodia interpunctella were the pests identified from grain samples. When compared to mid-latitude, where they were found in the range between 2.36± 0.21 and 17.50±0.98 mean number of species, all of these pests had a considerably ($p < 0.05$) larger distribution in lowland kebeles, where they predominated in the range between 5.44±2.00 and 23.61±1.75 amean number. During the nine-month storage period, the degree of pest infestation, percentage of grain damage, and weight loss were significantly ($p < 0.05$) higher in the bamboo bins when no management measures were implemented in the mid-land and low-land kebeles, respectively, than in the barn. Consequently, bamboo bin storage was considered ineffective for sufficient sorghum grain protection against pests and the associated loss over a longer storage period. But barn storage and the use of cultural pest management practices performed better in protecting stored sorghum from pests. Therefore, improving the bamboo bin storage method is needed to improve its grain protection efficacy.

PLoS ONE
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19 (2024)

Community perceptions and experiences on caring for the premature babies in Arba Minch health and demographic surveillance site, southern Ethiopia: Interpretive Husserlian phenomenological study

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Abstract

Introduction: Premature birth is the leading cause of under-5 child mortality, accounting for 18%. More attention is needed for premature babies. Myths, misconceptions, and negative attitudes stigmatize premature births and slow prevention and care efforts. In Ethiopia, studies have been conducted on premature birth and its risk factors. However, there is a lack of evidence regarding the perceived causes of premature birth, caring aspects, and community challenges. This qualitative study aims to address these research gaps.

Methods: This interpretive Husserlian phenomenological study was conducted from January 1–30, 2022. Purposive sampling was used to recruit 32 participants for focus group discussions and 10 participants for in-depth interviews. Participants included women, grandmothers, grandfathers, men, traditional birth attendants, and traditional healers. Interview and focus group data were analyzed using NVivo 12 Plus software and a thematic content analysis approach.

Results: In this study, the participants recognized premature babies by physical features such as transparent and bloody bodies, small and weak bodies, a limited range of motion, and bizarre behaviors. They perceived the causes of premature birth to be being young, carrying heavily loaded materials, accidents, illnesses, sin, social influence, and witchcraft. Participants provide warmth to premature babies by wearing cotton wool, making skin-to-skin contact, exposing to sunlight, and wrapping them in clothes. They also feed them boiled alcohol, muk, and formula, as well as fresh cow milk and butter. They frequently bathe the babies, wash and change their clothes, limit visits, and provide physical protection. The main challenges that the women faced were difficulty feeding and bathing the babies, limited social participation, psychosocial and economic impact, spirituality, and husband negligence.

Conclusions: The community has a gap in providing care for premature babies, and women with premature babies face many challenges. Therefore, we need to raise awareness of accurate information about the causes and care of premature babies, and we need to support women who have premature babies.

Human Behavior and Emerging Technologies
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2024 (2024)

Effectiveness of Video-Based Health Education on Breastfeeding Practices among Infants Aged 0-6 Months in Dirashe District, South Ethiopia: A Cluster Randomized Controlled Trial

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Abstract

Background: Exclusive breastfeeding (EBF) of infants during the first 6 months of their life is strongly recommended. Video-based communication is an innovative method that could promote EBF. The present study is aimed at assessing the effectiveness of video-based intervention in promoting breastfeeding practices from birth to 6 months postpartum. This was evaluated through maternal reports, as well as EBF of infants at 3 and 5 months of age, using the deuterium oxide dose-to-mother (DTM) technique.

Methods: In a cluster randomized community trial, 16 communities were assigned to receive a video-based behavior change communication (Video-Health) or standard health care messages (Control). Pregnant women in their first trimester (12±2 weeks) were enrolled and followed up, together with their infants, until 6 months postpartum. Data on breastfeeding practices were collected by questionnaire, monthly, in all the participants (n=508). Human milk intake (HMI) and nonmilk oral intake (NMOI) were measured in a subsample of 60 mother-infant pairs at 3 and 5 months postpartum using DTM. Mixed models and logistic regression were used to examine the difference in continuous and discrete breastmilk practices between the intervention and the control arms, respectively.

Results: The majority of mothers initiated breastfeeding early (92.1%), 82.4% reported colostrum feeding, and 17.5% provided prelacteal feeding. No significant differences were found between Video-Health and Control arms ($p>0.05$). The intervention significantly improved reported EBF rates at 4 and 5 months postpartum ($p<0.05$). DTM results showed that the proportion of women practicing EBF was 50%-67% less than reported at 3 months for both arms and at 5 months in the intervention arm. The intervention did not significantly affect measured EBF at 3 and 5 months postpartum but did improve HMI at 3 months. Non significant differences in NMOI were observed at 3 months, but at 5 months, there was a significant difference between the study arms.

Conclusions: Video-based behavior change communication did not result in significant improvements in reported breastfeeding practices, except for a higher reported adherence to EBF beyond 3 months. Additionally, the intervention had no effect on EBF as measured by the DTM. Early introduction of non-breastmilk foods and liquids persisted, despite self-reported EBF extending up to 6 months postpartum.

Keywords: deuterium dose-to-mother dilution technique; Ethiopia; exclusive breastfeeding; human milk intake; nonmilkoral intake

Reviews in Agricultural Science
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12 (2024)

Comparison of Locally Determined Crop Coefficients to FAO 56 (The Case of Ethiopia)

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Abstract

Proper irrigation scheduling and effective water management are impossible without the exact estimation of crop coefficient values in agroecology and crop variety. There is a research gap in the relevance of locally determined crop coefficients compared to the previously determined crop coefficients by FAO56. This review paper aims to compare and evaluate the locally determined crop coefficients with the crop coefficients documented by FAO56. Although different crops are grown in Ethiopian agroecology, only some crops have locally determined crop coefficients. These crops are onion, haricot bean, barley, wheat, tomato, teff, sugarcane, sorghum, cabbage, pepper and sesame. Except for the native crop (teff) of Ethiopia, the locally determined crop coefficient values of all others are compared with the values documented by FAO56. Accordingly, the locally determined crop coefficient values are significantly different compared to the values documented by FAO56. Considering pepper crops as a sample, updated Kc values were 1.19, 1.31, and 1.01 at the initial, mid, and late growing stages; whereas 0.6, 1.05, and 0.9 at the initial, mid, and late growing stages were documented in FAO56 document. The difference that happened between the locally determined crop coefficients and values determined by FAO56 is due to differences in crop variety, agroclimate, and the methods followed for water application and estimation of crop evapotranspiration. In line with this, the use of crop coefficient documented in FAO56 impacts water management and crop productivity, particularly in water scarcity. As reviewed different locally determined crop coefficients for different crops from different research papers, the values oscillated on the crop coefficient determined from FAO56. These oscillations indicate that it causes loss of water and aeration problems due to over-application of irrigation water. On the other hand, moisture scarcity in the crop root zones happens due to little irrigation water application to the crop. Therefore, local determination of crop coefficients for different varieties of crops in different agroecological zones is crucial for water resource projects for irrigation. Further research is required for locally determined crop coefficients considering crop variety, agroecology, and other scientific approaches.

Keywords: agro-climate, crop coefficients, crop evapotranspiration, crop variety, irrigation

Advances in Geographic Information Science
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Part F2902 (2024)

Application of Geospatial Technologies and AHP Technique in the Identification of Soil Erosion-Prone Zones in the Rift Valley, Southern Ethiopia

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Abstract

Soil erosion is causing significant environmental problems in many world regions, including the present study area Sile River watershed, which is located in the Southern Ethiopian Rift Valley. Consequently, land becomes degraded, biodiversity declines, and agricultural production decreases. Identification of susceptible soil erosion zones is highly needed to develop effective soil erosion management and conservation plans. The present study mainly aimed to use geospatial technologies and the analytical hierarchy process (AHP) technique to prioritize soil erosion-prone zones. There are nine significant soil erosion-controlling parameters were selected, such as drainage density (DD), slope, elevation, topographic wetness index (TWI), curvature, precipitation, soil type, land-use/land cover (LULC), and normalized difference vegetation index (NDVI). These selected thematic layers were mapped by utilizing optical and digital elevation satellite images, field observations, secondary data, GIS, and remote sensing tools. By adopting analytical hierarchy process (AHP) calculation methods, the weights of the selected thematic layers and their respective subthemes have been computed. After calculating the final weights of the selected thematic layers, the weighted linear combination method (WLC) was adopted to identify the areas prone to soil erosion. The final results show that 63.11 sqkm (27.56%), 115.33 sqkm (50.36%), and 50.57 sqkm (22.08%) of the study area is prone to low, medium, and high soil erosion-prone zones, respectively. An area under curve (AUC) is a statistical method used to assess the soil erosion model's accuracy. In this study, 60 soil erosion hotspots were located in high-resolution Google Earth images, and the same was used for the AUC calculation. Regarding AUC, the model performed well with a value of 0.719 (71.9%). The soil erosion assessment carried out in this study has provided satisfactory results. The outcome of this research has an important inference for planners and policymakers, as they can utilize this information to develop and implement appropriate water and soil conservation strategies within the Sile River.

Keywords: AHP**,** GIS**,** Remote sensing**,** Rift Valley**,** Sile River**,** Soil erosion**,** Southern Ethiopia

International Journal of Africa Nursing Sciences
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20 (2024)

Pregnant mothers' intention to use postpartum intrauterine contraceptive device and its associated factors in Arba Minch Town, Southern Ethiopia, 2022

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Abstract

Introduction: Postpartum intra-uterine device use contributes to the happiness and health of women, children, and families who are of reproductive age. Out of the 210 million pregnancies that happen worldwide each year, about 80 million are unintended. Increasing postpartum intrauterine contraceptive device intention can help reduce unplanned pregnancies and the incidence of abortion.

Methods: a cross-sectional study was conducted in pregnant mother's home from March to April 2022 to assess the intension to use PPIUCD and to identify factors. Through simple random selection, 482 pregnant women were surveyed using a pretested, structured questionnaire and in-person interviews. Four randomly selected Kebeles were involved in the study by using simple random sampling. The data was imported into Epi-data version 4.6.0.2 and then analysed using Stata version 14. Bivariate and multivariable logistic regressions were used to identify associated factors.

Results: 482 pregnant women have participated in the study, and 98.5 % of them responded. 13.7 % (95 % CI: 11.0–17.0) of the participants stated that they planned to use an intra-uterine device after giving birth. The intention to use a postpartum intrauterine contraceptive device had a significant association with the participants' educational level (AOR = 4.69; 95 % CI: 1.31–16.81), moderate level (AOR = 3.77; 95 % CI: 1.90–7.50), high knowledge (AOR = 4.82; 95 % CI: 1.96–11.87), and favorable attitude (AOR = 7.26; 95 % CI: 3.39–15.52), according to the results of the multivariable analysis.

Conclusion: In Ethiopia, compared to earlier research, there was a decreased intention to use postpartum intrauterine contraceptive devices. Encouraging the use of postpartum intrauterine contraceptives for social and behavioural changes can be more effective.

Keywords: Intention, Postpartum intrauterine device, Pregnancy

Journal of African Population Studies (JAPS)
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37 (2024)

Predictors of Sexual and Reproductive Health Rights Knowledge among Adolescents in Gamo Zone, Southern Ethio-pia: A Multi-Level Analysis

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Abstract

Understanding adolescents' knowledge about Sexual and reproductive health rights (SRHR) will help to empower them with the knowledge to make well-informed choices about their sexuality guides their decision-making and improves health outcomes. Despite this, there are limited studies related to adolescents' knowledge about SRHR in the study setting. Therefore, this study aimed to assess the level of SRHR knowledge and its predictors among adolescents in Gamo Zone, Southern Ethiopia. A community-based cross-sectional study was conducted from 2 March to 9 April 2023. A multistage stratified sampling technique was used to select study participants. A Structured face-to-face interviewer-administered questionnaire was used to collect data. Summary statistics and graphs were used to present the data. A multilevel linear regression analysis was used to identify individual and area (contextual)-level variables. B-estimates at 95% confidence intervals (CI) and p-value of less than 0.05 were considered to declare a level of significance. The finding showed that 49.66% [95% CI (46.79, 52.53)] of adolescents had good knowledge about SRHR. The result of multilevel linear regression analysis reveals that older adolescents (β=4.29, 95% CI: 3.46-5.12), having history of sexual exposure (β=1.95, 95% CI: 0.87 –3.04), perceived risks for SRH problems (β=1.09, 95% CI: 0.10-2.07), had paid work in the last 12 months (β=2.49, 95% CI: 1.33-3.64), living with parents(β=1.62, 95% CI: 0.59 to 2.65), having exposure to social media in the last 12 months(β=1.73, 95% CI: 0.72-2.74), and short time spent to reach health facilities(β= 1.88, 95% CI: 0.90-2.85) were independent two-level predictors of SRHR knowledge. Therefore, to enhance adolescents' understanding of SRHR, the government, and other pertinent organizations must fortify the rights-based approach. Furthermore, it is imperative to enhance the distribution of information through social media, while enhancing job prospects for adolescents would enhance their knowledge of SRHR.

Keywords: Adolescents; sexual and reproductive health rights; Knowledge; Southern; Ethiopia

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69 (2024)

Underweight and Predictors Among Children Aged 6–59 Months in South Ethiopia

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Abstract

Objectives: Underweight remains the primary public health concern among under-five-year-old children in Ethiopia, despite numerous government-implemented nutrition-specific and sensitive interventions. Therefore, this study aimed to assess underweight and associated factors among children in South Ethiopia.

Methods: Between March and April 2021, 717 children in the South Ari district who were between the ages of 6 and 59 months participated in a cross-sectional study. To choose a sample of households containing a minimum of one child between the ages of 6 and 59 months, a multi-stage sampling procedure was used. Data were collected by interviewer-administered structured questionnaires from the mothers of the children. To determine the factors associated with being underweight, a binary logistic regression analysis was built. All variables with a p-value <0.25 in the bivariable analysis were entered into a multivariable logistic regression analysis. To assess the strength of the association, an adjusted odds ratio (AOR) with a 95% confidence interval was used. With a p-value below 0.05, statistical significance was declared.

Results: The prevalence of underweight was determined to be 29.7% (95% CI: 26.5%, 33.2%). Child age 6–23 months [adjusted odds ratio (AOR) = 0.28; 95% confidence interval (CI): 0.18, 0.44], food insecurity (AOR = 1.48; 95% CI: 1.04, 2.10), sub-optimal child dietary diversity (AOR = 1.44; 95% CI: 1.01, 2.03), birth interval <24 months (AOR = 2.49; 95% CI: 1.75, 3.54), and common childhood illness (AOR = 2.21; 95% CI: 1.52, 3.21) were associated with being underweight.

Conclusion: Underweight among children is predicted by household food insecurity, suboptimal dietary diversity, and common childhood illnesses, necessitating further efforts to improve food security and manage common illnesses.

Keywords: underweight, predictors, children, south Ari district, South Ethiopia

Journal of Pregnancy
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2024 (2024)

Childbirth Self-Efficacy and Its Associated Factors among Pregnant Women in Arba Minch Town, Southern Ethiopia, 2023: A Cross-Sectional Study

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Abstract

Background: Childbirth self-efficacy is a pregnant women's perception of their ability to cope with labor stress. Low childbirth self-efficacy is linked to pain intolerance and poor labor progression, which increase the possibility of operative delivery. However, Ethiopia has limited data. So, the aim of this study was to assess childbirth self-efficacy and its factors among pregnant women attending antenatal care in public health facilities in Arba Minch town, Southern Ethiopia, in 2023.

Objective: To assess childbirth self-efficacy and associated factors among pregnant women attending antenatal care in public health facilities in Arba Minch town, Southern Ethiopia, in 2023. Methods. An institution-based cross-sectional study was carried out among 416 women from January 1 to January 30, 2023. A systematic random sampling technique was employed. Data were collected by KoboToolbox through face-to-face interviews using a structured and pretested questionnaire. Modified short-form childbirth self-efficacy inventory was used to score self-efficacy. The Statistical Package for Social Sciences, version 27, was used for data management and analysis. Descriptive statistics were calculated for each variable, and a logistic model was used. Statistical significance was determined at a p value of less than 0.05 and 95% confidence level.

Results: A total of 416 pregnant women participated in the study. Two hundred twenty-eight (54.8%) of the pregnant women had low childbirth self-efficacy. Age group in ≤24 years (AOR=3.80, 95% CI: 1.82-8), primigravida (AOR=1.51, 95% CI: 1.10-2.86), unplanned pregnancy (AOR=1.67, 95% CI: 1.02-2.70), poor social support (AOR=2.17, 95% CI: 1.09-4.30), having anxiety (AOR=1.30, 95% CI: 1.10-3.64), having poor knowledge of childbirth (AOR=2.21, 95% CI: 2.09-5.39), and severe fear of childbirth (AOR=6.40, 95% CI: 2.60-9.80) were statistically significant with low childbirth self-efficacy.

Conclusions: The magnitude of low childbirth self-efficacy was high in the study area. Being primigravida, unplanned pregnancy, age≤24 years, severe fear of childbirth, anxiety, poor social support, and poor knowledge were significantly associated with low childbirth self-efficacy. Therefore, giving special attention to these factors during antenatal care would be important.

Advances in Condensed Matter Physics
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2024 (2024)

Enhancement of Magnetization of the Diluted Magnetic Semiconductor (Ga, Mn) As by Hole Doping

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Abstract

In this paper, the effects of hole doping on the magnon specific heat, average number of magnons, magnetization, and Curie temperature (Tc) of the diluted magnetic semiconductor (DMS) (Ga, Mn) As are theoretically studied using green function formalism and employing a model system Hamiltonian consisting of magnons, holes, and interactions between magnons and holes. The specific heat capacity of magnons and the number of magnons are found to decrease in the presence of holes and hole-magnon interaction strength, whereas magnetization and Curie temperature (Tc) increase. Our study also reveals that at a constant finite temperature, an increased number of holes lead to a significant increase in magnetization. However, at T = 0, the ground state magnetization value does not exhibit any change with increased free holes and hole-magnon interaction strength. The increased magnetization resulting from doping with holes or electron excitations in this study may present an opportunity to utilize the system under consideration for spintronics purposes at room temperature.

International Journal of Low-Carbon Technologies
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19 (2024)

Innovative approaches to scaling up hydrogen production and storage for renewable energy integration

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Abstract

The global imperative to reduce greenhouse gas emissions and phase out fossil fuels has prompted hydrogen to emerge as a critical player in the transition to sustainable energy systems and eco-friendly transport solutions. This study endeavors to examine innovative technologies for hydrogen production and storage, with the objective of overcoming the obstacles that impede their widespread adoption. The integration of hydrogen with renewable energy sources is one of the methods that have been investigated. Specifically, the effectiveness of coupling hydrogen fuel cells with wind or solar power systems has been examined in order to ensure a reliable energy supply and improve grid stability. The results of this study present innovative methods for mass hydrogen production, including electrolysis of water and advanced techniques for extracting hydrogen from fossil fuels while minimizing environmental impact. Additionally, this study evaluates strategies for underground hydrogen storage, considering local geological conditions to optimize storage efficiency and safety. The findings indicate that salt caverns offer a secure and stable hydrogen containment system and have a high storage efficiency of up to 90%. The evaluation of depleted gas fields demonstrated promising results in terms of sealing integrity and storage efficiency (88%). The outcomes provide insights into the feasibility of large-scale hydrogen generation and storage, offering valuable guidance for future energy solutions dependent on hydrogen in diverse geographic contexts.

Keywords: energy storage; fuel cells; hydrogen; renewable energy integration; sustainable energy

Biodemography and Social Biology
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69 (2024)

The influence of parental occupational status on under-five mortality in Ethiopia

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Abstract

Few studies have examined the mediators of the association between parental occupational status and under-five mortality risk in Ethiopia. We examine the association between parental occupational status and under-five mortality risk in Ethiopia and the role of two mediating variables, antenatal care visits and delivery by a health professional, in this relationship. Using birth data from the nationally representative 2016 Ethiopia Demographic and Health Survey, the study finds that parental occupation, antenatal care visits, and delivery by a health professional are associated with under-five mortality risk. The study also finds that after controlling for mediating variables, parents engaged in professional, agricultural, and manual labor still have lower odds of under-five mortality risk than children of non-working parents. Future research should focus on the pathway from parental employment to child mortality risk, not through access to antenatal care and delivery by health professionals.

Journal of Blood Medicine
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15 (2024)

Hematological Abnormalities and Associated Factors Among Patients with Hypothyroidism at the University of Gondar Comprehensive Specialized Hospital

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Abstract

Objective: Abnormalities in blood cells are frequently associated with thyroid hormone disorders as a result of their involvement in the proliferation and production of blood cells. This study aimed to determine the magnitude and associated factors of hematological abnormalities in patients with hypothyroidism.

Methods: A cross-sectional study was conducted from January 1 to June 30, 2023, at the University of Gondar Comprehensive Specialized Hospital. The present study included a total of 300 patients with hypothyroidism prospectively using the systematic random sampling technique. The hematological parameter data were collected using data extraction sheets, whereas the associated factor data were collected using both structured questionnaires and data extraction sheets. For complete blood cell counts, 4 mL of anticoagulated venous blood was collected and analyzed. The data were entered into Epi-data version 3.1 and analyzed with Stata version 14. Both bivariate and multivariate logistic regressions were performed to identify factors associated with hematological abnormalities. A P value < 0.05 was considered to indicate statistical significance.

Results: The median value of red blood cell, hemoglobin, mean cell volume, white blood cell, and platelet were 4.63 x1012/µL, 14 g/ dL, 84.3fl, 5.3 x103/µL, and 228, respectively. The overall incidences of anemia, leucopoenia, and thrombocytopenia in patients with hypothyroidism were 26.3% (95% confidence interval (CI): 21–32), 15.7% (95% CI: 14.2–17.2), and 9% (95% CI: 7.5–10.5), respectively. Lymphopenia was detected in 9% (95% CI: 8.6–10.1) of the patients, and neutropenia was detected in 6% (95% CI: 4.4–7.6) of the patients. Only three factors, female sex (adjusted odds ratio (AOR) =2.1, 95% CI=1.3–3.1), alcohol consumption (AOR= 3.8, CI=1.7–8.9), and febrile illness (AOR=2.7, 95% CI=1.3–5.4), were found to be significantly associated factors for anemia.

Conclusion: The present study revealed heterogeneous hematological abnormalities in patients with hypothyroidism. Thus, early diagnosis and monitoring strategies are required to minimize complications in patients.

Keywords: hematological abnormalities, anemia, leucopenia, thrombocytopenia, thyroid dysfunction

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127 (2024)

Machine learning interfaces for modular modelling and operation-based design optimization of solar thermal systems in process industry

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Abstract

The trend of introducing solar thermal systems (STSs) in process industries has resulted in a new energy paradigm– an interactive platform where there are economic benefits and motivations to address sustainable development. On the other hand, this paradigm has also introduced fluctuations and uncertainties not previously seen on the energy system, and is challenging the industry. Industrial STSs are composed of large number of interacting, nonlinear and uncertain subsystems and, therefore are complex systems. This complexity of heterogenous, stochastic, and dynamic behavior make designing of industrial STSs as well as evaluation of their management strategies challenging tasks for the existing tools. In an attempt to support integration decisions, always inefficient and insufficient, machine learning (ML) is leveraged in this research. Following the ML approach, some important findings were made. Firstly, it permits for different releases of the same/different module, which can be easily embedded, coupled exogenously or run in parallel. Thus, the operation-based design approach, both for process and supply level integration of STSs, were scalable and tractable. Distinguished from past work, the approach also allowed testing of an improved STS sizing scheme, while at the same time, enabling optimization of its control concept for adaptive and flexible operation. In the considered case study, inclusion of time-varying heat demand, process temperature and solar irradiation in STS design reduces over-dimensioning by 10–30%. Furthermore, optimizing the control concept of the overall system led to improved energy efficiency of solar field and storage respectively by 23.7% and 8.3% over the state-of-the-art methods.

Frontiers in Nutrition
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11 (2024)

Household food security status and its associated factors among pensioners in Arba Minch town, South Ethiopia

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Abstract

Introduction: Food insecurity has remained a serious public health problem in developing countries, such as Ethiopia, over the past two decades. Vulnerable populations, such as pensioners, have been affected by this problem because of emerging socio-demographic changes, a global financial crisis, and climate change, all of which have contributed to the high food prices. Hence, this study aimed to assess household food security status and associated factors among pensioners in Arba Minch town, South Ethiopia.

Methods: A community-based cross-sectional study design was conducted from September to October 2023. Two hundred forty-four pensioners were chosen using a simple random sampling technique. Data were collected, cleaned, and entered into EPI-Data version 4.6 and exported to SPSS version 25 for analysis. Variables with a p-value of ≤0.25 in the bivariate analyses were candidates for the multivariable regression analysis. In the multivariable logistic regression, variables with a p-value of 0.05 were considered to have a significant association with the dependent variable.

Results: A total of 238 retired people were interviewed, with a response rate of 97.5%. Among the interviewed pensioners, 223 (91.4%) households were food insecure. Having more than one dependent member [AOR = 2.4, 95% C.I: 1.30, 6.64], being jobless after retirement [AOR = 3, 95% C.I:1.17, 5.61], and being in the lowest tertile of wealth status [AOR = 2, 95% C.I:1.36, 4.99] were identified as predictors of food insecurity.

Conclusion: The magnitude of household food insecurity was higher compared to the national average, and factors such as the current occupational status of the household head, dependency ratio, and wealth status of the household were significantly associated with household food insecurity. Therefore, policymakers and programmers should provide new strategies focusing on additional income-generating activities and salary increments and consider free services such as school fees and healthcare.

Keywords: food insecurity, pensioners, Arba Minch town, Ethiopia, Gamo zone

Applied and Environmental Soil Science
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2024 (2024)

Hydrogeochemical Evaluation of Groundwater Quality and Its Applicability for Various Purposes in the Drought-Prone Konso Zone, Rift Valley, Southern Ethiopia

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Abstract

Te present study area, the Konso Zone, is in Rift Valley, Southern Ethiopia, and highly depends on rivers and groundwater for economic and social development. Water availability in this area faces multiple challenges, including scarcity, quality concerns, and seasonal variations. In the Rift Valley region, including the present study area, groundwater quality is particularly problematic due to high fuoride levels. Moreover, the high concentrations of total dissolved solids in Konso Zone groundwater pose challenges for industrial, agricultural, and drinking purposes. GIS-based spatial analysis techniques, hydrogeochemical analyses, and water quality indices were used in the current study. Te evaluation of water quality involved the utilization of both groundwater quality and irrigation water quality indices. In the study area, the cations and anions exhibited a general trend with $Na^+ > Mg^{2+} > Ca^{2+} > K^+ > Fe^{2+}$ and $HCO_3^- > Cl^-$, $SO_4^{2-} > NO_3^- > F^-$. Multiple water types were identifed within the research area, including Na-HCO_3, Ca-Na-HCO_3, NaCl, and Ca-Mg/Cl, with Na-HCO_3 being the most prevalent. Te formation of the $NaHCO_3$ water type is primarily attributed to ion exchange processes, with siliciclastic aquifers being linked to cation exchange in sodium bicarbonate groundwater. Total Dissolved Solids and SO_4^{2-} contaminants signifcantly impact the water quality, resulting in deterioration. Gibbs's fgure indicates that 50% of the water samples were found where rocks were weathered, demonstrating the importance of water-rock interactions in groundwater composition. Water samples containing more fuoride than the WHO's limit of 1.50 mg/L were deemed unsuitable for consumption. Regarding irrigation suitability, most water samples from the Konso area were acceptable, except for the sodium percentage in 66.6% of the samples, which was unsuitable for irrigation. Tere are 26.67% of samples that are of questionable quality, 66.67% that are deemed inappropriate, and 26.67% that are deemed unacceptable. Tese fndings underscore the pressing need for comprehensive strategies and interventions to address water quality issues in the Konso Zone, emphasizing the critical importance of monitoring and managing groundwater resources to ensure sustainable and safe water access for various regional uses.

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Local Entropy Based Remora Optimization and Sparse Autoencoders for Cancer Diagnosis Through Microarray Gene Expression Analysis

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Abstract

Gene expression analysis can be used as a tool to detect cancer and the type of cancer in its early stages. However, the computational complexity for gene expression analysis is quite high due to the large amount of numerical data. Hence, dimensionality reduction techniques are employed to reduce the computational complexity, which in turns reduces the accuracy of cancer diagnosis. This research work focuses on the development of computerized tools with reduced computational complexity and increased accuracy to identify cancer cells in five different regions, namely breast, liver, lung, prostate, and renal. Sparse autoencoder is implemented to reduce feature dimensions, and Remora Optimization is used to increase the performance of cancer diagnosis system through transformation of features. The local entropy-based fitness function is utilized to evaluate the appropriateness of population in Remora Optimization algorithm, and it is considered as the important reason for performance improvement in the proposed cancer diagnosis system. 1027 patients are taken into consideration in this analysis of the microarray datasets, which were gathered from the Curated Microarray Database. Six distinct metrics are used to examine the classification performance, and four different supervised classifiers are investigated. When the suggested sparse autoencoder and local entropy-based Remora Optimization are applied, the average balanced accuracy of the examined classifiers is 93.4%. The average dimensions are decreased from 36045 to 80 dimensions using the suggested method. In the absence of the suggested methodology, the vanilla classifiers yield an average balanced accuracy of 82.7

Index terms: Cancer, entropy, sparse autoencoder, remora optimization, dimensionality reduction, deep, learning, machine learning.

Drug Design, Development and Therapy
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18 (2024)

Synthesis of a New Series of Anthraquinone-Linked Cyclopentanone Derivatives: Investigating the Antioxidant, Antibacterial, Cytotoxic and Tyrosinase Inhibitory Activities of the Mushroom Tyrosinase Enzyme Using Molecular Docking

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Abstract

Purpose: New bioactive anthraquinone derivatives are investigated for antibacterial, tyrosinase inhibitory, antioxidant cytotoxic activity, and molecular docking. Methods: The compounds were produced using the grindstone method, yielding 69 to 89%. These compounds were analyzed using IR,1 H, and13C NMR and elemental and mass spectral **methods**: Additionally, the antibacterial, antioxidant, and tyrosinase inhibitory activities of all the synthesised compounds were evaluated.

Results: Compound 2 showed remarkable tyrosinase inhibition activity, with an (IC50: 13.45 µg/mL), compared to kojic acid (IC50: 19.40 µg/mL). It also exhibited moderate antioxidant and antibacterial activities with respect to the references BHT and ampicillin, respectively. Kinetic analysis revealed that the tyrosinase inhibitory activity of compound 2 was non-competitive and competitive, whereas that of compound 1 was low. All compounds (1-8) were significantly less active than doxorubicin (LC50: 0.74±0.01µg/mL). However, compound 2 affinity for the 2Y9X protein was lower than kojic acid, with a lower docking score (−8.6 kcal/mol compared to (−4.7 kcal/mol), making it more effective.

Conclusion: All synthesized compounds displayed remarkable antibacterial, tyrosinase inhibitory, antioxidant, and cytotoxic activ-ities, with compound 2 showing exceptional potency as a multitarget agent. Anthraquinone substituent groups may offer the potential for the development of treatments. The derivatives were synthesized using the grindstone method, and their antibacterial, antioxidant, tyrosinase inhibitory, and cytotoxic activities were inspected. Molecular docking and molecular dynamics simulations were performed using compound 2 and kojic acid to validate the results and confirm the stability of the compounds.

Keywords: anthraquinone, tyrosinase enzyme, antioxidant activity, molecular dockingbinding affinitykojic acidantibacterial activitycytotoxic activity

Frontiers in Stroke
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3 (2024)

Post stroke aspiration pneumonia, associated factors, and treatment outcome among stroke patients admitted to Tibebe Ghion Specialized Hospital, Bahir Dar, Ethiopia

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Abstract

Background: Post-stroke aspiration pneumonia is a serious lung infection that occurs when stroke patients inhale food, saliva, liquid, vomit, or foreign objects. It is the leading cause of death for stroke patients worldwide, which accounts for 60% of stroke-associated deaths. Little is known about its prevalence, adverse outcomes, and determinants in Ethiopia. Therefore, this study aims to evaluate the prevalence of post-stroke aspiration pneumonia and associated factors in stroke patients admitted to the Tibebe Ghion Specialized Hospital.

Methods and materials: A retrospective cross-sectional study was conducted on 242 stroke patients admitted to the neurology unit of a medical ward from January 1, 2019, to December 30, 2020. Data were collected from the patients' cards using a pre-developed data collection tool. The collected data was coded, cleaned, and entered into Epi-Info version 7.25, and then exported to SPSS 26 for further analysis. Logistic regression analyses were performed to identify factors associated with aspiration pneumonia. The adjusted odds ratio with the corresponding 95% confidence interval and a $p < 0.05$ were noted to declare variables had a significant association.

Results: The mean age of the patient was 61.15 ± 13.959 years with a minimum age of 21 and maximum age of 102 years. Males account for 55.8% and females for 44.2%. Out of 242 patients post-stroke aspiration pneumonia was identified in 23.1% of patients, and 55.4% of stroke patients improved, while 23.2% died from post-stroke aspiration pneumonia. The study found that having dysphagia (AOR = 3.05; 95% CI: 1.13, 8.21), feeding through a Nasogastric tube (AOR = 10.58; 95% CI: 4.58, 24.42), and a GCS level of 8–12 (AOR = 2.58; 95% CI: 1.04, 6.42) were independent predictors of post-stroke aspiration pneumonia.

Conclusion: This study found a high prevalence of post-stroke aspiration pneumonia and its associated mortality. Stroke patients with dysphagia, low levels of consciousness, and those who are fed through a tube are at a higher risk of developing this condition. Therefore, it is crucial to provide special care to stroke patients with these conditions. The study also highlights the importance of assessing the practice of preventative measures for PSAP among stroke patients in this study setting. Copyright © 2024 Nigus, Sendek, Ewunetu, Cherkos and Yimer.

Keywords: post-stroke aspiration pneumonia, prevalence, stroke, Tibebe Ghion Specialized Hospital, treatment outcome

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Near miss road traffic accidents and associated factors among truck drivers in Gamo zone, southern Ethiopia by using a contributory factors interaction model

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Abstract

Background: Road traffic accidents (RTAs) are among the leading causes of injuries, fatalities, and the resulting increase in financial burdens worldwide. Every year, RTAs cause numerous serious injuries and fatalities in Ethiopia. it is important to understand how prevalent near-miss crash accidents are, and which by definition could have injured the victim but did not result in an actual accident. The determinants of these near-misses are essential in road crash accident reduction strategies. In spite of the fact that near-miss accidents are much more common than actual losses or injuries, very little research has been conducted on them. Thus, this study was intended to assess the near-miss accidents and associated factors among truckers in Gamo zone, southern Ethiopia.

Methodology: The community-based cross-sectional study was employed from May 12 to July 10,2022, using a structured interviewer-administered questionnaire. A simple random sampling technique was used to select participants. The data were analyzed using the statistical package for social sciences. A binary and multivariate logistic regression model was used to identify the determinants of near-miss accidents. A statistical significance level was set at $p < 0.05$.

Results: About 72.5% of truckers had experienced near-miss road traffic accidents. The majority of the near-miss accidents were caused by speeding, followed by driving on the wrong side of the road and skidding, 65 (22.6%), 39 (13.5%), and 38 (13.2%), respectively. Driving frequency per week, location of accidents, condition of the road, sleeping status, and weather conditions were significantly associated with near-miss accidents.

Conclusion: The prevalence of near-miss accidents is high in the Gamo zone. Being a younger and less educated driver, high driving frequency per week, driving on major roads and junctions, foggy weather, and inadequate sleep all contribute to the occurrence of accidents. Road safety measures that could address these identified factors are required to mitigate potential RTAs.

Keywords: near-miss accident, road traffic accident, truck drivers, Gamo zone, banana transportation

Risk Management and Healthcare Policy
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17 (2024)

Catastrophic Health Expenditure and Associated Factors Among Hospitalized Cancer Patients in Addis Ababa, Ethiopia

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Abstract

Background: Out-of-pocket (OOP) health expenditures for cancer care expose households to unanticipated economic consequences. When the available health services are mainly dependent on OOP expenditure, the household faces catastrophic health expenditure (CHE). This study aimed to estimate the incidence and intensity of CHE in hospitalized cancer patients and identify coping strategies and associated factors.

Method and Material: Hospital-based cross-sectional study design was conducted on 305 cancer inpatients in Addis Ababa between November 2021 and February 2022. All patients with cancer who were hospitalized during the data collection period were included in the study. The incidence of CHE was estimated at the 40% threshold of households' non-food expenditure and the intensity of CHE was captured based on the amount by which household expenditure exceeded the threshold and mean positive overshoot, the mean level by which CHE exceeds the threshold used. Multivariate logistic regression was used to assess the relationship between CHE levels and the independent variables.

Results: The incidence of CHE at the 40% threshold of households' non-food expenditure was 77.7%, while the O and MPO were 36.2% and 46.6%, respectively. CHE for cancer care was significantly associated with patient residence, increased number of chemotherapy cycles, increased duration of hospital admission, lack of insurance enrolment, and lower-income quintiles. Saving and selling assets were identified as the primary coping mechanisms.

Conclusion: The incidence and intensity of CHE among inpatients with cancer were high and which could lead to impoverishment of households. Improved quality and coverage of health insurance and decentralizing cancer care to regions standards similar to Addis Ababa will save households from incurring CHE.

Keywords: catastrophic out-of-pocket health expenditure, coping mechanismsn cancerEthiopia

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29 (2024)

Synthesis, antimicrobial, antioxidant, tyrosinase inhibitory activities, and computational studies of novel chromen[2,3-c] pyrazole derivatives

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Abstract

In this study, one-pot multicomponent reactions of novel chromeno[2,3-c] pyrazole derivatives (1–14) were performed using an AlCl3 catalyst via cyclisation. Various spectral and chromatographic techniques were used to elucidate the structure of the synthesised derivatives (1–14). The synthesised compounds were then inspected for their antibacterial, antioxidant, and tyrosinase inhibition activities. An in-silico screening approach was also employed to identify highly potent derivatives. Besides, we utilised density functional theory (DFT) with the B3LYP/6-31G+ (d, p) basis set to optimise the newly modified derivatives. This approach was used to calculate various properties, including electron density, electrostatic potential map, interaction strength, frontier molecular orbital energy, and reactivity characteristics. To examine the binding affinity, modes, and stability of the protein-drug complex, molecular docking with the 2Y9X protein structure were employed. The findings from DFT computations, along with physicochemical information and molecular docking binding affinity, showed promising results than standard and low active compound 1. The absorption, metabolism, and cytotoxic characteristics of all the novel derivatives were investigated in the ADMET prediction. Our findings could prove valuable in developing novel drugs for medicinal and pharmaceutical fields.

Keywords: Antibacterial activity, Antioxidant activity, Chromeno[2,3-*c*]pyrazole derivatives, Tyrosinase inhibitory activity

Frontiers in Pediatrics
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Determinants of neonatal hypoglycemia among neonates admitted to neonatal intensive care units of public hospitals in Wolaita Zone, Southern Ethiopia, 2023: An unmatched case–control study

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Abstract

Background: Globally, neonatal hypoglycemia is a common child health problem and significantly contributes to morbidity and mortality, with its impact being particularly detrimental in developing countries. Although being a prevalent metabolic condition, it is frequently overlooked. Furthermore, the problem is not adequately studied in Ethiopia, as seen by a few published studies on the topic, highlighting the lack of knowledge about its determinants. Objective: This study aims to assess the determinants of neonatal hypoglycemia among neonates admitted to neonatal intensive care units of public hospitals in Wolaita Zone, Southern Ethiopia, 2023.

Methods: An institution-based unmatched case–control study design was conducted among 249 (83 cases and 166 controls) participants. Data were collected from 29 March to 23 May 2023 using a pretested chart review extraction tool/checklist. A consecutive sampling method was used for participant selection. Data were analyzed using Statistical Package for Social Science version 25. Binary logistic regression analysis was used to identify the determinants of neonatal hypoglycemia, and statistical significance was declared at $P < 0.05$.

Results: A total of 83 cases and 166 controls were included in the study. The following factors were significantly associated with neonatal hypoglycemia: preterm neonates [adjusted odds ratio (AOR) 4.888 (95% confidence interval, CI, 1.113–21.478)], age of the neonate at admission (3–5 h) [AOR 4.205 (95% CI 1.852–9.547)], hypothermia [AOR 5.485 (95% CI 2.360–12.748)], late initiation of breastfeeding [AOR 6.229 (95% CI 2.665–14.599)], mode of delivery [AOR 5.034 (95% CI 1.688–15.011)], and small for gestational age [AOR 3.645 (95% CI 1.286–10.330)].

Conclusion and recommendation: In the current study, numerous determinants of neonatal hypoglycemia have been identified. Therefore, it is crucial to give due emphasis to providing comprehensive health education to mothers regarding effective breastfeeding methods, strategies to avoid neonatal hypoglycemia, and the various factors that heighten its likelihood. In addition, healthcare professionals should emphasize implementing preventive measures to prevent this grave condition.

Keywords: neonatal, hypoglycemia, determinants, case–control, Wolaita

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Climate change and its impact on streamflow in the upper Blue Nile River Basin, Ethiopia

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Abstract

To reduce uncertainty in climate projection and accompanied stream flow prediction, three CMIP5 climate model's ensemble means outputs of baseline and scenarios (RCP4.5 and 8.5) combined with HEC-HMS4.2 hydrological modelling of three large sub-basins were applied to estimate impact of climate change on streamflow of upper Blue Nile River Basin, Ethiopia. Mean annual, seasonal climate and streamflow changes were assessed for each sub-basin. Rainy season (June to September) precipitation becomes enhanced, while it becomes reduced during other seasons, hence mean annual decreased relative to historical. Average wet and dry season runoff change ranges from +67% to –52.16% and +62.6% to -59% under RCP4.5 and RCP8.5 during the mid-term (2050s), while during long-term (2080s) changes from +61.3% to –57% and +78.3% to -53.6% across three sub-basins. The projected mean annual streamflow showed a decrement of 10.6% for Kesse and Belles sub-basins and an increment of up to 25% for Didessa sub-basin.

Keywords: climate change, streamflow, water resource, Blue Nile River Basi

Earth Sciences Research Journal
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Intercomparison of multisource actual evapotranspiration satellite products in Bilate watershed, Ethiopia; [Intercomparación de productos satelitales multifuente que miden la Actual Evapotranspiración en la cuenca de Bilate, Etiopía]

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Abstract

Recent advancements in satellite remote sensing have led to increased spatial and temporal resolution of actual evapotranspiration (AET) estimates across scales. Yet, the accuracy of AET products remains unknown for many regions, prompting further investigation to guide selection. This study intercompares five AET products within Ethiopia's Bilate watershed, focusing on the 2009-2018 period. The products assessed include TerraClimate, Food and Agriculture Organization Water Productivity (FAO WaPOR), Moderate Resolution Imaging Spectroradiometer Operational Simplified Surface Energy Balance (ModisSSEBop), and Synthesis of Global AET. Reference evapotranspiration estimated using ground station climate data served as a basis for comparing the Satellite Products (SP). The intercomparison was con-ducted using descriptive statistics, scatter plots and Pearson's Correlation Coefficient to assess correlation, standard deviation, and root mean square error. Additional error statistics were also considered. Findings reveal higher AET values in the highlands compared to the lowlands of the Bilate watershed. A weak correlation (<0.35) exists between ETo and satellite-derived AET, potentially due to the averaging of AET values across diverse land cover classes, contrasting with point-scale reference measurements. The variance among AET products was varied across seasons and elevation ranges. While the annual patterns of AET were consistent across the products, large discrepancies in magnitude (average AET varies from 25 to 83 mm per month in the lower part) were detected. The ModisSSEBop global and continental products showed minimal mismatches, whereas the Synthesis of Global and FAO WaPOR products displayed slight differences. Notably, the FAO WaPOR's AET estimates showed relatively closer agreement with many products in terms of magnitude and variability of AET. In conclusion, the study highlights significant random and systematic differences between the AET products. The substantial mismatch between the products underscores the necessity for continued research to refine AET product accuracy through improved input dataset and revisiting the algorithms.

Keywords: Actual Evapotranspiration; Bilate; Intercomparison; Multisource; Remote Sensing, Evapotranspiration products

Data Analytics and Artificial Intelligence for Earth Resource Management
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Groundwater potential zone evaluations for improving resource management with spatial analysis approach

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Abstract

Groundwater is essential for commercial activities, agricultural, and residential purposes. The extraction of groundwater reserves in Ethiopia poses challenges due to complex geological formations, seasonal variations, and concerns regarding water quality. This study provided a comprehensive analysis of the likelihood of groundwater in the region. The study evaluated many geological attributes, including precipitation patterns, lineament density (LD), landforms, slope gradient, soil quality, water channel density, and land use and cover. The study categorized groundwater into four distinct classifications: extremely low, low, moderate, and high. The Western study focuses on a mere 0.68% of the possible groundwater. The central, western, and eastern regions exhibited a prevalence rate of 21.1%. The analysis identified a moderate groundwater potential zone, accounting for 77.31% of the total. 0.91% of the research area was occupied by the high-potential zone. In the high zone, quaternary deposits give rise to elevated lineaments, grabens, and horsts. The low zone is characterized by the presence of compacted basaltic rocks, low lineaments, and broad drainage systems. The removal of geology and precipitation from the theme layer maps resulted in a 32.14% and 45.33% rise in the low groundwater potential zone (GWPZ). The poor potential decreased by 1.89% and 1.5%, the high GWPZ decreased by 0.82% and 0.91%, and the intermediate potential decreased by 46.4% and 32.73%. The elimination of LD resulted in a reduction of 0.24% and 14.21% in poor- and low-potential zones while increasing moderate- and high-potential zones by 8.73% and 5.73%, respectively. This study employed a comprehensive methodology to investigate the groundwater zones and quality of Ethiopia's Omo River Valley. Displayed are variables that could impact groundwater zones. This study facilitates the management of groundwater, allocation of resources, and strategic planning of land use in the analyzed region. Results aid in the preservation of groundwater resources.

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Comparative nutrient utilization efficiency on diets containing combined fruit wastes in view of browser/grazer dichotomy in Ethiopian settings: Woyito-Guji bucks versus Doyo-Gena rams

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Abstract

The use of agricultural and food industry waste as animal feed is considered as best option to fill feed shortage gap and efficient utilization of available resources within food-feed production circularity. The aim of this study was to compare the effectiveness of combined fruit waste meal utilization between Woyito-Guji bucks' vs. Doyo-Gena rams in a 2 × 4 randomized crossover design with two species, four diets and four periods. The treatments were grass hay with 0% fruit waste (FW) + 100% concentrate mix (CM) (T1), 25% FW + 75% CM (T2), 50% FW + 50% CM (T3) and 75% FW + 25% CM (T4). Regardless of species variation, T1, T2 and T3 had comparable ($p > 0.05$) body weight gain and feed conversion efficiency values higher ($p < 0.05$) than that of T4. However, daily nutrient intake measurements of all prepared diets in this particular study shown that Doyo-Gena lambs score higher values ($p < 0.05$) than that of Woyito-Guji goats in all treatment groups. The nutrient digestibility values for organic matter (OM) and dry matter (DM) scored similarly but that of Crude Protein (CP), Neutral Detergent Fiber (NDF), Acid detergent fiber (ADF) and Ash scored higher ($p < 0.05$) for Woyito-Guji bucks as compared to Doyo-Gena rams. As a result, similar values for daily body weight gain and feed conversion efficiency were recorded in spite of feed intake variation between species. In general, both species had an improvement in nutrient intake, digestion and performance when fruit wastes were added as an alternative feed, although sheep experienced the greatest improvement.

Keywords: Doyo-Gena rams, fruit waste, nutrient utilization, Woyito-Guji bucks

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69 (2024)

Predictors of Overweight/Obesity Among Preschool Children in Arba Minch City, Southern Ethiopia: Does Consumption of Sweet Food Predispose to Overweight/Obesity?

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Abstract

Objectives: Childhood overweight/obesity is a serious public health problem in the world today especially low-and-middle income countries like Ethiopia. This study aimed to assess the prevalence of overweight/obesity and associated factors among preschool children. **Methods:** A community-based cross-sectional study was conducted among preschool children aged 3–5 years in Arba Minch city from April to June 2022. A multistage sampling method was used to select 577 study participants. Data were collected using a structured and pretested questionnaire. A binary logistic regression model was used for analysis. An adjusted odds ratio (AOR) with a 95% confidence interval (CI) was used to assess the strength of the association. **Results:** The combined prevalence of overweight/obesity was 23.9% (95% CI: 20.5, 27.6). Age of 36–47 months, family size < five, watching TV/video for ≥2 h, and consuming sweet foods, were factors associated with being overweight/obese among preschool children. **Conclusion:** Overweight/obesity was predicted by consuming sweet foods, long time TV/video watching, and large family size in the study area. Special attention should be given to child feeding practices and reducing sedentary lifestyles.

Keywords: overweight, obesity, preschool children, Arba Minch, South Ethiopia

International Journal of Hydrology Science and Technology
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18 (2024)

Groundwater recharge and its response to land use – land cover dynamics in Biji catchment of Marodi-Jeeh, Somaliland

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Abstract

The land cover dynamics in Biji catchment of Somaliland was undertaken to evaluate groundwater (GW) recharge response to LULC change using integrated geospatial and distributed modelling approach. Satellite imagery (Land sat TM and ETM+ 30 m) classification of 1986, 2005 and 2019 using Arc GIS software image processing techniques were employed. Land use change of agriculture over the last 33 years was assessed as 16.8%–24.8%, bare land 15.8%–14.9%, shrub 67.3%–59.7%, and built-up 0.06%–0.5%. The water balance indicates evapotranspiration loss of 61.1%, runoff 4.7%, and GW-recharge 34.2%. GW recharge response of land use dynamics in the last three periods was about 135.8, 142.5, and 137.7 mm, respectively which is predominantly due to agricultural expansion and urbanisation. During the same period, WetSpass model was used to estimate total flow with a correlation coefficient of 0.82 and 0.88 respectively at a statistically significant level.

Keywords: Biji catchment, Somaliland, groundwater recharge, LULC, WetSpass model

Transactions of the Royal Society of Tropical Medicine and Hygiene
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118 (2024)

Public perceptions of genomic studies and hereditary diseases in Aari community, South Omo Zone, Ethiopia

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Abstract

Background: Genetic and genomic research is revolutionizing precision medicine; however, addressing ethical and cultural aspects is crucial to ensure ethical conduct and respect for community values and beliefs. This study explored the beliefs, perceptions and concerns of the Aari community in South Ethiopia regarding genetic concepts, hereditary diseases and ethical research practices related to sample collection, storage and sharing.

Methods: In-depth interviews and focus group discussions were conducted with community elders, health officials, tuberculosis patients and apparently healthy individuals. Data were thematically analysed using MAXQDA software.

Results: Participants identified diseases such as podoconiosis, leprosy, goitre and epilepsy as hereditary and perceived some as 'curses' due to generational impact and social stigma. Disease susceptibility was attributed to divine intervention or factors such as malnutrition and sanitation. Although hereditary diseases were considered unavoidable, in some cases environmental factors were acknowledged. Participants shared personal examples to demonstrate inheritance concepts. Blood held cultural significance, and concerns about its potential misuse resulted in scepticism towards giving samples.

Conclusions: This study emphasizes the significance of comprehending local beliefs and perceptions and stresses the need to establish effective communication, build trust and address underlying causes of hesitancy to improve recruitment and ensure ethical conduct.

Keywords: community engagement, cultural beliefs, Ethiopia, genetics, hereditary diseases, research practices

Frontiers in Reproductive Health
DOI: https://doi.org/10.3389/frph.2024.1416280
6 (2024)

Spatial distribution and urban–rural disparity of unmet need for family planning among married/in-union women in Ethiopia: a spatial and decomposition analysis

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Abstract

Background: High unmet need for family planning combined with other factors, such as high early marriage and teenage pregnancy, increases the risk of developing obstetric fistula and other complications. This study aimed to assess spatial distribution and urban–rural disparities of unmet need for family planning among married/in-union women in Ethiopia.

Methods: The study was conducted on secondary data from a cross-sectional survey that was conducted nationally between September and December 2019 using a two-stage cluster design on a total of 265 enumeration areas. A total weighted sample of 5,349 married/in-union women was included in the analysis. ArcGIS Pro and SaTScan software were used to handle spatial analysis. Finally, multivariable decomposition analysis via a logit model was used to decompose the observed difference in unmet need by the compositional difference and the difference in effects of explanatory variables between places of residence.

Results: Spatial distribution of unmet need for family planning was clustered in Ethiopia with a global Moran's I index value of 0.25 (p-value = 0.004). Accordingly, enumeration areas in West Hararge, Arsi, Bale, Gujji, Borena, Jimma, and East Wellega zones of Oromia region, and Gurage, Hadiya, Silte, Gedio, Sidama, Wolaita, Alaba, and Dawro zones of South Nation and Nationality People region, and the southern part of Zone 3 in Afar region were detected as hotspot areas. The decomposition results revealed that there is a significant disparity in unmet need between urban and rural resident women (0.074, p-value < 0.001). Endowment and coefficient factors accounted for the urban–rural disparity, contributing 68.32% and 31.68%, respectively. Household size, husband’s opinion of family planning, community acceptance of family planning, woman’s age at first sexual intercourse, and the woman's age were key determinants of the urban–rural disparity.

Conclusion: The results revealed a significant disparity in the unmet need for family planning based on place of residence, with a clustered spatial distribution across the study area and notable hotspot areas. Thus, targeted interventions should focus on mobilizing resources to high-risk areas and addressing the needs of high-risk groups to reduce the observed variation.

Keywords: unmet need, family planning, spatial analysis, multivariate decomposition, urban–rural disparity, Performance Monitoring for Action, PMA, Ethiopia

Frontiers in Public Health
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12 (2024)

Measles second dose vaccine uptake and associated factors among under-five children in Jigjiga City, Somali Region, Eastern Ethiopia: a community-based cross-sectional study

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Abstract

Background: Measles is one of the leading causes of under-five mortality and morbidity worldwide. Although the routine service for the second dose of the measles-containing vaccine (MCV2) was introduced in Ethiopia recently, there is a paucity of evidence regarding its coverage and the factors that hinder its uptake at both the local and national levels. Thus, this study aimed to assess the uptake of MCV2 and its associated factors among children aged between 15 and 36 months old in Jigjiga City, Somali Region, Ethiopia.

Methods: A community-based cross-sectional study was conducted among 429 children aged between 15 and 36 months old with their mothers/caregivers in Jigjiga City from April 1 to May 1, 2023. A multistage sampling technique was used and data were collected by using structured interviewer-administered questionnaires. The collected data were entered into Epi-data version 3.2 and analyzed in a statistical package for the social sciences (SPSS) version 26. Bivariate and multivariable logistic regression analyses were performed to identify factors associated with the uptake of the measles second dose vaccine. An adjusted odds ratio with 95% CI were reported and statistical significance was declared at $p < 0.05$.

Results: The coverage of MCV2 among children aged between 15 and 36 months was 21.4% (95% CI: 17.7, 25.2). The educational status of the mother (AOR = 3.154; 95% CI: 1.68, 5.93), place of delivery (AOR = 1.90; 95% CI: 1.08, 3.25), postnatal care visits of the mother (AOR = 2.40; 95% CI: 1.37, 4.22), time taken to reach a health facility (AOR = 2.67; 95% CI: 1.28, 5.57), and knowledge about child vaccination (AOR = 2.43; 95% CI: 1.45, 4.08) were factors significantly associated with the uptake of the measles second dose vaccine.

Conclusion: The coverage of MCV2 in the study area was low compared to the national immunization targets. Educational status of the mother/caregivers, place of delivery, postnatal care visits of the mother, time to reach a health facility, and knowledge about vaccination of children were significantly associated with measles second dose vaccination. The focus should be given to improving the awareness of mothers on the importance of child vaccination to improve the uptake of measles second dose vaccine and reduce the burden of measles in the region.

Keywords: measles, MCV2, children, Somalia, Ethiopia

Frontiers in Endocrinology
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15 (2024)

Diabetic microvascular complications and associated factors in patients with type 2 diabetes in Southern Ethiopia

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Abstract

Background: Microvascular complications are long-term complications that affect small blood vessels, usually developed in diabetes, and are primary causes of end-stage renal disease, several painful neuropathies, and blindness. Thus, this study aimed to determine diabetic microvascular complications and factors associated with them among patients with type 2 diabetes.

Methods: An institution-based cross-sectional study was conducted among 378 type 2 diabetes patients. The presence of at least one diabetic microvascular complication diagnosed by physicians and found on the record was considered to have microvascular complications. The data was collected by reviewing the medical records of T2DM patients who were on follow-up from January 1, 2012, to December 31, 2021. The collected data was entered into EpiData version 3.1 and analyzed by Stata version 14. Bivariate and multivariable logistic regression were used to identify statistically significant risk factors for diabetic microvascular complications at p-value < 0.05.

Results: Patients with type 2 diabetes mellitus had a prevalence of diabetic microvascular complications of 26.5% (95% CI: 22.0%, 30.9%). Diabetic neuropathy was the highest (13.2%), followed by diabetic nephropathy (12.4%), and diabetic retinopathy (6.4%). Increasing age, poor glycemic control, hypertension comorbidity, anemia, positive proteinuria, a longer duration of type 2 diabetes mellitus, and hypercholesterolemia were significantly associated factors with diabetic microvascular complications.

Conclusion: Diabetic microvascular complications were highly prevalent. Therefore, the study suggests that interventional strategies should be taken for poor glycemic control, hypertension comorbidity, anemia, positive proteinuria, and hypercholesterolemia to control the development of diabetic microvascular complications in patients with type 2 diabetes.

Keywords: microvascular complications, prevalence, associated factors, T2DM, southern Ethiopia

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Doping and Pressure Effects on Yttrium Hydrogen Selenide: Tuning and Enhancing Photochromic Behavior

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Abstract

In this paper, the structural, electronic, phonon, and optical properties of lanthanum (La)-doped yttrium hydrogen selenide (YHSe), along with the effects of pressure variations on its optical properties, are investigated using the density functional theory method. Both the La-doped and YHSe systems are dynamically stable, as indicated by phonon calculations showing no imaginary frequencies in the Brillouin zone (BZ). The influence of pressure on optical properties is examined, revealing that increased pressure enhances these properties, particularly by improving the absorption coefficient in the ultraviolet (UV) range. Moreover, the bandgap energy of both La-doped YHSe and YHSe compounds is explored. Increasing La concentration reduces the bandgap and enhances the density of states (DOS) at Fermi energy, inducing metallic characteristics in YHSe. Furthermore, the optical properties are examined at various La concentrations, most of which exhibit a nonlinear relationship as the La concentration increases. Doping under extreme conditions significantly enhances the optical properties of La-doped YHSe, particularly in the UV-light wavelength range. Specifically, the absorption coefficient reaches its maximum value in the energy range of 6.678 −13.023 eV within the UV region for all concentrations, indicating strong absorption in this range. This suggests the material's effectiveness in absorbing electromagnetic radiation, particularly in the UV range, making it a promising candidate for photochromic applications. A thorough exploration of the optical properties under doping reveals prominent peaks, particularly in response to the UV spectrum, with a slight shift toward higher energies beyond the UV range. This suggests that the material under study holds promise as a candidate for sustained photochromic performance over time.

Keywords: DFT; doping; extreme-pressure; phonon; photochromic materials; yttrium hydrogen selenide

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Access to essential medicines used in the management of noncommunicable diseases in Southern Ethiopia: Analysis using WHO/HAI methodology

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Abstract

Objectives: This study aims to assess access to essential medicines used in the management of noncommunicable diseases through analysis of the availability, prices, and affordability of these essential medicines in Arba Minch town, Gamo Zone, Southern Ethiopia.

Methods: A cross-sectional design was carried out using the World Health Organization/health action international methodology between 2 March and 2 May 2023, within public and private healthcare facilities located in Arba Minch town, Southern Ethiopia. The median price ratio served as a metric. Statistical tests like the Shapiro-Wilk and Kolmogorov-Smirnov were utilized to assess the normal distribution of price data. The Wilcoxon-Mann-Whitney U test was also employed to compare median buyer's prices (patient prices) between public and private healthcare institutions. Treatment affordability was determined by estimating the number of days' wages required by the lowest-paid government employee in Ethiopia to afford the prescribed medication regimen.

Results: Among 23 health facilities surveyed, the pooled availability of essential medicine used in the management of noncommunicable diseases was 18.7% (range: 0%–30.1%), with the public and private facilities contributing 16.3% and 38.3%, respectively. The overall percentage of availability originator brand versions was 1.1% for overall health sectors, 0.6% for public sectors, and 1.2% for private sectors. The overall percent availability of lowest price generics was 36.2% (range: 0%–26.2%; public: 32.0%; private: 37.1%). Only seven lowest price generics satisfied the World Health Organization target of 80% and above. The overall median price of lowest price generic medicines in private was two times higher than in public sectors. The top five median price scorers were amlodipine, furosemide, insulin, beclomethasone, and salbutamol. The Mann-Whitney U test showed that 11.6% of lowest price generics medicines had a statistically significant median price disparity between the public and private sectors ($p < 0.05$). The overall percent of unaffordability was found to be 100.0%, (public: 70.4; private: 100.0%).

Conclusions: This study revealed the limited availability and potential financial burdens on patients seeking essential noncommunicable disease medications. Limited availability suggests the need for better supply chain management and consistent stock availability. The price disparities and affordability challenges identified underscore the necessity for policy interventions such as price regulation and subsidized programs to ensure equitable access to essential noncommunicable disease medications in Arba Minch town, Southern Ethiopia.

Keywords: Access to medicine, availability, prices, affordability, essential medicines, noncommunicable diseases, Arba Minch town

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India and Bangladesh: an analysis of bilateral trade between two emerging economies of SAFTA

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Abstract

The paper analyses India-Bangladesh bilateral trade with reference to South Asian Free Trade Area. For the purpose of analysis, the data period ranges from 1995 to 2019. The primary analysis reveals that bilateral trade has been weak, lackadaisical and the SAFTA agreement has not brought about any perceptible change in bilateral trade performance of these two countries. The causes of poor trade performance have been checked by applying revealed comparative advantage (RCA) as suggested by Balassa (1965) and trade complementarity index (TCI) as suggested by the International Trade Department of World Bank (ITD-World Bank, 2010). The prospect of intra-industry increment was also examined by using Grubel-Lloyd index introduced by Grubel and Lloyd (1971). The analysis reveals that India and Bangladesh suffer from lack of export specialisation in a majority of product groups and weak trade complementarities exist between them.

Keywords: India-Bangladesh trade, revealed comparative advantage, RCA, trade complementarity, Grubel-Lloyd index, SAARC, SAFTA, India, Bangladesh

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Investigation of Woody Species Composition, Diversity, and Carbon Stock under Agroforestry Practices in Oromia National Region State, Central Ethiopia

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Abstract

Agroforestry is a common practice in the tropics that is characterized by various activities such as parkland on cultivated lands or home garden agroforestry around homesteads. In Ethiopia, agroforestry is an ancient land use type that is practiced by smallholder farmers. Scattered trees in cropland or parkland trees and home garden trees are old agroforestry practices, and the most dominant practices exist in different parts of Ethiopia. They cover large areas of highland, midland, and lowland agroecologies of Liban Jawi District in West Showa of Oromia National Regional State, Central Ethiopia. However, woody species particularly in parklands are declining in many agricultural landscapes due to the overuses for fuel wood, charcoal production, and expansion of agricultural lands due to the degradation of nearby forests. In the study sites, comprehensive studies in terms of their composition, diversity, structure, and carbon stocks are still not well explored. In this context, we assessed woody species composition and diversity, structure, and carbon stocks because parkland and home garden agroforestry practices in three agroecologies of highland, midland, and lowlands in the district were not quantified. About 45 parkland woody species were collected from 150 plots of 5000 m2, and 35 home garden woody species were collected from 70 plots of 400 m2. As a result, a total of 80 species belonging to 52 families and 62 genera were collected from parkland and home garden agroforestry practices. Woody species diversity was analyzed using species richness, Shannon diversity index, and Shannon evenness index. In this study, the Shannon diversity (2.8) and Shannon evenness indexes (0.54) of woody species were computed in parkland agroforestry, in the meantime the Shannon diversity index (3.30) and Shannon evenness index (0.52) for woody species of the home garden were computed. The distribution of diameter classes of 10-30 cm had the highest number of trees and shrubs followed by 31-60 cm diameter classes. However, the highest number of trees and shrubs were in 61-90 cm diameter class in the home garden. In this study, woody species, such as Citrus sinensis, Mangifera indica, Persea americana, Sesbania sesban, Vernonia amygdalina, and Azadirachta indica were the dominant species under the two agroforestry practices. The values of carbon stack for highland, midland, and lowland in parkland agroforestry were 19.8 MgCha-1, 17.6 MgCha-1, and 17.5 MgCha-1, respectively. Meanwhile, the total biomass of woody species in highland, midland, and lowland for homestead agroforestry was 32.6 MgCha-1, 34.7 MgCha-1, and 31.2 MgCha-1, respectively. These resulted in carbon dioxide sequestered of 72.59 CO2 equivalents (tha-1), 64.52 CO2 equivalents (tha-1), and 64.16 CO2 equivalents (tha-1) in highland, midland, and lowland woody species, respectively. This study holds significant inputs for policymakers, regional administrators, environmentalists, and natural resource experts by informing the farmers' management and conservation of woody species on cultivated lands and home garden agroforestry plants around their homesteads which is serving as ecosystem services and climate mitigation response within Liban Jawi district. Under parkland and homestead agroforestry practices, communities should have know-how to predict the environmental consequences of the destruction of woody species on their farmlands.

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A policy brief: improving access and utilization of adolescent sexual and reproductive health services in Southern Ethiopia

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Abstract

Background: Adolescent sexual and reproductive health (ASRH) is fundamental to the overall wellbeing and development of young people. In Southern Ethiopia, adolescents face significant barriers to accessing and utilizing ASRH services: they include limited information, pervasive cultural stigma, and inadequate healthcare infrastructure. Addressing these barriers is critical to reducing unintended pregnancies, preventing sexually transmitted infections, and achieving national and international health objectives. Despite the existence of policies aimed at improving ASRH, these challenges persist, highlighting the urgent need for targeted policy reforms and effective implementation strategies to ensure a healthier future for adolescents in the region.

Main findings: Recent research has identified substantial barriers to ASRH services in Southern Ethiopia. Key challenges include widespread gaps in knowledge, socio-cultural stigma, and strong influences from family and peers, compounded by limited-service availability. The absence of adolescent-friendly care, coupled with insufficient outreach efforts, further restricts access. Healthcare providers also encounter significant obstacles, such as stigma, inadequate training, and a lack of institutional support, which undermine their ability to deliver effective services. Service utilization varies markedly based on geographic location, economic status, and educational attainment, with approximately half of adolescents lacking a comprehensive understanding of sexual and reproductive health and rights (SRHR). Moreover, persistent stigma, low levels of social support, and limited self-efficacy continue to hinder the uptake of these essential services.

Policy implications: To improve ASRH services in Southern Ethiopia, a multi-faceted approach is imperative. Increasing public education through school programs and awareness campaigns can mitigate stigma and misinformation, fostering a more supportive environment. Initiatives such as providing transportation support and establishing mobile health clinics will significantly improve access for adolescents in underserved areas. Strengthening healthcare services by offering specialized training for providers and establishing adolescent-friendly clinics will elevate the quality of care. Engaging families, communities, and peer networks is essential for building a supportive framework that encourages adolescents to utilize SRH services. Finally, implementing skill-building and counseling programs will empower adolescents to make informed decisions regarding their sexual and reproductive health, ultimately contributing to improved health outcomes across the region.

Keywords: policy brief, adolescent sexual and reproductive health, health service utilization, barriers to healthcare access, policy recommendations, health system strengthening, Southern Ethiopia

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Epidemiology and Economic Cost of Trypanosomosis Among SmallHolder Cattle Herders in Arba Minch and Zuria Districts, Gamo Zone, Ethiopia

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Abstract

A significant limitation to cattle production is animal trypanosomosis, which threatens household food security and livelihoods. In addition to stalling livestock productivity, the disease has a devastating impact on animal health. Besides, halting livestock productivity, the disease has a devastating effect on health. Thus, the objectives this study was to assess the epidemiology, and financial impacts of bovine trypanosomosis on livestock producers' in Arba Minch and Zuria districts of Gamo zone, Ethiopia, from December 2021 to January 2023. Both repeated survey and cross-sectional study were carried out to assess the economic losses, estimate the prevalence and assess the determinants of bovine trypanosomosis. Direct microscopy was applied using buffy coat method to detect trypanosome parasite. The study included 182 households and 384 bovine species. Bovine trypanosomosis caused substantial economic losses through cattle mortality, drug purchases, and the oxen's loss of draft power. Also, farmers spent a significantly (P <.05) higher amount of money treating trypanosomosis than all other diseases combined. The annual losses per household were estimated to be 9528 ± 1754 Ethiopian Birr (ETB) (95% CI: 6065-12 992) (US$ 176.4) which were spent on purchasing trypanocidal drugs per year per household. The overall mortality from bovine trypanosomiasis was 8.8%. Many farmers prioritized draft power losses as the most significant impact of the disease. Analysis of blood samples also showed a 7.8% overall prevalence of bovine trypanosomosis. The disease burden was significantly (P <.05) higher in the black body coat animals compared to white ones. This study showed that trypanosomosis is an important animal health problem and a potential threat to health and productivity of cattle in Arba Minch and zuria districts of Gamo, Southern Ethiopia. The common trypanocidal drugs were administered by the farmers themselves. Hence, policymakers and professionals should prevent irrational drug use and regularly monitor local trypanocide usage.

Keywords: Bovine trypanosomosis, economic impacts, epidemiology, Gamo zone, Ethiopia