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Pivotal Factors for Sustainable Development

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Pivotal Factors for Sustainable Development

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SUB-THEME ONE:

The Triple Burden of Malnutrition and its Impact on Health, Productivity, and Longevity

The Health Cost of Early Childhood Famine: A Project Summary

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Abstract

There exists an alarming rise in the prevalence of chronic non-communicable diseases among the adult population in low and middle-income countries. Interventions to mitigate these problems require an understanding of context-specific drivers beyond counting the classic established dietary and lifestyle risk factor. For this endeavor, we set out to investigate the impact of childhood famine on adulthood anthropometrics, metabolic, and health outcomes during adulthood. A qualitative study, a series of systematic reviews, and historical cohort studies were conducted from 2019 to 2022. Nutritional insult during the first 1000 days of life due to famine resulted in decreased estimated glomerular filtration rate (eGFR), higher chronic kidney disease, suboptimal blood glucose control, dyslipidemia, unhealthy adult anthropometric indices, and reduced cognitive functioning later in adulthood. Early childhood adversaries could shape adult health to the worst. The relevance of these findings should be interpreted considering the prevalent undernutrition in Ethiopia, which could have close or similar consequences.

 Keywords: Dyslipidemia, Famine, Nutrition, Undernutrition

Malnutrition in Infants Aged Under Six Months Attending Community Health Centres: A Cross-Sectional Survey Conducted to Inform Future Cluster Randomized Control Trial

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Abstract

Poor understanding of malnutrition burden is a common reason for not prioritizing the care of small and nutritionally at-risk infants aged under-six months (hereafter infants) in low and middle-income countries. This study aimed to estimate the prevalence of anthropometric deficit in infants attending health centres in the Oromia Region, using the Composite Index of Anthropometric Failure (CIAF); and to assess the overlap of single indicators underweight and low Midupper Arm Circumference (MUAC) with stunted, wasted, and CIAF prevalence. We undertook a two-week long survey of all infants visiting each of 18 health centres located in the Oromia Region, Ethiopia. We measured weight, length, and MUAC; and calculated weight-for-length z-score (WLZ), length-for-age zscore (LAZ), and weight-for-age z-score (WAZ). We defined wasted, stunted, and underweight as WLZ, LAZ, and WAZ < -2, respectively; and low MUAC as MUAC < 11.0cm if infant is aged < 6 weeks and < 11.5 then after. We defined CIAF as any infant with WAZ, LAZ or WLZ < -2. Overall, 21.7% (95% CI: 19.2; 24.3) of infants presented CIAF and 10.7% (95% CI: 8.93; 12.7) had multiple anthropometric deficits. Low MUAC overlapped with 47.5% (95% CI: 38.0; 57.3), 43.8% (95% CI: 34.9; 53.1), and 42.6% (95% CI: 36.3; 49.2) of the stunted, wasted and CIAF prevalence, respectively. Underweight overlapped with 63.4% (95% CI: 53.6; 72.2), 52.7% (95% CI: 43.4; 61.7), and 59.6% (95% CI: 53.1; 65.9) of the stunted, wasted and CIAF prevalence, respectively. Underweight and a low MUAC, as single indicators, appears to capture most infants that are concurrently wasted and stunted. Anthropometric deficits, single and multiple, are prevalent in infants attending health centres in Ethiopia. To identify any form of anthropometric deficit, as classified by wasted, stunted, underweight, CIAF, or CISAF,WAZ appears to perform better than MUAC, whilst both are good at identifying infants u6m with multiple anthropometric deficits. Further research is needed to understand which criteria or combination of criteria would be best for future programmes managing small and nutritionally at-risk infants u6m and to understand the associated functional and clinical outcomes, notably short term-risks of mortality and morbidity

Keywords: Anthropometric, Malnutrition, Stunted, Underweight

Optimization of Nutritional and Sensory Qualities of Complementary Foods Prepared From Sorghum, Soybean, Karkade and Premix in Benishangul - Gumuz Region, Ethiopia

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Abstract

Consumption of nutritionally deficient complementary foods in developing countries is among the main contributing factors to infants and young children's malnutrition. Therefore, this study was aimed to optimize the nutritional and sensory properties of complementary food made from malted sorghum, blanched soybean, boiled karkade seeds and premix. A D-optimal mixture experimental design with 18 runs was generated by design expert software within in the constrained: 40-60% malted sorghum, 20-30% blanched soybean, 10-20% boiled karkade seeds and 10% premix (5.0% figl leaf powder, 4.5% sugar and 0.5% iodized table salt). Statistical model evaluation and optimization were done using D-optimal mixture design expert software. Sensory evaluation was conducted using 53 untrained panelists on two selected formulations and the control (local formulation). The study shows that with an increasing ratio of blanched soybean and boiled karkade seeds flour in the blend, a significant ($p < 0.05$) increase in protein, fat, energy and mineral contents, and a decrease in tannin and phytic acid contents of high mineral bioavailability except for oxalate: calcium ratio in the formulations were observed. The optimal blending ratio was 45.0% malted sorghum, 26.0% blanched soybean, and 19.0% boiled karkade seeds flour plus 10.0% premix. The gruel made from the new formula was significantly ($p < 0.05$) liked in terms of aroma, flavor, mouthfeel and overall acceptability than the control sample. The findings suggested that the optimal mix of these traditionally processed ingredients can potentially alleviate protein-energy malnutrition and micronutrient deficiency to mitigate expensive commercial infant complementary foods sold in the market.

Keywords*: Blending ratio, Composite flour, Figl leaves, Food ingredients*

Trends and Determinants of Minimum Acceptable Diet Intake among Infant and Young Children Aged 6–23 Months in Ethiopia: A Multilevel Analysis of Ethiopian Demographic and Health Survey

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Abstract

The minimum acceptable diet (MAD) has been used globally as one of the main indicators to assess the adequacy of feeding practices. More than half of the causes of under-five child mortality in developing countries including Ethiopia are attributed to malnutrition. With the exception of anecdotal information on the subject, progress overtime and how it influences the MAD has not been studied or well understood. Thus, this study aimed to determine the trends and determinants of MAD intake among infants and young children aged 6–23 months in Ethiopia. A community-based national survey dataset from the Ethiopian demographic and health survey (EDHS) 2019 were to identify predictors of MAD. In addition, the 2011, 2016, and 2019 EDHS data was used for trend analysis. The World Health Organization indicators were used to measure MAD. A weighted sample of 1457 infants and young children aged 6–23 months. A mixed-effects multi-level logistic regression model was employed using STATA version 16.0. The proportions of infants and young children who received the MADs in Ethiopia were 4.1%, 7.3%, and 11.3% during the survey periods of 2011, 2016, and 2019, respectively. Having mothers who attended primary education [adjusted odds ratio (aOR) =2.33 (95% C.I 1.25 to 4.35)], secondary education [aOR=2.49 (95% C.I 1.03 to 6.45)], or higher education [aOR=4.02 (95% C.I 1.53 to 10.54)] compared to those who never attended formal education. Being in a medium household wealth [aOR=4.06 (95% C.I 1.41 to 11.72)], higher-level wealth [aOR=4.91 (95% C.I 1.49 to 16.13)] compared to those in the lowest household wealth. Being in 12–18months age group [aOR=2.12 (95% C.I 1.25 to 3.58)] and in 18–23months age category [aOR=2.23 (1.29 to 3.82)] compared to 6–11months age group; and having postnatal check-ups [aOR=2.16 (95% C.I 1.31 to 3.55)] compared to their counterparts. Moreover, residing in urban [aOR=3.40 (95% C.I 1.73 to 6.68)]; living in a communities' where majority had a media exposure [aOR 1.80 (95% C.1.17 to 2.77)] were found to be significantly influence consumption of the MAD. The trend of MAD among children of 6–23 months was steady in Ethiopia. Sociodemographic and socioeconomic factors such as maternal education, child age, household wealth; and health system related factors such as maternal postnatal check-ups had a significant influence on infants' and young children's MAD feeding. Indeed, community-level factors such as place of residence, and media exposure affect the MAD of infants and young children. Thus, behavioral change communication interventions are recommended to improve dietary practices in infants and young children.

Keywords: Dietary practices, Ethiopia, Minimum acceptable diet, Postnatal

Metabolic Syndrome Distributions in Dietary Diversity Score Groups and Its Associated Factors among Adults in the Urban Community of Jimma, Southwest Ethiopia

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Abstract

Dietary diversity score has long been recognized as a key component of diets quality balances for healthy life status. However, diets with more variety of food items might increase calorie intake and body weight, which, in turn leads to central obesity (waist circumference).Therefore, this study aims to determine the prevalence of metabolic syndrome among dietary diversity score groups, and its associated factors among adults in the urban community of Jimma, Southwest Ethiopia. A total of 915 adults aged $\geq$ 18 years were randomly recruited in this cross-sectional study.The study was undertaken from June 17, 2019, up to July 27, 2019. To this end, the collected data were entered to Epi Data 3.1 and analysed using and SPSS 25 version. What's more, a multivariable logistic regression was used to assess associated factors of the unrecognized metabolic syndrome; adjusted odds ratio (AOR) with its corresponding 95% CI, at P-value $\leq$ 0.05. The occurrence of metabolic syndrome was 14.4%, and it is more prevalent in females, 11.15% than males, and 3.25%. The most prevalent components of the metabolic syndrome were low level of high-density lipoprotein, elevated level of triacylglycerol, and waist circumferences. Even though metabolic syndrome is not significantly associated with any of the dietary diversity score groups, its prevalence distribution varies among the groups (6.6% in middle, 5.8% in high and 1.9% in low dietary diversity groups). With potential confounders adjusted, by 75% female was significantly associated with the occurrence of metabolic syndrome than male (102 vs. 29, AOR = 0.25 at 95%CI: 0.15–0.40, P = 0.001). Whereas, age $\geq$ 35 years old (104 vs. 27, AOR = 2.91 at 95%CI:1.78–4.86,P = 0.001), large family size > 5 (65 vs. 10,AOR = 2.43 95% CI: 1.10–5.36, P = 0.03), overweight and obesity (121 vs. 10, AOR = 6.97, 95% CI: 4.50 –10.83, P = 0.005), elevated total cholesterol (103 vs. 28,AOR = 2.46, 95% CI: 1.47–4.11, P = 0.001), and consuming (spices, condemns and beverages) $\geq$ 4 days per week (79 vs. 52, AOR = 0.52, 95% CI:0.33 –0.82, P = 0.005) were positively associated with the prevalence of metabolic syndrome as compared to their counterparts. Unrecognized metabolic syndrome was relatively high in the study community. The prevalence of metabolic syndrome varied among dietary diversity groups. But any of the dietary diversity scoring categories was not significantly associated with the occurrence of metabolic syndrome. Thus, awareness needs to be made to practice healthy diet and regular physical activity to maintaining normal body weight. Moreover, early screening of metabolic syndrome should be promoted.

Keywords: Dietary diversity, Ethiopia, Lipid profile, Metabolic syndrome,

Association between Iron-Folic Acid Supplementation and Pregnancy-Induced Hypertension among Pregnant Women in Public Hospitals, Wolaita Sodo, Ethiopia 2021: A Case- Control Study

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Abstract

Pregnancy-induced hypertension is the new onset of high blood pressure after 20 weeks of gestation in women with previously normal blood pressure. To the best of our knowledge, no study has been conducted in our country to investigate the association between this pregnancy problem and iron-folic acid supplementation. The aim of this study was to determine the association between iron-folic acid supplementation and pregnancy-induced hypertension (PIH) in pregnant women at public hospitals in the Wolaita Sodo zone. An institution-based case-control study was conducted among pregnant women who visited public hospitals in the Wolaita Sodo zone from March 3, 2022, to August 30, 2022. A consecutive sampling method was used to select the study participants. The total sample size was 492, of which 164 were cases and 328 were controls. The data were collected by conducting face-to-face interviews and measurements. The data were entered into EpiData version 4.6 and exported to STATA 14 for analysis. Those variables with a p-value less than 0.05 were considered statistically significant. Descriptive statistics and odds ratios were presented using texts, tables, and figures. A total of 471 women participated in this study, yielding a response rate of 96%. The cases had a mean age of 25 ± 4.43, while the controls had a mean age of 25 ± 3.99. The mean age at first pregnancy among cases was 20 ± 2.82 and among controls was 20 ± 2.97. The average number of deliveries for cases and controls was 1.97 ± 1.41 and 1.95 ± 1.38, respectively. There is no significant association between iron-folic acid supplementation and PIH. Pregnant women with high hemoglobin levels had higher odds of PIH as compared to those without it (AOR = 3.65; 95% CI: 1.0–12.9). Eating kocho (AOR = 14.4; 95% CI: 1.2–16.7) was positively associated with PIH.There is no association between iron-folic acid supplementation during pregnancy and pregnancy-induced hypertension. Pregnant women with high hemoglobin levels had higher odds of PIH as compared to those without it. There is an association between Koch consumption and PIH. More research should be done using stronger designs.

Keywords: Case-control, Ethiopia, Iron-folic-acid supplementation, Pregnant women

Evidence on currently applied dietary interventions in MAM children: A systematic review and meta-analysis

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Abstract

Moderate acute malnutrition (MAM) is defined by a weight-for-height z-score (WHZ) between -3 and -2 of the WHO reference or by a mid-upper arm circumference (MUAC) ≥11.5cm and <12.5cm. Compared to well-nourished children, children with MAM have an increased risk of mortality and infections, and impaired physical fitness, motor skills, and cognitive development. To synthesize the evidence for the effectiveness of Ready-to-Use Supplementary Food (RUSF) compared to other dietary interventions or no intervention on functioning at different levels of the International Classification of Functioning, Disability, and Health (ICF) among children with MAM between 2-12 years old. Three databases (PubMed, Scopus, and Web of Science) were systematically searched (last update: November 20th 2022). Pooled estimates of effect were calculated using random-effects meta-analyses. The level of evidence was estimated with the Grading of Recommendations, Assessment, Development, and Evaluation (GRADE) method. Eight studies were included. RUSF had a significant small-sized better effect (pooled mean: 0.38; 95% CI= [0.10;0.67], p=0.01, I^2=97%) on different anthropometric measurements compared to other dietary interventions among MAM children. Comparing RUSF with corn-soy blend Plus Plus (CSB++) showed that children who were treated with RUSF had a significant small-sized but better effect on their weight gain, MUAC, WHZ, and weight-for-length z-score compared to children who received CSB++ (pooled mean: 0.16; 95% CI= [0.05;0.27], p=0.01; I^2= 35%). MAM children treated with RUSF had a better recovery rate compared to those treated with CSB++ (pooled risk difference: 0.11; 95% CI= [0.06;0.11], p<0.001; I^2=0%). The level of evidence was low. RUSF intervention seems promising in improving MAM children's nutritional outcomes and recovery rate compared to other dietary interventions. The low level of evidence indicates the need for strong randomized control trials in MAM children to establish the true effect of RUSF.

Keywords: Children, Malnutrition, Ready-to-use supplementary food, School-age children, Wasting,

Spirulina (*Arthrospira fusiformis*) to Irradicate Stunting and Other Forms of Child Malnutrition from Ethiopia

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Abstract

Spirulina (*Arthorspira fusiformis*) is a blue-green algae found in hot-tropical lakes throughout the tropics. It has been used by humans since time immemorial in Mexico, China and Africa. It is a single cell protein source containing as much as 65-70% of its total mass. The objective of this study is to bring to the attention of the audience the importance of Spirulina in the struggle against child malnutrition in Ethiopia. Ethiopia loses a staggering 55.5 billion ETB each year for the expense of stunting and child malnutrition. The current stunting rate in Ethiopia is about 39%. This is greater than the world and East African stunting rate. It is well known that stunning and poverty are directly related. Stunting is significantly declining throughout the world but increasing in Eastern Africa. This is, in fact, not surprising since poverty is also increasing. Spirulina has been promoted as a solution to eradicate stunting and other forms of malnutrition since the 1970s. However, nations failed to consider spirulina mainly due to lack of awareness, technology and scientific knowledge. Thanks to the Ministry of Innovation and Technology, which funded the first part of the project on mass culture of spirulina, pilot spirulina farm is now on the verge of inauguration. The Ethiopian Rift Valley is one of the most suitable places for spirulina farm, since Spirulina is indigenous to this place. Children are defined as stunted if their height-for-age is more than two standard deviations below the WHO Child Growth Standards median. Ethiopia has made some progress towards achieving the target for stunting, but 39% of children under 5 years of age are still affected, which is higher than the average for the Africa region (30.7%). Technological adaptations are underway by different government and non-governmental institutions. By putting together, all the efforts, technology and resources, Ethiopia will soon be one of the countries that will defeat stunting and all forms of child malnutrition and even pose for exporting spirulina to African countries.

Keywords: *Arthrospira fusiformis*, Child malnutrition, Ethiopia, Spirulina, Stunting

The Effect of Household Source of Drinking Water on Malnutrition among Under-Five Children in Ethiopia: A Systematic Review and Meta-Analysis

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Abstract

Nutritional status of children reflects the overall health status of children. Undernutrition is caused by various factors, most of which relate to poor diet and repeated infections, particularly in poor socioeconomic populations. The few studies conducted on the association between child malnutrition and household source of drinking water among under-five children present inconsistent and inconclusive findings. Therefore, the objective of the current systematic review and meta-analysis was to determine the pooled estimates on the effect of household sources of drinking water malnutrition among under-five children in Ethiopia. Both published and unpublished studies were accessed through electronic search from databases such as PubMed, Medline, HINARI, Scopes, CINAHL, PopLine, MedNar, Embase, Cochrane Library, the JBI Library, the Web of Science, and Google Scholar. All observational studies that were conducted on the association between malnutrition and the source of drinking water among under-five children in Ethiopia were included in the review. The meta-analysis was conducted using STATA version 14 software and results were presented in forest plots. The pooled estimate with 95% confidence intervals was computed using a random effect model. We used funnel plots, and Egger's and Begg's tests at a significance level of 5% to check the presence of publication bias. A total of 1009 published and unpublished studies were identified of which 22 studies were included in the final analysis with a total of 12792 under-five children. Our analysis found that the source of drinking water had a statistically significant effect on the occurrence of malnutrition among under-five children. The overall pooled estimate showed that the odds of developing malnutrition among under-five children whose households had protected drinking water sources was 39% lower than those under-five children whose households with unprotected water sources (OR: 0.61, 95% CI: 0.44, 0.84). The systematic review and meta-analysis found a statistically significant effect of household sources of drinking water on malnutrition, in which children from households who used protected water sources for drinking were less likely to develop malnutrition as compared with their counterparts. This finding indicates the need for an increase in the coverage of protected water sources and creating awareness on how to treat drinking water at the household level, particularly in rural households.

Keywords: Ethiopia, Malnutrition, Source of water, Under-five

SUB-THEME TWO:

Growing Population, Food, and Nutrition Security: Challenges and Strategies for Ethiopia

Impacts of Water Hyacinth (*Eichhornia Crassipes*) on the Diversity and Abundance of Fishes and Littoral Macroinvertebrates in Koka Reservoir, Ethiopia

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Abstract

This study aimed to assess the impacts of water hyacinths on the diversity and abundance of fishes and littoral macroinvertebrates in Koka Reservoir, Ethiopia. The descriptive and exploratory sampling design was employed to get primary data. The area was initially categorized as highly infested, moderately infested, less infested, or infestation-free based on the degree of weed infestation, and one site was randomly selected from each. Water temperature, pH, DO, TDS, and EC were measured in situ using portable multi-parameter probes, whereas NO_3^-, BOD_5, and TP content were analyzed in the laboratory. The fish and macroinvertebrates (BMI) samples were taken three times in monthly intervals. Fish samples were obtained from fishermen's daily catches. For BMI collection, a multi-habitat sampling approach of 25*25cm area was implemented using a standard D-shaped hand net with a mesh size of 500 μm. The result showed a significant physicochemical difference among the study sites ($p < 0.05$), with the Hargisa and Barko exhibiting the highest and lowest DO, pH, NO_3- and PO_4^{3-} content, respectively. Hargisa site had also the highest water turbidity, EC, TDS, and BOD5. Water turbidity and *Eichhornia crassipes* infestation were positively and significantly correlated ($r = 0.953$, $p = 0.046$). Four fish species comprising 192 individuals were recorded. The h composition was observed at Barko and Dambal sites, with the largest share of *Oreochromis niloticus* (38.53%) and *Cyprinus carpio* (31.77%). The fish abundance did not differ significantly between the study sites ($p > 0.05$), except for *C. gariepinus*, which displayed a negative correlation with water hyacinth infestation ($r = -0.982$, $p < 0.05$). Similarly, a total of 871 macroinvertebrates from 10 orders and 18 families were found, with the highest and lowest abundance recorded at Barko and Hargisa sites, respectively. The SDI, H-FBI, and %CHIR varied significantly among the sampling sites ($p < 0.05$). SDI was negatively correlated with WH ($r = -0.977$, $p = 0.023$). Generally, *E. crassipes* changed the water's chemistry and greatly impacted the diversity and abundance of fishes and macroinvertebrates in the reservoir. Therefore, effective management of *E. crassipes* is crucial to maintain the lake's healthy and consistent ecosystem services.

Keywords: Fishes, Koka Reservoir, Macroinvertebrates, Water hyacinth

Gilgel Gibe Reservoir Fishery: Current Stock Status and Future Directions to Promote Fish Production in the Region

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Abstract

This report presents the findings of a study on the Nile tilapia population in Gilgel Gibe Reservoir, located in the upper reach of the Omo River Basin in southwest Ethiopia. The reservoir predominantly supports a Nile tilapia fishery that generates considerable socioeconomic benefits for the local community. Currently, there are concerns about a decline in the fish landings. This study aimed to evaluate the current state of Nile tilapia and suggest measures to enhance fish production in the area. Fish sampling was conducted over 147 days from March 2020 to July 2021 involving 1230 gillnet settings and 3255 fishers operated. A length-based approach was employed to generate relevant data and run data analyses in FISAT II software (version 1.2.2). A total of 25,994 fish specimens, with an average length of 23.2 cm and a range of 9-42 cm, were collected during the study period. The estimated annual catch was 64,543 fish (6.48 tons) at 3054 gillnet settings and 8082 fishers operated. The size groups that significantly contributed to the catch were in the length ranges of 15-17 cm (35.6%), 17-19 cm (24.9%), 13-15 cm (18.9%), and 19-21 cm (9.9%), respectively, accounting for 89.3% of the total catch. The estimated size of the fish population that corresponds to the present catch as estimated by virtual population analysis (VPA) was 453,223 fish (28.12 tons). The underlying population parameters for the predictions of fish abundance, yield, and biomass estimated following relevant standard methods include asymptotic length (L∞, 46.67 cm), growth constant (K, 0.28), and natural mortality (M, 0.68/year). The average annual recruitment (R) of Nile tilapia in the reservoir was 121,955 fish (2.8 tons), with the highest recruitment rate in July (19%) followed by February (14%). At this rate of recruitment, the maximum sustainable yield (MSY) was predicted at 6.49 tons with corresponding fish biomass of 30.2 tons, reached at 0.9 times the current fishing effort level of 3054 gillnet settings and 8082 fishers operated. It is, thus, evident that the current level of exploitation has already surpassed the sustainable level and the stock biomass has consequently declined to 26.32% (i.e. 28.12 tons). Length at first maturity (Lm50%) was also found to be higher (14 cm) than length at first capture (Lc50%, 12 cm). Therefore, effort reduction and implementation of mesh size limits are urgently needed. Considering the dynamic nature of a reservoir water level and water quality problems that could potentially affect fish productivity, a more restrictive approach to effort setting is highly imperative. Therefore, the study recommends the adjustment of the current effort level from 8 gillnet settings/day to 3 gillnet settings/day and 22.14 fishers/day to 9 fishers/day to ensure that the stock biomass is maintained above 50%. For more effective intervention, management measures should also involve ecosystem-based holistic approaches such as aquaculture development and conservation of the riparian (buffer) zone of the reservoir. Further research is needed to monitor the fish population and evaluate the effectiveness of these measures over time.

Keywords: Fisheries management, Gilgel Gibe Reservoir, Nile tilapia population, Omo River, Sustainability

Impact of Probiotic Sources on Performance of Artificially Propagated African Catfish, *Clarias gariepinus* (Burchell, 1822) Larvae

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Abstract

The African catfish is one of the promising aquaculture species in Ethiopia and a potential source of quality protein for human nutrition. However, among the major bottlenecks in catfish farming, fry production takes a lion's share. The high mortality rate of its fry in artificial settings has limited the access and availability of catfish seeds for aquaculture and restocking of the overexploited country's water bodies. This study was conducted to evaluate the impact of probiotic sources on the performance of artificially propagated African catfish larvae. The experiment was carried out at Biology Department, Jimma University in eight aquaria grouped into three treatments; *Lactobacillus spp*. from African catfish (T1), *Lactobacillus spp*. from Nile tilapia (T2), *Lactobacillus spp*. from Tej (T3) and control without probiotics (T0) for 30 days. Each treatment was inoculated with an equal concentration of probiotics (0.5ml) into the water every three days. The fries were fed twice a day at 10% of their body weight. The maximum survival rate (78.3%) was recorded in T1, whereas the minimum survival rate (56.5%) was recorded in the control. The highest weight gain (WG), absolute growth rate (AGR) and better Fulton condition factor (FCF) were recorded in T1, while the least growth performance values were recorded in the T0 ($p < 0.05$). Noticeable variations were observed in performance values among the probiotics isolated from various sources. The *Lactobacillus spp.* isolated from the African catfish appeared to have outperformed. The *Lactobacillus spp.* isolated from Nile tilapia, which in turn has surpassed the *Lactobacillus spp.* from Tej. It thus seems that the probiotic tends to be more beneficial If it is administered to the same fish species from where isolated. Moreover, the inoculation of any type of probiotics in water improves the growth performance and survival of the larvae than without probiotics.

Keywords: African catfish larvae, Growth performance, *Lactobacillus spp.*, Probiotics

Risk of DDT Residue in Maize Consumed by Infants as Complementary Diet in Southwest Ethiopia

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Abstract

Infants in Ethiopia are consuming food items such as maize as a complementary diet. However, this may expose infants to toxic contaminants like dichlorodiphenyltrichloroethane (DDT). Maize samples were collected from the households visited during a consumption survey and from markets in Jimma zone, southwestern Ethiopia. In the analytical procedure, the residues of total DDT and its metabolites were analyzed using the Quick, Easy, Cheap, Effective, Rugged and Safe (QuEChERS) method combined with dispersive solid phase extraction cleanup (d-SPE). Deterministic and probabilistic methods of analysis were applied to determine the consumer exposure of infants to total DDT. The results from the exposure assessment were compared with the health-based guidance value in this case the provisional tolerable daily intake (PTDI). All maize samples (n = 127) were contaminated by DDT, with a mean concentration of 1.770 mg/kg, which was far above the maximum residue limit (MRL). The mean and 97.5 percentile (P 97.5) estimated daily intake of total DDT for consumers were respectively 0.011 and 0.309 mg/kg bw/day for deterministic and 0.011 and 0.083 mg/kg bw/day for probabilistic exposure assessment. For total infant population (consumers and non- consumers), the 97.5 percentile estimated daily intake were 0.265 and 0.032 mg/kg bw/day from the deterministic and probabilistic exposure assessments, respectively. Health risk estimation revealed that, the mean and 97.5 percentile for consumers, and 97.5 percentile estimated daily intake of total DDT for total population were above the PTDI. Therefore, in Ethiopia, the use of maize as complementary food for infants may pose a health risk due to DDT residue.

Keywords: Daily intake, DDT, Infants, Maximum residue limit

Potential Impacts of Climate Change on the Strategy of Wheat Production to Ensure Food and Nutrition Security in Central Ethiopia

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Abstract

It is necessary to evaluate the potential effects of climate change on wheat production and find adaptation options. The research objectives were to assess the impacts of climate change and identify adaptation strategies to mitigate its detrimental effects on wheat production. Future climate data for the 2050s were generated using ensemble 17 global circulation models output under the RCP8.5 scenario. Three wheat cultivars, three planting dates, and four nitrogen rates had their yield responses simulated for the baseline period (1984–2022) and the mid-century (the 2050s). The results showed that temperatures dramatically increased in the 2050s. The minimum temperature was observed to rise more rapidly than the maximum temperature. Based on farmer practices and research recommendations, the estimated wheat (picaflor cultivar) yield is predicted to shift from -46.65% (Kulumsa) to +10.98% (Fitche) in the 2050s compared to the baseline periods. With the addition of carbon fertilizer, Fitche's projected picaflor output is anticipated to rise from +15.99% (380 ppm) to +34.43% (571 ppm). Carbon fertilization could help wheat production withstand the unfavorable effects of climate change. The mid-planting windows and the fourth decade of June were shown as the best times to plant medium-duration wheat types. Increasing nitrogen application rates from 92 to 138 kg N ha^{-1} is anticipated to decrease the adverse effects of climate change at all sites. Combining a change in planting date with a high nitrogen rate is one adaptation strategy to mitigate the detrimental consequences of climate change. The study makes the case that crop models, climatic models, representative concentration pathways, projection periods, and crop management techniques must all be considered as a recommendation.

Keywords: Adaptations, CERES-Wheat, multi-model projections

Microbial Biotechnology: From Household Practices to Production of Industrial Commodity

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Abstract

Microbial biotechnology is the use of microorganisms to obtain an economically valuable product or activity at a commercial or large scale. The use of microorganisms for the production of useful products on a large scale is rooted in household practices where products are made through spontaneous fermentation. Through scientific investigation of the traditional production processes, optimization of the processes, and identification of appropriate starter culture(s), the local products are being produced on a large scale (controlled fermentation) although many of the local products still remain household arts. The microorganisms used in controlled fermentation are natural, laboratory-selected mutant or genetically engineered strains. Microbial products, including fermented foods and beverages, make a significant contribution to ensuring household food security and the economic growth of the country. Several reports show that fermented foods enhance sustainable development and economic growth. Some of the microbial products are already commercialized and generating huge revenue. For instance, in 2018 alone, the total value of China's traditional fermented food industry output exceeded 1.5 trillion CNY, accounting for approximately 11% of the food industry and 1.6% of the total gross domestic product*. In Ethiopia, too, few microbial products (including bio-fertilizer, bio-control agents, fermented foods/beverages, etc., are already commercialized or in the process of large-scale production. Despite the significant contribution it had to the national economy, however, various factors are working against the development of microbial biotechnology, in general. These limiting factors, and the possible strategies in place to minimize the challenges to boost their contribution in ensuring food security or livelihood of large segments of the human population will be discussed.

Keywords: Biotechnology, Fermentation, Food security, Livelihood, Starter culture

Optimizing Black Soldier Fly Larvae (*Hermetia illucens*) Growth and Waste Recycling Performance through Organic Waste Substrate Type and Feeding Strategy

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Abstract

The use of Black Soldier Fly (BSF), *Hermetia illucens*, larvae to treat organic waste presents a promising solution for developing countries. The larvae consume organic waste efficiently and convert it into a biomass composition that is 40% protein and 30% fat. This protein can replace costly fish and soybean meal in animal feedstock while reducing waste pile size and mitigating pollution. Experiments were conducted to evaluate the performance of BSF larvae in digesting and degrading different sources of organic waste, including avocado waste (AW), kitchen waste (KW), and chicken manure (CM). Young larvae (3-5 days old) were introduced with 2000 larvae per basin for 16 days in circular plastic containers (Ø 32 × 12 cm) with 100, 150, and 200 mg/larva/day continuous and batch feeding. Larvae fed every four days with waste materials developed into significantly larger larvae and pre-pupae than those fed at once. The average larval biomass was 289.1 g and 241.7 g for the continuous and batch-feeding strategies, respectively. Larval waste reduction rates ranged from $56.9 \pm 2.6\%$ to $78.9 \pm 3.6\%$ and $55.3 \pm 2.2\%$ to $77.24 \pm 5.1\%$ with continuous and batch feeding strategies, respectively, and were significantly affected by the different daily diets. The bioconversion rates ranged from $4.3 \pm 1.2\%$ to $7.8 \pm 1.2\%$, with the highest values observed with the continuous feeding diets. This study confirms the great potential of BSF as a component of waste management chains and a source of sustainable protein for animal feed manufacturing industries.

Keywords: Bioconversion, Black Soldier Fly, Larval biomass, Waste management

Green Synthesis of Novel Phosphor Materials: An Indirect Approach to Sustainable Development

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Abstract

Tetraethyl Orthosilicate (TEOS) is a precursor used as the silica source for the synthesis of various silicate-based inorganic materials. However, its high scarcity in most developing countries has been a bottleneck for the growth of research focusing on silicate-based inorganic phosphor materials in such countries. Its purchase is performed through cross-border payment which in turn requires foreign exchange (FX). Therefore, the advancement of research focusing on silicate-based inorganic phosphor materials is hardly possible in countries hit by foreign exchange risk. Hence, a new mechanism which does not require cross-border payment or FX should be designed to alleviate this problem. This is one approach of alleviating FX risk which in turn positively affects sustainable development. In this work, calcium magnesium silicate was synthesized via the sol-gel route using calcium carbonate ($CaCO_3$), magnesium carbonate ($MgCO_3$) and *Stenotaphrum secundatum* grass extract (in place of TEOS) as starting materials. X-ray diffraction (XRD), Fourier Transform Infra-Red Spectroscopy (FTIR), UV Visible (UV-Vis), Photoluminescence (PLs) as well as scanning electron microscopy (SEM) and energy dispersive x-ray spectroscopy (EDX) were used to study the phase composition, functional groups identification, absorption spectra determination, examining excitation and emission spectra, surface morphology /microstructure and elemental composition analysis or mapping of the samples. The FTIR spectra show the existence of the functional groups by (Si-O-Si, Si-O, O-Ca-O, O-Mg-O, SiO_4, Ca^{2+}, Mg^{2+}) symmetric stretch, asymmetric stretch, vibrational mode and bending mode in the synthesized samples confirming that *stenotaphrum secundatum* grass extract can effectively be used in place of TEOS for the synthesis of silicate-based inorganic materials.

Keywords: Characterization, Grass extract, Green synthesis, Phosphor, Tetraethyl Orthosilicate

Application of Low-cost Technology for Pollutant Removal from the Water Using Low cost Materials

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Abstract

Water is essential to life as a universal solvent and an important part of the human body's metabolic processes, and must be fundamentally clean and fresh for life to exist. However, increased industrial and agricultural activities are producing a wide variety of harmful chemicals that pose a major threat to global water pollution. Adsorption is the best and most versatile and efficient alternative for avoiding contaminants such as phosphorus runoff from wastewater. In addition, most sorbents have not been found to be sufficiently useful as they have low adsorption capacities after prolonged contact and do not function at the natural pH of water, where residual carbon is very attractive for the removal of phosphorus contaminants. The main purpose of this research is to study and evaluate the impact of design parameters on the removal of phosphate from aqueous solutions by inexpensive sorbents (coal waste) using a classical slurry batch setup. Kinetic and equilibrium sorption experiments were performed to remove phosphate from aqueous solutions through coal waste from coal mining centers in Ethiopia and to investigate its potential use as an efficient adsorbent. Waste coal materials were first washed, dried, pulverized, treated with metal cations, and sonicated to enhance adsorption efficiency. Design parameters such as contact time, solution pH, and initial concentration were considered. Phosphate concentration was measured using a continuous flow analyzer. The zero-point charge of coal waste was measured using the solid addition method using the KNO_3 as a solution maker. In addition, the effects of coexisting ions on adsorption were investigated, and adsorption equilibria and adsorption kinetics were evaluated. The zero charge point value was measured to be less than 5. A maximum removal capacity of 5.2 mg/g phosphate was achieved at an initial phosphate concentration of 10 mg/L, fine particle size (0.075 mm to 0.425 mm), and pH 3.5. The sorbent dosage is 40 g/L and the contact time is 240 minutes. A second-order pseudo-equation well represents the experimental data with correlation values $R^2 > 0.99$. Langmuir and Freundlich isotherm models were studied and the Freundlich isotherm fitted the experimental data better. The kinetic and sorption isotherm results show that the surface-modified coal waste is suitable for phosphate removal from aqueous sources. It was also observed that the effect of coexisting anions on phosphate removal strongly influenced the removal process. However, additional testing is required in the flow setup to draw final conclusions. Recycling and regeneration of the adsorbent material is highly recommended for further investigation.

Keywords: Adsorption, Adsorbent material, Phosphate removal, Water pollution

SUB-THEME-THREE:

Community Engagement in Health, Fitness, and Wellness Program: Practice, Challenges and Prospects for Ethiopia

Exercise is Medicine: Barriers and associated factors to Exercise Prescription among Healthcare Workers in Ethiopia

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Abstract

Physical exercise is medicine and a recognized cost-effective way of preventing over 35 non-communicable diseases (NCDs). However, physical exercise referral and prescription remain the most marginalized and little attention has been devoted to the current Ethiopian healthcare system, with the barricades to its inclusion being unclear. The present study explores the barriers and associated factors to exercising referral and prescription among healthcare workers in Ethiopia. A mixed method research, sequential explanatory design, was employed at public health facilities (n=13 hospitals) in Ethiopia. The participants were selected proportionately and randomly from 13 public referral hospitals. We collected data in two phases among (N=312, (n=195 males and n=117 females) healthcare professionals. In the first phase, a questionnaire with five Likert scales ranging from "strongly agree" to "strongly disagree" was used. In the second phase, a structured interview was conducted with (n=39) each hospital's medical directors and health team managers. The first phase results revealed that lack of national coordination to promote physical exercise ($t(311) = 69.20$, $p < .0005$), trained physical exercise professionals ($t(311) = 14.42$, $p < .0005$); physical exercise guidelines ($t(311) = 33.25$, $p < .0005$); training and skill on how to prescribe physical exercise among healthcare providers ($t(311) = 62.94$, $p < .0005$); dynamic system ($t(311) = 65.62$, $p < .0005$); and dynamically built environment that inspires physical exercise participation ($t(311) = 59.64$, $p < .0005$) were identified as barriers. The second phase results depict that the absence of dynamic people, dynamic community, and inadequate political will, deficient health information coverage of physical exercise and limited engagement of Exercise science professionals in the healthcare system were also identified as barriers. Physical exercise appears overlooked in the Ethiopian healthcare system. Healthcare organizations and policymakers could consider the cited obstacles to plan, design and integrate physical exercise into the healthcare system to prevent NCDs in Ethiopia.

Keywords: Dynamic system, Exercise Prescription, Lifestyle Diseases, Healthcare, National Coordination

Effect of Aerobic Exercise on CD4 Cell Counts, Viral Load and Selected Psychosocial Traits among HIV Infected Individuals in Nekemte, Ethiopia

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Abstract

Human Immunodeficiency Virus (HIV) is a virus that targets and alters the immune system, which increases the risk and impact of other infections and diseases. This study was aimed at determining the effect of aerobic exercise on CD4 cell counts, viral load and selected psychosocial traits among HIV infected individuals Nekemte, Ethiopia. The study design was randomized controlled trial. The 58 HIV infected individuals those who are attending an anti-retroviral (ART) were selected by random sampling method from Nekemte referral Hospital, Chalalaki health center, and Nekemte health center. These 58 subjects were randomized equally into two group i,e control group and experimental group with twenty-nine (29) participants each . The Experimental group was participated in aerobic exercise program for 12 weeks whereas the control group was left to do their usual day-to-day activities. 10 ml of blood was drown from each subject in order to analyze for CD4 cell/ml count and viral load/ml by using Becton Dickinson FACSort and Abbott Real Time HIV-1 Qualitative Control Kit respectively whereas psychosocial trait survey was carried out by using standardized questionnaire . Descriptive statics were used to summarize the participant socio-demographic characteristics. Data were collected after the 12 weeks. Paired sample t-test and independent sample t-test were used to analyze pre-post data of the study. The level of significance was set at 0.05. Mean ages of control and experimental groups were 34.66$\pm$4.6 years and 38.1$\pm$6.7 years respectively. Paired t-test result revealed that experimental group has shown significant change in CD4 pretest 456.69(65.36) and posttest 513.13(55.60), p=0.001, viral load pretest 3076.65(469.78) and posttest 2227.04(370.85), p=0.002 and selected psychosocial trait pretest 15.27(2.1) and posttest 35.45(4.26), (p=0.01). The control group has shown significant in viral load pretest 4421.8(442.69) and posttest 3577.9(469.78), p=0.02 while the other CD4 cell 447.85(65.47) 456(59.55), p=0.24 and psychosocial didn't show significant difference pretest 16.25(1.25) and posttest 16.35(2.25), p=0.81 after 12 weeks. 12 weeks aerobic exercise can increase CD4 cell count and solve psychosocial traits but cannot solve viral load among HIV infected individuals participate under ART drug. The significant of viral load was because of ART drug, which had similar effect among control group.

Keywords: Aerobic exercise, AIDS, ART, CD4 cell count, HIV, psychosocial trait, viral load

Effects of Aerobic and Resistance Exercises on Blood Glucose Level and Related Physiological Variables of Type 2 Diabetic Patients of Ambo University Referral Hospital, Ethiopia

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Abstract

Regular exercise has been shown to improve blood glucose control, reduce cardiovascular risk, contribute to weight loss, and improve wellbeing. Furthermore, it may prevent Type 2 Diabetes Mellitus (T2DM) in high-risk individuals. The objective of this study was to examine the effects of aerobic and resistance exercises on the blood glucose levels and related variables BMI, BP, RHR and VO_{2max} of T2DM outpatients with attended their medication regularly at Ambo University referral hospital. One group pre-posttest prospective follow-up interventional quasi-experimental study was applied to examine the effects of identified exercises training on diabetic patients of Ambo university referral hospital. Physically active diabetic men and free from any other metabolic syndrome diseases with their mean age=50.25 ± 14.43, BMI of 29.5 kg/m2 and the mean of diabetic medication duration of 4.50 ± 2.45 were participated on the study. Out of thirty-six (N=36) subjects, twelve (n=12) participated in this study through the arranged inclusion and exclusion criteria. Dependent variables were BG level; BMI, BP, RHR, and VO2 max were measured before and after arranged eight-week exercise training. SPSS (version 23.0, IBM was used for the analyses of data. The frequency, mean, and SD of the dependent variables variation were analyzed and the paired sample t-test was applied to check if there were significant differences between the variables pre-post exercises training program than their normal sedentary life with medication and the significance level for the obtained results were set at $P<0.05$. From the analysis of data, the change of mean percentage on dependent variables, FGB, BMI, SBP, DBP and Vo2max were 3.92%(p<0.003), 2.73%(0.001), 4.05%(p<0.059), 5.85% (p<0.062) and 116%(P<0.029) respectively. Therefore, a significant improvement were observed on all variables. Clinically meaningful blood glucose levels and related dependents variables of T2DM diabetes patients were improved following the combination of aerobic and resistance exercise training.

Keywords: Aerobic exercise, Blood glucose level, Blood pressure, Resistances exercises, T2DM, VO_{2max}

Challenges and Practices of Physical Exercise Participation in Gymnasium among Undergraduate Students in Public and Private Universities in Addis Ababa, Ethiopia

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Abstract

The purpose of present study was to investigate challenging factors that affect the practice of physical exercise in gymnasium among undergraduate students in Public and Private Universities in Addis Ababa City. This study was survey and conducted to determine challenges and practices of physical exercises among undergraduate students in eight universities. The sample contained 624 students, who were selected by using random sampling techniques. The study used both quantitative and qualitative research design. To collect data and information close ended questionnaire was used. All variables were analysed and tested by using the Statistical Package for the Social Sciences (SPSS) Version 20 to analyse descriptive analysis such as mean, frequency and percentages. Moreover, One-way Analysis of Variance (ANOVA) and Chi-Square test was employed with the alpha value 0.05as a part of inferential statistics. The results indicated that, from total 624 participant undergraduate students, 251 (40.2 %) were female and the remaining 373 (59.8 %) were male students. In the current study only 107 (17.2 %) of students were used university gymnasium facilities. However, greater number, 75 % of public and private students were not involved in any extracurricular activities on their campus. Sex, year in University, age, living place before joining the university, living place while attending university are the revelled challenges to exercise participation in gymnasium. Additionally, focusing on study time, not participating in extracurricular activity, tobacco use, lack of time to go gymnasium, lack of knowledge about the benefits of regular physical exercise, and peer pressure were identified challenges to participate in physical exercise at gym (p<.01). In the study, quite a lot of challenges were found that influencing students participation in university gymnasium facilities. Therefore, both public and private universities should build gymnasiums and fitness centres parallel to academic duties around student living arrangements.

 Keywords: Exercise, Fitness centres, Lifestyle, Gymnasium, University students

Effects of twelve-week aerobic exercise on selected health-related physical fitness variables on Gonji preparatory school male students

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Abstract

The purpose of this study was to investigate the effects of 12-week aerobic exercises on health-related physical fitness variables on Gonji preparatory school grade eleven male students. The study design was quasi experimental study a two-arm parallel-group randomized controlled design method. Purposively 242 grade eleven male and female students aged from 18 to 22 years were selected as study population; from this population 108 male students fulfilled the inclusion criteria of the study. From these, 51 students involuntary to participate and 57 were willing to participate in the study. For ease of management, only 30 male students were allocated randomly into an experimental group (n = 15) and a control group (n = 15). The experimental group was exposed to aerobic exercises for 40 - 60 minute a day for 3 days a week during 12-week. Both study groups were exposed to 40 minute per week in school regular physical education class during study period of 12-week. Study groups had taken pre-test and post-test measurements. Paired t-test and independent t-test were used for data analysis. The level of significant was set at $p < 0.05$. Statistically significant difference have been detected between the pre-test and post-test values on experimental group in body composition (t=-3.571, $p < 0.05$ and cardiorespiratory fitness (t=-4.258, $p < 0.05$), but control group in body composition (t= -1.786, p>0.05 and cardio-respiratory fitness (t=-0.091, $p > 0.05$) registered no statistically significant difference. The result obtained from experimental group indicated that there were significant differences observed in body composition and cardio-respiratory fitness, but not on control group. Based on the current finding, a 12-week moderate aerobic exercise program for 40 - 60 minute a day for 3 days a week has positive effect on the improvement of physical fitness, but not improvement 40 minute school regular physical education practical class. The conclusion of the study revealed that physical education practical class insufficient time allocated for grade 11 male students for preparatory schools.

Keywords: Aerobic fitness, Body composition, cardiovascular endurance, physical fitness, twelve-week

Computer-aided Decision Support System for Diagnosis of Heart Diseases

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Abstract

Cardiovascular diseases (CVDs) are the leading causes of death worldwide and the number of people dying from these diseases is steadily increasing. The rapid economic transformation leading to environmental changes and unhealthy lifestyles increase the risk factors and incidence of cardiovascular disease. The limited access to health facilities, lack of expert cardiologists, and lack of regular health check-up trends make CVD a major cause of mortality in low-resource settings. Computer-aided diagnosis using artificial intelligence techniques (AI) can help reduce the mortality rate by providing decision support to experts allowing early diagnosis and treatment. In this paper, an AI-based computer-aided heart disease diagnosis decision support system has been proposed using clinical data, patient information, and electrocardiogram (ECG) data. The proposed system includes three modules: an ECG processor module that allows cardiologists to process and analyze the different waveforms, a machine learning-based heart disease prediction module based on patient information and clinical data, and a deep learning-based 18 heart conditions multiclass classification module using 12-lead ECG data. A user-friendly user interface has also been developed for ease of use of the proposed techniques. The heart disease prediction module was found to be 100% accurate in predicting heart disease based on clinical and patient information, and the multiclass classification module was 93.27% accurate, on average, in classifying heart conditions based on a 12-lead ECG signal. The ECG processor also provides quick diagnosis by analyzing important ECG waveforms and segments. The proposed system may have the potential for facilitating heart disease diagnosis. The proposed method allows physicians to analyze and predict heart disease easily and early, based on the available resource, improving diagnosis accuracy and treatment planning.

Keywords: Artificial intelligence, Cardiovascular, Computer-aided diagnosis, ECG

Classification of heart sounds associated with murmur for diagnosis of cardiac valve disorders

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Abstract

Now a day, cardiovascular diseases have been a major cause of death in the world. The heart sound is still used as a primary tool for screening and diagnosing many pathological conditions of the human heart. The abnormality in the heart sounds starts appearing much earlier than the symptoms of the disease. In this paper, the Phonocardiography signal has been studied and classified into three classes, namely normal signal, murmur signal and extra sound signal. A total of 15 features from different domains have been extracted and then reduced to 7 features. The features have been selected on the basis of correlation based feature selection technique. The selected features are used to classify the signal into the predefined classes using multi- class support vector machine classifier (SVM). The performance of the proposed denoising algorithm is evaluated using the signal to noise ratio, percentage root means square difference, and root mean square error. The experimental result shows that the 4th level of decomposition for the Db10 wavelets gives the highest signal to noise ratio (SNR) values when using the soft and hard threshold. The overall accuracy, Sensitivity and Specificity of the developed algorithm is 97.96%, 97.92 % and 98.0% respectively. The algorithms presented in this research require only electronic stethoscope as input signal unlike other methods which require electrocardiogram (ECG) gating and the proposed method delivered a considerable improved result for detection heart valve-related diseases.

Keywords: Auscultation, Discrete wavelets transform (DWT), Heart Sound, Phonocardiography (PCG), Support vector machine

The Method of Lightning Flash for Electrically Charged Wearable Materials to Protect Humans from SARS CoV-2

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Abstract

This article aims to introduce the method of lighting flash for wearable charged materials to protect humans from severe acute respiratory syndrome 2 (SARS CoV-2) that causes COVID-19 infection. The wearable materials can be any, day-to-day clothes including personal protective equipment. Charged wearable materials are designed to enhance the surface charge of a human face. Then the enhanced charged face will induce an opposite electric charge on SARS CoV-2 contaminated droplets directed to the nose, mouth, and eyes during sneezing, coughing, talking and singing by the second infected body. In the process, the SARS COV-2 polluted droplets are attracted to an electrically charged face. The virus will be controlled via the discharging electric current. This can be considered as a weak man-made lightning flash that fits the purpose. The moderate electric current in an electrostatic discharging procedure has no diverse effect on humans except destroying SARS CoV-2. For the effectiveness of weak lightning flash; the physiology of SARS CoV-2 is engaged. The main physiology of SARS CoV-2 are spikes, envelope, membrane and nucleocapsid-proteins. Among its physiological parts, the spikes protein sites of SARS CoV-2 are liable for electric discharging. This is similar to lightning flashes generated by trees in a thunderstorm. The method lastly ends by destroying the spikes and subsequently SARS CoV-2 itself. The functional implementation of the method brings down SARS CoV-2 under zero infection-causing level. Finally, this clue will be enriched via research and be emerged and thrived to handle the problems of COVID-19 infection. Thereafter, the method will be developed and made fruitful and one of the best selective methods in controlling SARS CoV-2 to the end which is the health and health-related problems of the day.

Keywords: COVID-19, Lightning flash, SARS CoV-2, Surface Charge, Wearable Materials

Bionomics, Seasonal Dynamics, Species Composition and Insecticide Susceptibility of *Anopheles* Mosquitoes in Malaria Prone Areas of Ethiopia

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Abstract

In Ethiopia, malaria is highly seasonal with varying intensity of transmission due to altitudinal and climatic variations. Information on principal, secondary and suspected malaria vector species composition, seasonal dynamics, bionomics and insecticide susceptibility status at locality levels are important to design an effective vector control strategy. Adult female *Anopheles* mosquitoes were collected from the Lare district of Gambella Regional State and Jimma Zone of Oromia Regional State using CDC light traps and human landing catches (HLC). The *Anopheles* were morphologically identified and preserved. Larvae and pupae of *An. gambiae* complex, *An. pharoensis* and *An. coustani* were collected from breeding sites and reared into an adult. Bioassays were conducted on non-blood-fed emerged adult females using WHO insecticides. Molecular identification was conducted using Sanger sequencing and TaqMan qPCR was used to investigate the presence of infective stage *Plasmodium*. Data were analyzed using IBM SPSS statistics (v.20.0) and values were considered significantly different at $p < 0.05$. A total of 11,871 *Anopheles* belonging to four species were collected, with *An. coustani* being the most abundant (47.86%). The majority (74.21%, n = 8809) of Anopheles were collected using CDC light traps. The mean monthly density of female *Anopheles* collected by HLC was 8.42 mosquitoes per-person-night and the mean monthly mosquito density using CDC LT was 16.83 per-trap-night. There was no direct association between *Anopheles* density and rainfall in the Lare district. *Anopheles pharoensis*, *An. gambiae* s.l and *An. coustani* complex were susceptible to Primiphose methyl, Propoxur and Bendiocarp. All sub-samples that were morphologically identified as *An. coustani* were molecularly confirmed to belong to the *An. coustani*. The TaqMan assay did not detect the infective parasite stage from samples of *An. pharoensis* and *An. coustani*. *An. gambiae*, *An. pharoensis*, *An. coustani* and *An. funestus* were captured from the Lare study site while *An. funestus* was not detected from the Jimma study site. *An. coustani* was the largest captured mosquito in this study. High vector density was recorded following rainy seasons.

Keywords: *Anopheles* mosquitoes, Bionomics, Ethiopia, Secondary vectors

Evaluation of the Biological and Residual Activity of Larvicide Formulations (SumiLarv™ 2MR, SumiLarv™ 0.5G & Abate® 1SG) against Invasive Mosquito *Anopheles stephensi* in Ethiopia

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Abstract

The efficacy and residual activity of SumiLarv 2MR, SumiLarv 0.5G and Abate 1SG (positive control) against exotic invasive vector *Anopheles stephensi* larvae was evaluated in Awash Subath Kilo, Afar Regional State, Ethiopia. One disc of SumiLarv 2MR (2g in weight) containing 40 mg pyriproxyfen per disc was applied into plastic containers each containing 100L, 250L and additional 250L containers with a half dose rate to equate to 1 disc/500L of drinking water (tap water). Four replicates were conducted per treatment. The water was conditioned for 7 days before use. Plastic containers with 100L, 250L and 500L (equivalent) of water without a SumiLarv 2MR disc with two replicates per treatment acted as controls. Emergence inhibition rates of released larvae were observed for up to eight months. After the completion of the trial, the residual content of pyriproxyfen left in each SumiLarv 2MR disc was analysed using HPLC. The results of this trial confirmed the high residual efficacy of SumiLarv 2MR against *An. stephensi* larvae during the study period of eight months. However, the residual efficacy of SumiLarv 0.5G and Abate 1SG was performed for seven and five weeks, respectively. Eight-month-old SumiLarv 2MR discs were left with almost 50% residual content of pyriproxyfen showing the potential of SumiLarv 2MR residual efficacy to continue. Therefore, SumiLarv 2MR appeared to be an effective larvicide with longer residual efficacy to control container breeding *An. stephensi* in Ethiopia.

Keywords: *Anopheles stephensi*, Ethiopia, Pyriproxyfen, SumiLarv 2MR

SUB-THEME FOUR:

Agricultural Transformation, Water Energy Nexus: The Role in Ensuring Food and Nutrition Security

Tropical Forage Diversity and their Potential Contribution to Agricultural Transformation for Sustainable Development in Ethiopia

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Abstract

A variety of annual and perennial grasses, dual-purpose herbaceous legumes, and multipurpose leguminous trees and shrubs are among the 18,664 accessions of tropical forage germplasm maintained in the International Livestock Research Institute (ILRI) forage genebank in Addis Abeba, Ethiopia. We have been characterizing some of them, such as Napier grass (*Cenchrus purpureus*), Rhodes Grass (*Chloris gayana*), Oats (*Avena sativa*), lablab (*Lablab purpureus*), Cowpea (*Vigna unguiculata*), and *Sesbania sesban*, for the available genetic diversity and identifying climate resilient, adaptive, and high biomass yielding genotypes that can be used as an alternative feed source in the dry season, and the collection has shown a wide range of phenotypic and genetic diversity. The perennial grasses, such as Napier grass, offer several beneficial qualities, including good feed quality, high dry matter content, and year-round availability. They can also be utilized in the paper industry since they contain a lot of cellulose, which can be used as a carbon source and for producing biofuels. Most herbaceous legumes maintained in the gene bank have a high nutritional value and can be used for human and animal feed. They can also benefit the environment through symbiotically fixing nitrogen and having a long tap-root system. Leguminous trees and shrubs provide foliage during dry seasons when herbaceous species are scarce and are a good source of high-quality, protein-rich fodder for subsistence and commercial cattle production. However, most tropical forage species are orphan crops that must be more utilized and characterized. Molecular genetics approaches offer opportunities and are a promising strategy for improving the production and productivity of these underutilized crops, which can significantly contribute to Ethiopia's agenda for agricultural transformation for sustainable development.

Keywords: fodder, forage, gene bank, Napier grass

Nanotechnology in Agriculture, Food Processing and Packaging: it's Role in Agricultural Transformation and Food Security

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Abstract

The foremost universal challenge on our planet is establishing food security which is affected due to rapidly increasing population, climate change, famine, drought, flooding, conflict, and others. The global food supply is interrupted by bio-resources expenditure for energy production, manufacturing chemicals, high post-farming loss, less value addition, inefficient distribution and marketing systems, and other factors. Ensuring food security in developing countries is essential through increasing the productivity of agricultural products, minimizing the depletion of natural resources, post-farming losses, and maximizing value addition. Innovation and new technologies for enhancing the production of crops through intensive and extensive agriculture are critical, especially for farmers in developing countries. Researchers strive to adopt newer technologies to improve the supply and narrow the food demand gap. Nanotechnology is one of the promising technologies that could improve agricultural productivity via nano fertilizers, efficient herbicides, pesticides, soil feature regulation, wastewater management, and pathogen detection. It is equally beneficial for industrial food processing with enhanced food production, excellent market value, elevated nutritional and sensing properties, improved safety, and better antimicrobial protection. Nanotechnology can also reduce post-farming losses by increasing the shelf life with the aid of nanoparticles. However, further investigation is required to solve the environmental safety and health risks associated with the technology.

Keywords: Agriculture, Food processing, Food packaging, Food security

Innovative Technologies in Improving Crops Productivity in Nutrient-Deficient Soils of Ethiopia: The Untapped Role of Phytobeneficial Microbes

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Abstract

Ethiopia has the highest agricultural production potential with 34.09% of the land suitable for agriculture. At present, the sustainability of ecosystems is in danger due to both application of varied degrading agents and the intensive exploitation of tropical forests. Some major challenges to the sustainability of the world's agriculture are: i) pollution, ii) biodiversity loss, iii) soil degradation/nutrient loss/erosion, iv) water scarcity/salinity, v) carbon footprint, and vi) natural resources depletion. During the last decades, inventories of the soil's productive capacity indicate severe degradation and loss of arable lands. The situation is highly exacerbated in economically disadvantaged SubSaharan countries where soil fertility management is too poor or not at all there. Currently, the ever-increasing population growth in Ethiopia prompts also extensive usage of agrochemicals to attain optimum yields. Nevertheless, their cost and other constraints (i.e., environmental hazards) potentially discourage smallholder farmers from using them in recommended quantities. The use of such chemicals added to the recent climate change scenario leads to losses in soil fertility and hence, requires an alternative to boost crop productivity while sustaining ecological quality via organic farming. Globally, there is widespread interest in the use of eco-friendly and innovative technologies such as phytobeneficial microbes that contribute to sustainable agriculture. It is a well-established fact that eco-friendly and innovative technologies are essential components in natural and managed terrestrial ecosystems to restore soil fertility. The voluminous literature has revealed that phytobeneficial microbes and organic fertilizers improve the overall growth of crop plants growing under diverse argo-ecological zones. Organic agriculture has developed rapidly worldwide during the last few years and is now practised in approximately 120 countries of the world (mainly in Central Europe and India). African countries (Uganda, Kenya, Tanzania, South Africa, Cameroon and Ghana) have also gone far ahead in the production of certified organic foods. Thus, this review paper gives a brief account of major constraints to crop productivity and designs strategies to circumvent them to ensure the sustainability of crop production in Ethiopia. Moreover, the paper describes also the organic farming techniques, benefits derived from the technologies, adoption levels, and constraints to organic farming practices with due emphasis on microbial inoculants. The challenges posed to agriculture and food security require a holistic and strategic approach to linking knowledge with action. Key elements of this are greater interactions between decision-makers and researchers in all sectors, greater collaboration among climate, agriculture and food security communities and consideration of interdependencies across whole food systems and landscapes.

Keywords: Biological nitrogen fixation, Compost, Microbial inoculants, Phosphate solubilization, Stress tolerance, Vermicomposting

QTL Mapping for Selected Yield-Related Traits in Different Mapping Populations of *Solanum Pimpinellifolium* Using Single Nucleotide Polymorphism Markers

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Abstract

Tomato production is challenged by many limitations, with high humidity being among the major causes of low fruit production worldwide. Finding the major genomic regions associated with selected desirable traits for increased fruit production under a humid environment becomes necessary. In this study, we constructed four small balanced-F_3 (H35W, D34W, T33W, and U37W) and four unbalanced-BC_1F_2 (H34W, D34W, T33W, and U36W) tomato mapping populations with a common parent of *S. pimpinellifolium* (wild parent 'LA2093'). We performed joint, inclusive composite interval mapping (JICIM) analysis on our generated reverse nested association mapping (R-NAM) populations for agronomic traits and performance under humid conditions. The objective was to identify genomic regions associated with yield-enhancing features. A composite linkage map was constructed using single nucleotide polymorphism (SNP) markers from four F_3 and four BC_1F_2 populations. It resulted in an improved version of the individual linkage maps shown by genome span covered in the composite map (1272.34 cm for F_3 mean composite population) and (1722.46 cm for BC_1F_2 mean combined population) which individual linkage maps could not be done due to small population size. Using F_3m composite population, several significant quantitative trait loci (QTLs) of different size effects were identified for the number of primary branches (R^2 = 28.49%), days to first anthesis (R^2 = 14.67%, 27.60%), days to 50% anthesis (R^2 = 11.96%, 16.74%, 18.99%), the total number of flower per plant (R^2 = 11.74%, 16.94%), total number of fruit per plant (R^2 = 10.58%, 13.34%), and actual fruit yield (R^2 = 70.66%). The significant QTLs detected using BC_1F_2m composite population also revealed varying size effects for the number of primary branches (R^2 = 15.86%, 43.28%), number of secondary components (R^2 = 13.08%, 34.11%), days to first anthesis (R^2 = 11.53%, 31.88%), days to 50% anthesis (R^2 = 56.33%), the total number of flower per plant (R^2 = 14.10%, 15.71%, 22.55%), and total number of fruit per plant (R^2 = 10.77%, 15.56%, 16.28%, 22.93%). Digenic epistasis was not evident. Several regions of the genome showed effects on more than one trait. Using a composite map and QTL analysis under the R-NAM population structure increased the power to detect small-effect QTLs that were segregating in at least two of the populations but would not be seen using individual linkage maps. The unbalanced-BC_1F_2 composite proved to be a better genetic resource for detecting QTL than the F3 combined population.

Keywords: agronomic traits, Digenic epistasis, genomic regions, polymorphism

Geographical Variation in *Coxiella burnetii* Seroprevalence in Dairy Farms Located in South-Western Ethiopia: Understanding the Broader Community Risk

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Abstract

Q fever is a zoonotic disease caused by *Coxiella burnetii*, leading to abortion, infertility in ruminants, and debilitating diseases in humans. Jimma zone, including Jimma town, located in the Oromia region of Ethiopia, was affected by an outbreak of abortions in ruminants related to Q fever infection between 2013 and 2015. This study aimed to investigate the geo-clustering of *C. burnetii* seroprevalence in dairy farms of Jimma town and identify the environmental risk factors associated with seroprevalence distribution. Two hundred twenty-seven cattle were tested for antibodies against *C. burnetii* in 25 farms. We explored the clustering of *C. burnetii* seroprevalence using semivariograms. Using Open Bugs, a geostatistical regression-based model was implemented to quantify the risk factors and to predict the geographical variation in *C. burnetii* seroprevalence at unsampled locations in Jimma town. Our results demonstrated that the risk of exposure in dairy cattle varied across the landscape of Jimma town and was associated with environmental risk factors. The predictive map of *C. burnetii* seroprevalence showed that communities in the eastern part of Jimma town had the highest risk of exposure. Our results can inform community-level investigations of human seroprevalence in the high-risk areas east of Jimma.

Keywords: geo-clustering, Jimma, infertility, Open Bugs, seroprevalence

Modeling Watershed Hydrological Response to Climate Change and Adaptation

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Abstract

Climate change is one of the inevitable global environmental problems disturbing the pattern of normal watershed hydrological response to different elements of hydrologic cycle. It is globally accepted that climate change is deteriorating water resources and its availability and water security at global and local scale. To counteract such adverse impacts of climate change on water resources, it is imperative to develop the most effective and sustainable climate change resilience and adaptation strategies. For the effective formulation of such strategy, the contribution of knowing the watershed hydrological response to climate change is manifold. This can be achieved via modeling the interaction between watershed hydrological response and climate change. Hence, the main objective of this study was modeling watershed hydrological response to climate change in order to develop the sustainable climate change resilience and adaptation strategy, case study on Gilgal Gibe watershed, Omo Gibe River Basin, Ethiopia. The hydrological and meteorological data for a baseline period of 1986-2016 were collected from Ethiopian ministry of water and energy (MoWE) and national meteorological agency (NMA) respectively. Three regional climate models (RCM), i.e. RACMO22T, RCA4 and CCLM4-8-17 governed by one global climate model (GCM), i.e. MOHC-HadGEM2-ES were downloaded from CORDEX-Africa and utilized in order to consider the projected climate data into the study in attempt to see the present and future hydrological response against climate change. The watershed climatic elements such as temperature and precipitation were extracted for every grid points covering the study area using Rstudio package and checked for bias correction using scale variance and power transformation respectively. The climate projection of the three RCM and their ensemble indicated rising in maximum and minimum temperature at near future (2020-2050) and mid future (2051-2080) term respectively by 2.34°c and 3.86°c under RCP4.5 and 2.15°c and 3.43°c under RCP8.5 greenhouse gas emission scenarios. The precipitation depicted a little variation over the two-time horizon under both RCP4.5 and RCP8.5 scenarios. However, the stream flow which was computed using the calibrated and validated HEC-HMS model was showed an oscillating trend along the two time horizons both under RCP4.5 and RCP4.5 greenhouse gas emission scenarios. Such findings of the study are very important for water resources planners and managers to formulate the appropriate climate change resilience and adaptation strategies for the proposed watershed.

Key Words: Climate Change Adaptation, Climate Resilience, GCM, Hydrologic Modeling, RCM

Impact of Irrigation Expansion on Hydro Power Generation: a case of Gilgel Gibe I Hydropower, Jmma Zone,Oromia Regional State, Ethiopia

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Abstract

Increased natural and anthropogenic stress have threatened the Earths ability to meet the growing human demands for food, energy and water (FEW) in sustainable way. FEW are the three fundamental interconnected resources, created a nexus, that changes in one of these resource affect the others. Now a day, the low flow amount of Gilge Gibe River (GGR) is becoming decreased due to extraction of water from the tributary rivers for water supply and irrigation. Hence, the intended aim of this research was to assess the impacts of upstream water extraction for irrigation on the power production of GG I hydropower. Spatial data like; Soil, Land Use and Land Cover (LULC) and Digital Elevation Model (DEM), Climate data like; humidity, sunshine hour, wind speed and temperature, Hydrologic data like; river flow data, Hydropower data like; storage capacity of reservoir, evaporation from reservoir, different levels of reservoir, elevation verses volume curve of the reservoir were used for the analysis. All those data were collected from respective governmental organizations, including National Meteorology Agency of Ethiopia (NMA), Ministry of Water and Energy office (MWE), Ethiopian Mapping Agency (EMA), Zonal and District level irrigation development offices. The analysis was conducted using Geographic Information System (GIS) and CROP WAT software as tool for irrigation suitability assessment and Water Evaluation and Planning (WEAP) model for the development of hydropower generation scenarios with different irrigation schemes. Firstly, the irrigation potential of the area was estimated to be 56913 ha, under highly and moderately suitable class. Based on the analysis, expansion of irrigation from currently existed (6366 ha) to a full potential of irrigation (56913 ha), would impose reduction of power reduction from 560 to 480 GWh by the end of the scenario period (2040). It means that, extracting water for irrigation of the whole suitable land, leads to reduction of hydropower production by 14.3 % especially in dry season. Hence, there should be an optimized use of the water resource so that, maintain the three interconnected resource (FEW)sustainable.

Key Words: Gilgel Gibe, Hydropower, Irrigation Expansion, Scenarios

Integrated Water Resources Management in the Upper Blue Nile Basin: the Case of Nashe-Amerti-Fincha'a

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Abstract

Soil degradations and the changes in climate affects the function and operation of existing water infrastructure but also the long-term outcomes of water management practices. To address problems with water resources on a regional to local scale, an examination of the situation and its possibilities based on strong scientific evidence is required. This study was aimed to examine the future outlook of Nashe-Amerti- Finca'a (NAF) and evaluate management practices to account for changes in water resources brought on by LULC and climate change. Four statistically bias corrected Regional Climate Models (RCMs) from the coordinated regional climate downscaling experiment (CORDEX)-Africa were used to develop the climate change scenarios for the near future (2021-2050) and mid-term (2051-2080). Then a calibrated and validated Soil and Water Assessment Tool (SWAT) was used to evaluate the LULC and Climate change impacts. All models, including the ensemble mean of the models, projected a decrease in precipitation and an increase in temperature under all scenarios. The effects of temperature change and precipitation variability show that temperature change dominates in controlling the water balance components. The changes in climate and LULC shows a decline of total water yield, surface runoff, aquifer recharge and groundwater. The decline of the seasonal flows owing to the higher evapotranspiration demands and increase in vapor pressure deficit causes decline in annual flow which could result in a reduced water resources availability. The study also shows that in areas like NAF, where the need for household energy is entirely dependent on forest resources, deforestation driven by rapid population growth is likely to continue causing serious climate change problems like decline in crop yields, food security, rising aridity and drought. Implementing contour farming, reforestation and soil bund reduces sediment yield by 17.1% - 64.8% at the catchment level. The application of sediment yield reduction could reach tolerable levels by the implication of soil bund in agricultural land with reforestation in steep slopes. Overall, the impacts of LULC change shows that changes in land use activities and vegetation cover are essential in restoring degraded soils that helps to maintain ecosystem service but also climate change adaptation.

Keywords: Climate change, LULC, Management practices, NAF, Water resources

Determination of Physical and Mechanical Properties for Selected Early Maturing Varieties of Sorghum (*Sorghum bicolor* (L. Muench)) Grains

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Abstract

Moisture-dependent physical and mechanical properties of sorghum grain were evaluated for selected improved early maturing varieties produced under Hararghe lowland areas in Ethiopia. The objective was to generate the information required to choose, improve, design, develop and set operation conditions of postharvest handling and processing equipment needed for these improved varieties. Three early maturing (Makko, Qaqaba, and Malkam) and one local (Muyra) variety were selected and studied at six different levels of grain moisture content ranging from 10% to 20%(wb). The Muyira variety was added to observe the deviations of the improved varieties' seeds from the local ones. The grains were investigated for size, shape, densities, coefficient of friction, angle of repose, and breakage force parameters. The data were analyzed using descriptive statistics. Means of the grain major, intermediate and minor diameters were increased linearly with the increase of the grain moisture content. The geometric mean diameters of 4.40±0.18, 3.99±0.21, 3.74±0.12 and 3.49±0.17 mm at 10%(wb) were increased to 4.83±0.23, 4.47±0.16, 4.19±0.11, and 3.95±0.21 mm at raised moisture of 20%(wb), respectively, for Muyra, Makko, Malkam and Qaqqaba varieties. Grain of Muyra variety was obtained the largest, followed by Makko, whereas Qaqqaba was the least of them. The bulk density was decreased linearly from 0.885, 0.854, 0.825, 0.910 g/cm^3 at 10%(wb) to 0.701, 0.688, 0.673, and 0.723 cm^{-3} at increased moisture of 20% (wb) for Muyra, Makko, Malkam, and Qaqaba varieties, respectively. The porosity, angle of repose, and static coefficient of friction were increased linearly with moisture content. The minimum breaking force and work done during deformation were decreased with increasing moisture for all varieties in which the points were reduced from 168.60, 182.50, 176.20, and 162.00 N to 86.54, 95.78, 89.28, and 79.68 N for Qaqaba, Muyra, Makko, and Malkam when moisture increased from 10 to 20% (wb). The grain properties of the three improved early maturing varieties were significantly different, and all differed from the local mudra variety seeds.

Keywords: mechanical properties, moisture dependent, physical properties, sorghum grain

The Feeding Value of Amaranth (*Amarantha caudatus*) Grain Seed on a Layer Diet

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Abstract

Amaranth is a pseudocereal with high nutritional value that can thrive in adverse environments where other crops may not survive. This study aimed to assess the effects of different levels of amaranth grain inclusion on the production performance, egg quality, and blood parameters of tetra super B laying hens. The experiment used a Completely Randomized Design (CRD) with four treatments and three replications. The treatments were: T1 (control) - no amaranth in the diet; T2 - 10% amaranth in the diet; T3 - 15% amaranth in the diet; and T4 - 20% amaranth in the diet. A total of 120 laying hens at 32 weeks of age were randomly assigned to the treatments. The parameters measured were feed intake, egg production, egg mass, feed conversion ratio, internal and external egg quality, blood hematology, and serum biochemistry. The data were analyzed using the General Linear Model (GLM) of SAS (2014) and Tukey multiple range tests to compare the means. The results showed that increasing the level of amaranth in the diet from 10% to 20% significantly reduced ($p<0.001$) the feed intake, egg production, and egg mass and increased ($p<0.001$) the feed conversion ratio. However, there was no significant effect on any of the internal and external egg quality parameters measured. The blood haematology parameters were also not affected by the dietary treatments. The only serum biochemistry parameter that was influenced by the dietary treatments was triglyceride, which significantly decreased ($p<0.001$) as the level of amaranth increased in the diet. Ten percent of amaranth grain can be included in the diet of laying hens without compromising their performance and health.

Keywords: Amaranth, Inclusion level, Layer performance, Pseudocereal

PART THREE:

POSTER ABSTRACTS

Under Nutrition and Associated Factors among Pregnant Women in Public Health Care Facilities of Gedio Zone, SNNPRS, Ethiopia

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Abstract

Pregnancy is a time that the body goes through many physical and hormonal changes. Balanced nutrition during pregnancy helps for the expected weight gain of the mother and the growth and development of the fetus. Suboptimal level of vital nutrients during this time may increase the risk of other adverse pregnancy outcomes. Although good efforts are made by Ethiopia Government by developing food and nutrition policy and national nutrition program to address malnutrition, there has been little progress in reducing pregnant Undernutrition in Ethiopia; it has been too slow. This study aims to assess the magnitude of Under Nutrition and Associated Factors among Pregnant Women in Public Health care Hospitals of Gedio Zone, SNNPRS, Ethiopia, from Feb to March 2020. An institutional based cross sectional study design was used in Public Hospitals of Gedio Zone. Data on socio—demographic and economic characteristics were collected using a pretested structured questionnaires while, Anthropometric measurements such as MUAC, height and weights were collected using a height measuring board and digital bath balance. The data were coded and entered into computer using Epidata version 3.3 and analyzed using SPSS version 20. , Bivariate logistic regression analysis was done to assess the association between outcome variable and independent explanatory variables. Odds ratios along with 95%CI were estimated to identify factors associated with nutritional status using multivariable logistic regression analysis. The level of statistical significance was declared at p -value less than 0.05. The magnitude of Undernutrition among pregnant mothers was 21% (95%CI: 20.8–21.2). On a multivariable logistic regression analysis, after adjusting for other co-variables, Average Monthly income (AOR: 2.89; 95%CI: 1.49-5.6), mother's educational status (AOR: 4 .2: 95%CI: 2.34-7.86)., Nutrition Education and counseling (AOR: 3.23 ; 95%CI: 1.6-15), health condition of the pregnant women(AOR: 2.19; 95%CI: 1.78- 5.84) and Parity (AOR: 5 ; 95%CI: 1.56-9.67) had a significant association with nutritional status of pregnant mothers. The magnitude of Undernutrition in pregnant mothers in this study was found to be very high; Average household monthly income, family size, Mothers Educational status, nutrition Education and Counselling, current health condition of the mother and Parity were factors significantly associated with undernutrition among pregnant women.

Keywords: Undernutrition, MUAC, Public Health facilities

Effect of Nutrition Education during Pregnancy on Birth Weight using Structural Equation Modeling in Southeast Ethiopia: A Cluster Randomized Controlled Trial

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Abstract

Birth weight is a good summary of multifaceted public health problems, including long-term maternal malnutrition, chronic illness, and poor health care during pregnancy. However, evidence for the effect of nutrition education during pregnancy on birth weight is sparse in Ethiopia, particularly in the study areas. Therefore, this study aimed to explicate the effect of nutrition education during pregnancy on birth weight using a structural equation modeling (SEM) approach in Southeast Ethiopia. A community-based two-arm parallel cluster randomized controlled trial was conducted among 447 randomly selected pregnant women attending antenatal care (224 intervention group and 223 control group) at health facilities from February to December 2021 in Southeast Ethiopia. We used a multistage cluster sampling technique followed by systematic sampling to select the study subjects. Pregnant women who participated in the interventions were given nutrition education starting at 16 weeks of gestation and continuing for 6 months. Pregnant women in the control group received the routine standard care provided by the health care system. We used a pre-tested interviewer-administered structured questionnaire to collect the data. Birth weight was measured within the first hour of birth. We employed a SEM to examine direct, indirect, and total effects through a mediator on birth weight. The beta coefficient (β), along with a 95% confidence interval (CI), were estimated. The SEM revealed that receiving intervention during pregnancy (standardized $\beta = 0.141$, 95% CI: (0.038, 0.244) had a significant direct effect on birth weight. Whereas, it was revealed that receiving intervention during pregnancy ($\beta = 0.523$, 95% CI: (0.083, 0.962), being literate ($\beta = 1.519$, 95% CI: (0.619, 2.419), and having a higher wealth quintile ($\beta = 0.688$, 95% CI: (0.202, 1.174) had a direct or total effect on dietary diversity score (DDS). Similarly, it revealed that receiving intervention during pregnancy ($\beta = 0.139$, 95% CI: (0.036, 0.242) had a total effect on birth weight. Both the direct and total effects of nutrition education during pregnancy contributed to birth weight. There is also an urgent need for pregnant women's literacy and economic empowerment to improve DDS in Ethiopia.

Keywords: Birth weight, nutrition education, pregnancy, structural equation modeling, Ethiopia

Nutritional Status and Its Associated Factors among Elderly People in Ilu Aba Bor Zone, Southwest Ethiopia: A Community-Based Cross-Sectional Study

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Abstract

The number of elderly people is expected to rise from 900million to 2billion between 2015 and 2050 (from 12% to 22% of the total global population), with developing countries accounting for the majority of this increase. As a result, the elderly are the fastest growing population group. These trends have a significant impact on the likelihood that many people will live longer in less-than optimal health, be at risk of malnutrition and with various chronic conditions that can occasionally result in functional disability, anorexia, depression, social isolation and loneliness all are quality of life aspects. Although Ethiopia is a young country, with 46% of the population under the age of 14 years, approximately 5% of the 81million Ethiopians are 60 years or older. By 2050, this percentage of the population is predicted to nearly double to 9%. Older men should expect to live an extra 15 years after turning 60 years, and older women can expect to live an extra 16 years. Nutritional status is an important component of physical and mental health for people of all ages. Due to increased vulnerability to degenerative diseases, the nutritional needs and health problems of the human body vary as it ages. The proportion of malnutrition among Ethiopia's old population ranges from 15% to nearly 50% in both rural and urban areas Investigating the prevalence and determinants of malnutrition in a vulnerable group is critical for suggesting strategies to address the issue and providing holistic assistance for older persons. Few studies have looked at the nutritional status of Ethiopia's elderly population and almost none were done in the study region to date. Studies of the elderly aged 60 years and older who live in urban and semi-urban areas have shown that factors affecting nutritional status differ, indicating the need for greater research into the factors that contribute to underweight and overweight status in the elderly. This study aims to assess the nutritional status and its associated factors among older adults in urban and semi-urban areas of Ilu Aba Bora Zone, southwest Ethiopia, between October 3 and November 10, 2021. The Mini Nutritional Assessment was used to evaluate nutritional status and the STEPwise approach was used to collect data on backgrounds and lifestyle. SPSS V.22.0 was used for data analysis. Multinomial logistic regression was computed. The level of significance was set at 0.05.Elderly people who were malnourished or at risk of malnutrition were found to make up 48.1% (44.1% to 52.1%) and 17.4% (14.5% to 20.6%) of the population, respectively. Those aged 80 years and older had a chance of being at risk of malnutrition (adjusted OR (AOR) =22.555; 95% CI: 7.963 to 63.881), while the odds of being malnourished were 11.5 times higher (AOR=11.755; 95% CI: 4.825 to 28.638). Informal education was a significant predictor of being at risk of malnutrition (AOR=6.102; 95% CI: 2.684 to 13.871). Urban dwellers were 8.9 times more likely to be malnourished. Inadequate financial resources make people 3.7 times more likely to be malnourished. A lower wealth index was a significant predictor of being at risk of malnutrition (AOR=4.156; 95% CI: 1.361 to 12.692). Single elderly people had a 3.4- fold higher risk of malnutrition. Elderly people with chronic pain, who were smokers and alcoholics, and who had depression were all at risk of nutritional problems. The risk of malnutrition and malnourishment was high. Age, urbanization, finances, education, economics, being a woman, smoking and alcohol are associated factors. Interventional studies are warranted to minimize malnutrition challenges in the study population.

Keywords: Elderly, Malnourished, Mini nutritional assessment, Nutrition, Nutritional status

Time to Initiation of Complementary Feeding and its Predictors among Children Aged 9-23 Months in Meket District, Northeast Ethiopia: An Inverse Gaussian Frailty Model

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Abstract

Globally and nationally, only 64.5% and 49.2% of infants received solid or semi-solid foods, respectively. The available evidence indicates that time to initiate complementary feeding practices is still poor and varies from region to region. Therefore, the aim of this study was to assess the time to initiation of complementary feeding and its predictors among children aged 9-23 months in Meket District, Amhara Region, Ethiopia. A community-based retrospective cohort study was conducted from June to July, 2022 among 459 systematically selected mothers/caregivers with their children aged 9-23 months. Data entry was done by Epi Info version 7 and exported to STATA version 14 for analysis. The life table was used to estimate the probability of complementary feeding initiation over time, and the Kaplan–Meier survival curve together with the log-rank test were used to investigate the experience of CF initiation. The result of descriptive statistics was reported by table, frequency and percent. The proportional hazard model assumption was checked by log-log plot of survival, and the assumption was not fulfilled. Model fitness was checked by the log likelihood, AIC and BIC values. The smallest values were observed in univariate frailty model with inverse Gaussian distribution (Log likelihood=-372.87, AIC=775.7). An adjusted hazard ratio with a 95% confidence interval and a P-value of 0.05 were used to declare the significant predictors. A total of 459 lactating mother/care-givers with their children aged 9-23 months were interviewed, making the response rate 100%. The mean age of mother/care-givers was 31.18±7.87 (SD) years. More than half 342 (52.72%) of the children were male. The median time of complementary feeding initiation was 6 months [95% CI 5.46–6.60]. Attending primary education (AHR = 1.8; 95% CI: 1.16, 2.78), occupation of the mother (AHR = 1.43; 95% CI: 1.04, 1.95), home delivery (AHR = 1.61; 95% CI: 1.09, 2.37), and birth preparedness (AHR = 1.37; 95% CI: 1.03, 1.81) were the predictors of time to complementary feeding initiation. The median time to complementary feeding initiation was consistent with the WHO recommendation. Maternal education, maternal employment, place of delivery, and birth preparedness were the predictors of time to initiation of complementary feeding. Therefore, working with the education sector, increasing health facilities delivery rate, strengthening counseling on birth preparation, increasing maternity leave until six months of age, and initiating corner feeding should be part of the complementary feeding practices promotion agenda.

Keywords: Children, complementary feeding, Meket District, predictors

Diabetes mellitus self-management education at Jimma University Medical Center: evidence-based implementation project

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Abstract

Low and middle-income countries are currently enduring the heaviest global burden of diabetes and diabetes-related mortalities. Diabetes self-management education (DSME) improves patient clinical outcomes, health status, and quality of life. Lack of awareness about best practice guidelines and recommendations may be associated with increased risk of diabetes morbidity and mortality.The objective of this study was to improve knowledge and skill of health care providers and patients with diabetes by enhancing evidence-based practice through self-management education to increase compliance with best practice recommendations. Joanna Briggs Institute (JBI)'s three-phase Practical Application of Clinical Evidence System and Getting Research into Practice audit criteria of diabetes of audit management criteria were used. To understand barriers, 12 audit criteria, patient's medical record handling and educational plan according to set standards were evaluated. To mitigate the barriers, strategies of training and supportive supervision on evidence-based DSME were implemented from 20 April 2018 to 7 June 2018. Sixteen health professionals and 80 patients with diabetes participated in the study conducted in Jimma University Medical Center. Both a baseline and follow-up audit was conducted using the JBI feedback tool. The baseline audit results indicate that 3 of the 12 audit criteria recorded zero percent compliance, whereas other compliances were below 40%, representing poor compliance with the current evidence. The post implementation audit reported 100% compliance for criteria on availability of structured education plan, existence of appropriate training for staff, the presence of education regarding nutrition and medications, while for the remaining criteria on competency of staff members for delivering DSME, assessment of prior diabetes knowledge, status of documentation after each session, and the presence of appropriate referrals or booking the compliance rate was improved to 88%. Similarly, criteria on the presence of individualized education plan improved (0–75%), encountering knowledge regarding physical activity (6–75%), self-monitoring of blood glucose (4–60%), and prevention diabetes complications (10–90%). There were remarkable changes in both patients and care providers on comparison of pre-intervention and post-intervention, particularly in availability of materials, involvement of staff in self-management education, nutrition, and medication.

Effect of Empathy Training on The Empathy Level of Healthcare Providers in Ethiopia: A
Cluster Randomized Controlled Trial

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Abstract

Empathy has deteriorated throughout clinical training and medical practice and little is known about the effect of empathy training on the empathy of healthcare providers providing care for fistula survivors. Hence, we evaluated the effect of empathy training on the empathy level of healthcare providers in Ethiopia. A Cluster randomized controlled trial was conducted from December 20/2021 to March 20/2022 among randomly selected healthcare providers at five fistula treatment centers in Ethiopia. The empathy training intervention was conducted for consecutive three days. Total means score, percentage changes, and Cohen's effect size were computed. A linear mixed effects model, intention-to-treat, and independent t-test were used for data analysis. The majority of study participants were nurses in the profession, married, and first-degree holders. There was no significant effect of socio-demographic features in the baseline empathy score of the intervention arm. At the baseline, the mean empathy scores of the control and intervention arms were 102.10 ± 15.38 and 101.13 ± 17.67, respectively. The effect of empathy training on the total mean score changes of empathy of the intervention arm compared to the control arm at each follow-up time had a statistically significant difference. After a week, a month, and three months of post-intervention, the total mean empathy scores between the intervention and control arms were: (intervention 112.65 ± 18.99, control 102.85 ± 15.65, d=0.55, P=0.03); (intervention 109.01 ± 17.79, control 100.52 ± 12.57, d=0.53, P=0.034); and (intervention 106.28 ± 16.24, control 96.58 ± 14.69, d=0.60, P=0.016) with the overall percentage changes of 11%, 8%, and 5% from the baseline scores, respectively. The empathy training had more than a medium effect size. However, over the follow-up intervals, there was a decreasing trend in the total mean empathy scores of healthcare providers; suggesting that there should be continued empathy training and integration of it into educational and training curriculums to enhance and sustain empathy of healthcare providers. This study contributes to improving the empathy of healthcare providers, their relationships with fistula survivors, their future workforce, patient outcomes, and satisfaction with care.

Keywords: Effect, Empathy level, Empathy training, Ethiopia, Healthcare providers' empathy

Evaluation of the Protective Role of *Ensete ventricosum (Welw.)* Corm Extract (EVCE) against Dyslipidemia and Nephrotoxicity Induced by Isoniazid and Rifampicin in Mice: Experimental Study

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Abstract

Anti-tuberculosis drugs are antimicrobial agents important for treating communicable disease called tuberculosis. Despite their importance, anti-tuberculosis drugs such as isoniazid and rifampicin have severe adverse effects like nephrotoxicity with acute renal failures and dyslipidemia. *Ensete ventricosum (Welw.)* is a nutritional herbaceous perennial plant, and it has indigenous ethnomedicinal values for the society. This study aimed to evaluate the protective role of *Ensete ventricosum (Welw.)* corm extract (EVCE) against dyslipidemia and nephrotoxicity induced by isoniazid and rifampicin in mice. The present study was conducted on thirty Swiss albino mice randomly allocated into five groups. Group-I (only distilled water), Group-II (only isoniazid 75mg/kg and rifampicin150mg/kg), Group-III (isoniazid and rifampicin along with 200mg/kg EVCE), Group-IV (isoniazid and rifampicin along with 400mg/kg EVCE), and Group-V (isoniazid and rifampicin along with silymarin) were given for thirty days. At the end of the study, the experimental animals were sacrificed after being injected anesthetic drug, and blood was drawn for kidney function test, and lipid profiles and the kidney was also taken from each experimental animal for histopathological evaluation. Data were entered and analyzed by using one-way ANOVA of SPSS version 25. Serum levels of creatinine, blood urea nitrogen (BUN), uric acid, total cholesterol (TC), triglyceride (TG-c), and low density lipoprotein (LDL-c) of the group-II mice were significantly ($P<0.01$) elevated, and serum levels of total proteins and albumin of group-II mice were significantly ($P<0.01$) decreased as compared to group-I. The group of mice treated with an EVCE reinstated those derangements. The kidney section of group-II mice showed an abnormality in kidney structure; however, these deformities were not detectable in group-IV mice. The EVCE has sufficient anti-dyslipidemia and nephroprotective potential against anti-tuberculosis drug-induced kidney injury.

Keywords: Anti-tuberculosis, *Ensete ventricosum (Welw.)*, EVCE, dyslipidemia

Susceptibility of Primary, Secondary and Suspected Vectors to *Plasmodium vivax* and *Plasmodium falciparum* Infection in Ethiopia

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Abstract

The current malaria vector control methods focus on the primary malaria vector; however, the impact of secondary and suspected vectors is limited. Defining the susceptibility of secondary and suspected vector species to different parasites in time and space is essential in malaria control and elimination programs. Thus, this study aimed at assessing the susceptibility of *An. gambiae* s.l., *An. coustani* complex, and *An. pharoensis* to *Plasmodium vivax* and *P. falciparum* infections in Ethiopia. Larvae of *Anopheles* spp. were collected from different aquatic habitats and reared to adults under laboratory conditions. The adult female mosquitoes were identified by species as *An. gambiae* s.l., *An. coustani* complex, and *An. pharoensis*. The three *Anopheles* spp. were permitted to feed infected blood in parallel with the same gametocytes drawn from *P. falciparum* and *P. vivax* gametocemic patients by indirect membrane feeding assays. Out of 5,915 female *Anopheles* mosquitoes exposed to gametocyte-infected blood, 2,106 (35.6%) mosquitoes fed successfully in the 32 independent infection experiments. There was a significant variation in feeding rates among the three exposed *Anopheles* spp. (G = 48.43, $P < 0.0001$). All three *Anopheles* spp. were susceptible to P. vivax and P. falciparum infections. The percentage of infected mosquitoes following feeding on an infected blood meal was significantly different among species (G = 6.49, $P < 0.05$). Even though the proportion of infected mosquitoes significantly differed in intensity of infection, infection rate, and mean oocysts among the species. The mean oocyst and infection rate were highly correlated with gametocyte density ($P < 0.001$). Primary, secondary, and suspected vectors were experimentally susceptible to both *P. vivax* and *P. falciparum* infections. An effective malaria elimination program might include surveillance and control tools that target secondary and suspected vectors, which might have an outdoor transmission role and reduce focal malaria transmission.

Keywords: *Anopheles*, Infection rate, Malaria, Membrane feeding assay, Oocysts, *Plasmodium*

Effects of Eight Weeks Aerobic Exercise and Garlic Ginger Mixture on Body Mass Index, Blood Sugar and Waist Circumference of Patients with Type 2 Diabetic Mellitus In Case of Jimma University Medical Center

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Abstract

This study aimed to determine the effects of aerobic exercise, garlic and ginger mixture, on Body mass index (BMI), Fasting blood sugar (FBS) and Waist circumference (WC) in patients with type 2 diabetes in JUMC. The experimental study design was employed and 40 patients were selected based on inclusion criteria and divided randomly into four groups. Garlic ginger group (GGG=10), aerobic exercise group (AG=10), garlic and ginger (mixture) plus aerobic exercise group (GGAG=10), control group (CG=10). GGAG underwent both interventions for 8 weeks, GGG ingesting 4g of mixture of (three times a week), and AG underwent 50–70 minutes of aerobic exercise. Data were analyzed by using paired sample T test for in the group and Post hoc multiple comparison one-way ANOVA analysis for the difference between groups by SPSS version 26.0 at p< 0.05. In GGG pre to posttest, the mean difference (MD) of (BMI is .74; P=. 000, (FBS is 21.2; P =.000), and (WC is .957; P =.000). In AG MD of (BMI is 1.040(P =.000), (FBS is 18.3 P=.002), (WC is 1.067 P =.000), In GGAG MD of (BMI is 1.121 P = .000), (FBS is 35.8 P =.000), (WC is 1.887 P =.000). GGAG has shown the MD on GGG by .38 in BMI at P =.049), by 14.60 in FBS at P =.018), by .93 in WC at P=.032, which shows as the mixture of Garlic and Ginger combined with aerobics more effective in controlling BMI, FBS and WC of T2DM patients of JUMC than mixture of Garlic and Ginger alone. This study conclude that, as a mixture , an aerobics exercise and the combination of the two has significant effect on BMI,FBS and BMI of T2DM patients of JUMC and the mixture combining with aerobic exercise is more significant than others. Hence, the patients are recommended to use the combination.

Keywords: Aerobic exercise, Body mass index, Diabetic mellitus, Fasting blood Sugar, Garlic and Ginger Mixture, Waist Circumference

Surgical Management of Dystocia in Local Breed Sheep: A Case Series

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Abstract

Dystocia means difficulty in parturition to the point of needing human intervention and it is a major cause of lamb loss in the flock and may result in great economic loss to the farmers. Two local breed adult ewes of different age and causes of dystocia were presented to Veterinary Teaching Hospital (VTH) with the history of full-term gestation and three-month gestation in case 1 and 2, respectively. Clinical and physical examination finding revealed that there were weak and unable to stand, and straining in case 1 and anorexia, lethargy, recumbent with attempt to stand, abdominal distension and granting sound in case 2. Live fetus in case 1 and died fetus in case 2 was dictated up on abdominal palpation and ultrasonography findings. Vaginal examination also has undergone and revealed that incomplete dilation of cervix in case 1. Depending on diagnostic finding caesarian section were admitted and a single live fetus and a twin died fetuses were removed from case 1 and 2, respectively under line infiltration anaesthesia in case 1 and inverted "L" blocks in case 2. Following the successful caesarian section the dam of case 1 was died after 18-hours of post-surgery but the dam of case 2 was recovered uneventfully without any complications in period of 15 post-operative days.

Keywords: Caesarian section, Dystocia, Ewes, post-surgery

Evaluation of Dried Thyme (*Thymus Schimperi*) Leaf Meal on Production Performance, Egg Quality and Blood Parameters of Laying Hens

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Abstract

The goal of the study is to determine the effect of dietary supplementation of Thymus schimperi leaf meal (TLM) on production performance, egg quality and haemato-biochemical parameters of Bovan brown layers. A total of 96 laying hens 25-week age were randomly assigned to four treatments with 6 replications/treatment. The treatments were control (standard commercial laying hen diet), TLM1.5 (control + 1.5% TLM), TLM2.5 (control + 2.5% TLM) and TLM3.5 (control + 3.5% TLM). Egg production, feed intake and feed conversion ratio were recorded for each replicate. Two eggs per replication were used to measure internal and external egg quality traits on a monthly basis. At the end of the trial, blood samples were collected from 2 birds/replicate for determination of albumin, uric acid, aspartate aminotransferase, alanine aminotransferase, alkaline phosphatase, luteinizing hormone, prolactin and progesterone. One-way analysis of variance was used to determine the effect the treatment recorded response variables. All blood parameters were within the normal ranges of the breed. Egg production, feed conversion ratio, internal egg quality traits, external egg quality traits of TLM2.5 were significantly higher than the control. Furthermore, TLM2.5 had significantly the least feed conversion ratio among the dietary treatments. In conclusion, TML2.5 is recommended to improve egg production and egg quality without adverse effect on hens' health.

Keywords: Antibiotics, Egg albumin, Feed conversion ratio, Hough unit, Thyme, Yolk colour

Integrating Wearable-Textiles Sensors and IoT for continuous EMG monitoring

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Abstract

Electromyography (EMG) is a technique used to measure the electrical activity of muscles. EMG can be used to assess muscle function in a variety of settings, including clinical, research, and sports medicine. The aim of this study was to develop a wearable textile sensor for EMG monitoring. Here, we have developed an integrated biomedical monitoring system that records EMG signal through embroidered textile sensor, and has its application in telemetric assessment of muscle activities and fatigue. We have taken an IoT based approach to acquire the EMG using 'Myoware muscle sensor' and transmit the signal wirelessly through a Wi-Fi-enabled micro controller unit (Wifi enabled Node MCU; ESP8266). The MCU was integrated with Myoware muscle sensor and the embroidered smart sleeve textile electrode enabled us to measure electromyography, similar to that of the conventional methods. Further, in our case, we used the 'Thing Speak' server's interface to facilitate an IoT based live recording of EMG in a smartphone or PC. The digitized signal could also be imported into the Arduino's serial plotter via 'Cool term' software. To verify the performance of our developed prototype, we compared the EMG signal recorded from the Biceps, Triceps, and Tibialis muscles using both the smart textile electrode as well as the gelled electrode. The time domain features such as the root mean square (RMS) and average rectified value (ARV) extracted from the EMG of three muscle types using our prototype were within the range of 1.001+0.091 to 1.025+0.060 and 0.291+0.00 to 0.65+0.09, respectively. Further, we also performed the principal component analysis (PCA) for a total of 18 features (15 TD (time-domain) and 3 FD (frequency-domain)) from the 3 different muscle type signals. From the loading plot we identified, the mean frequency (MNF), spectral centroid (SC) and the signal energy (EN) to be the primary factors which contributed to the differentiation of the 3 muscle types unambiguously.

Keywords: Electrode Position, EMG, IoT-integrated Textile sensor, Smart sleeve