Increased demand for tree products has raised demand for tree production and need for site matching. The main aim of this study was to explore tree seed sources and determine the influence of seed distribution to site matching. The specific objectives were (i) to determine the main category of tree seed source relied for seed production by formal and informal sectors; (ii) seed tree abundance in each category of tree seed sources within two study sites; (iii) to determine the influence of tree seed distribution to site matching in Central (Kikuyu, Lari in Kiambu County and Nong Road forest in Nairobi County) and Western Kenya (Lurambi, Shinyalu, Malava in Kakamega County and Maseno area in Kisumu County). Primary data were collected through use of questionnaires which were administered to seed officers of formal and informal sectors across the study sites. Research instruments used were GPS, questionnaires and the forest tree seed zones of Kenya. Multistage purposive sampling procedure was used to select the respondent and all the 83 tree seed sources from the two study sites. All respondents also filled 191 seed distribution forms for their seeds collected and distributed in the year, 2016/2017 from their sources. Date of mean annual rainfall (mm) and annual average temperatures (°C) were collected from field seed stations. The tree seed zone of where seed was distributed was recorded. The seed trees abundance in each tree seed source was recorded from (farmland, natural forests, seed orchard and plantation) source categories. Seed tree abundance in seed sources by category between the two study sites was measured in two levels: seed sources with < 40 trees) and seed sources with ≥40 trees) according to Re´nyi diversity profile. Descriptive statistics was used to determine the main tree seed source category relied for tree seed production by both formal and informal sectors across the two study sites. Seed distribution influence on site -matching between formal and informal sector and seed tree number in each seed source category (farmland, plantation, natural forests and seed orchard) between the two study sites were obtained using 95% confidence level and significance level of 0.05. Also, a combination of Microsoft Excel, frequencies and ANOVA were used to compare, seed tree abundance in each category within the two study sites and also to compare tree seed distribution by formal and informal influence to site matching data. All analysed data were tabulated and presented as charts, graphs or tables. Results showed that, the most common tree seed source category relied for seed production by formal and informal sectors was farmland tree seed source with (38.55%), followed by plantations (21.69%), seed orchards (20.48 %) and the least utilized was natural forests category (19.28 %) in the two study sites. There was no significance difference in seed tree abundance for farmland, plantation and natural forest seed source categories between the two study sites as P(T<=t) two-tail > 0.05. However, there was a
significance difference in seed tree abundance in seed orchard category between central and Western study sites \( P(\text{two-tail}) < 0.05 \). Also there was no significance difference on influence of tree seed distribution to site matching between formal and informal sectors \( P(\text{two-tail}) > 0.05 \). Data analysis revealed that only 42.4\% of the seeds distributed by both formal and informal sector matched the planting site. In conclusion, farmland seed sources are the most utilised for seed provision although, they had the lowest seed tree abundance followed by natural forests sources. It is recommended that, formal organizations facilitate an inventory of all tree seed sources in rest of Kenya and ways of enhancing seed tree abundance and site matching for sustainable tree production in Kenya.

**EFFECTS OF AFRICAN ELEPHANT (Loxodonta africana) POPULATION ON VEGETATION AROUND WATER POINTS IN ARABUKO SOKOKE FOREST, KILIFI COUNTY, KENYA**

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The African elephants (Loxodonta africana) are keystone species in its ecosystem. They have been ranked by the International Union on Conservation of Nature (IUCN) as vulnerable species and are of high conservation concern. In Kenya, Arabuko Sokoke Forest (ASF) has been ranked as one of the priority areas for elephant population estimates by the IUCN African Elephant Specialist Group. This study aimed at determining the elephant population density and distribution in Arabuko Sokoke Forest and to assess the impacts of elephants on vegetation around water points within the Forest. Elephant population and distribution was determined using the Faecal Standing crop method which incorporates dung decay rate, defecation and dung density. Elephant dung decay rate was determined by identifying and monitoring 59 fresh dung piles at an interval of 7 days until they completely decayed. Dung decay rate was calculated using the reciprocal of mean survival time. Dung density was determined by counting dung piles along 34 line transects each measuring 1 Kilometre systematically placed at an interval of 5 Km from each other and calculated using the DISTANCE Version 7 software. Impacts of elephants on vegetation were determined by laying two 1 Km long line transects on each of the two water points at Arabuko Swamp and Kwa Muiru respectively. On each line transect, 20m by 10m plots were laid at an interval of 100m. On each plot the variables measured and recorded included: The local name, height, diameter at breast height and the rate of utilization of the plant species; in form of browsing and debarking. Linear regression and analysis of variance were used to determine the statistical difference in the variables in relation to distance from water points. The mean survival time for elephant dung pile in Arabuko Sokoke Forest was estimated to be 147.90 (SE ±6.09) while the elephant dung pile decay rate was 0.0068. Elephant dung density \( (Y) \) was 1365.4 dung piles/Km2 (95%, CI=931.6 to 2001.2) while the elephant density \( (E) \) was 0.51 elephants/km2. Elephant population in Arabuko Sokoke Forest was estimated to be 215 (95% CI=145 to 318). Both height and diameter at breast height (dbh) had a strong negative relationship with distance from Arabuko Swamp (Height: \( P < 0.0001; \ r^2 =0.605 \) and dbh;\( P=0.0038; \ r^2=0.1194 \) respectively). Around Kwa Muiru water point, there was a strong positive correlation between the distance from water point and height (\( P<.0001; \ r^2 =0.232 \)) and diameter at breast height (\( P<0.00; \ r^2 =0.0009 \)). Eighty five (85) plant species were recorded around Arabuko Swamp while around Kwa Muiru water point, 99 plant species were recorded. There was a significant difference in species
richness (P=0.023), diversity (P=0.005) and dominance (P=0.41) between the two water points. Plant utilization by elephants around the two water points was associated with browsing than debarking. Around Kwa Muiru, browsing was higher with 77.8% of the plant species recorded being browsed compared to 68.2% browsed plant species around Arabuko Swamp. Debarking was high around Arabuko Swamp compared to Kwa Muiru water point with 62.4% and 47.5% of the total plant species recorded being debarked respectively. Compared to other studies done to determine elephant population in Arabuko Sokoke Forest, this study shows that there is an increase in elephant population from the previous estimates. It is therefore vital to continue monitoring their population and the associated ecological effect they have on vegetation on temporal and spatial scale.

ASSESSMENT OF WATER QUALITY IN AQUACULTURE PONDS IN TIGONI, KIAMBU COUNTY, KENYA

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Fisheries and aquaculture is an important source of food, income and livelihoods for hundreds of millions of people around the world. Aquaculture production has increased from 29.5 million tonnes in 2010 to 37.5 million tonnes in 2014 in the world and 1.3 million tons in 2010 to 3.8 million tonnes in Africa. There is no sufficient information suitability of water quality in aquaculture ponds in Tigoni. The aim of the study was to determine the suitability of aquaculture ponds for fish farming based on their water quality the specific objectives of the study were; to find out quality of water in aquaculture ponds, to identify the type of algae in aquaculture ponds and to evaluate the relationships between water quality and algae in the aquaculture ponds. The study area was Tigoni in Kiambu County. Stratified random sampling design was used to select 8 sample ponds which water samples were collected twice a month for four months. Parameters were temperatures, pH, conductivity, dissolved Oxygen (DO), secchi depth, Biochemical oxygen demand (BOD), nitrates, phosphate and algae identification was also done. The mean values for the physical parameters ranged from 19.69±0.48 0C to 22.54±0.57 0C (water temperature), 7.57±0.52 (pH), 190.25±127.86 to 416.50±168.93 µS/cm (conductivity), 14.13±3.36 to 28.38±7.13cm (transparency) and 4.03±1.39 to 6.63±1.37 mg/l (dissolved Oxygen). Chemical parameter 1.99±0.52 to 2.82±0.48 mg/l (BOD), 5.06±1.05 to 57.57±15.84 mg/l (phosphate) and 0.38±0.10 to 8.86±1.20 (One Way ANOVA indicated significant difference between pond F and H (P=0.001) (temperature), pond A and G (P=0.001) (pH), pond A and C (p=002) (conductivity). Pond D from G (p=0.000) (Secchi depth), pond C and G (P=0.001) (DO). Pond D and G (p=0.001) (BOD) Pond F and H (p=0.001) (phosphates) and pond A and H (0.000) (nitrates). Mean temperature were in the lower range with pond D and H being below optimum range. DO t test, pond G had a significant differ ence (t=7.500, α=0.05, p=0.00) and there was no significant difference in BOD in all ponds. A total of 12 genera of algae were identified. Composition per pond was; pond A, B, C, D, E, F, G and H recorded 6, 10, 7, 6, 7, 7, 10 and 11 genera respectively. Temperature, lowest Pond H 6 genera identified, highest mean pond 7 genera were identified. Phosphate, Pond H highest mean 11 genera pond F 7 genera. Nitrates highest in pond H 11 genera while lowest was in pond A 6 genera were identified. In conclusion, water quality in most aquaculture ponds did not vary significantly from one pond to another and the quality in most aquaculture ponds met quality for fish farming. Ponds high in phosphates and nitrates had more genera of The study recommends water management intervention be practiced to manage water quality and control algae growth also water and soil conservation to control nutrient load in water sources. Research on suitability of water used for aquaculture in the area,
a comparative study for water quality in liner and earthen ponds and the algae composition and abundance in the aquaculture ponds.

**TIED-RIDGING AND INTEGRATED SOIL FERTILITY MANAGEMENT TECHNOLOGIES' EFFECTS ON SOYBEAN-MAIZE YIELDS AND SELECTED SOIL PHYSICAL PROPERTIES IN THARAKA-NITHI COUNTY, KENYA**

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Deficits in soil moisture and low soil fertility are major constraints to smallholder farming systems in Sub-Saharan Africa. Farmers in Tharaka-Nithi County, Kenya, have over the decades suffered huge declines in crop yields as a result of continuous cultivation with inadequate replenishments of the lost soil nutrients and lack of appropriate soil water conservation technologies. Experiments were set up at Kigogo primary school, Mukuuni location in Tharaka-Nithi County to determine the effects of tied ridging and integrated soil fertility management technologies on: i) Soil water content at different soil depths, ii) Soil bulk density and aggregate stability, iii) Soybean and maize yields, iv) Economic feasibility during the long and short rains of 2016. A randomized complete block design with eight treatments replicated four times on 6 m × 4.5 m plots was employed. The treatments were: control, no inputs with tied ridging, T. diversifolia + inorganic fertilizer with or without tied ridging, manure + inorganic fertilizer with or without tied ridging and sole inorganic fertilizer with or without tied ridging. H516 maize variety and gazelle soybean variety were used as the test crops. Soil moisture was monitored using Diviner 2000® fortnightly at 0-100 cm depth. Soil samples were collected at 0-5 cm depth using core rings for bulk density and at 0-20 cm depth for aggregate stability analysis. Maize grain and stover, soybean grain and biomass yields were determined at harvesting and labour data collected throughout the experiment. Data was subjected to Analysis of variance using Statistical analysis software version 9.2 and means separated using Least Significant Difference (LSD) at p≤0.05. The results showed that at the 20 depth, treatments had a significant effect (p=0.05) on soil moisture under soybean during the LR 2016 season. During the SR 2016 season, treatments also significantly affected (p<.0001) soil moisture content under soybean and (p=0.0005) in treatments under maize within the 30 cm depths. Manure and/or T. diversifolia plus fertilizer with or without tied ridging had the highest soil moisture content during the two cropping seasons. The highest (-7.69%) decrease in soil bulk density was observed in T. diversifolia plus fertilizer with tied ridging and the same treatment had the highest (+4.76%) increase in aggregate stability in soybean over the control. In SR 2016, soybean grain yields were significantly (p<0.0001) affected by the treatments. Manure plus inorganic fertilizer under tied ridging numerically recorded the highest (3.15 t ha-1) soybean grain yields in LR 2016 while T. diversifolia plus fertilizer without tied ridging gave the highest (1.08 t ha-1) in SR 2016. During the LR 2016, maize grain yields were significantly highest (4.87 t ha-1) in the treatment with T. diversifolia plus fertilizer under tied ridging while manure + inorganic fertilizer without tied ridging gave the highest (1.27 t ha-1) in SR 2016. The highest net benefits under soybean were recorded in the tied ridging with no inputs treatment in LR 2016 and in the control during SR 2016. The highest net benefits were recorded under T. diversifolia plus inorganic fertilizer with tied ridging during the LR 2016 and SR 2016 under maize. Short-term implementation of a combination of either T. diversifolia or manure with inorganic fertilizer is recommended for enhancing maize and soybean production while improving soil physical conditions in Kigogo Tharaka-Nithi County.
ADOPTION OF BIOMASS BRIQUETTES AS ALTERNATIVE SOURCE OF ENERGY IN MAASAI-MAU REGION, NAROK COUNTY, KENYA

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Climate change phenomenal is a trend that impacts the local communities by affecting their way of life. High demand for wood products to meet the demand of energy supply in Maasai-Mau region has seen the depletion of the forest cover thus increasing carbon dioxide emission and other greenhouse gases into the atmosphere. However, there is no extensive research on the benefits of alternative sources of energy like solar, biogas and biomass briquette in mitigating these impacts. The study investigated the adoption of biomass briquettes as an alternative source of energy in Maasai-Mau, Narok County, Kenya. The study was guided with three objectives (i) to determine the level of adoption of biomass briquette in Maasai-Mau region, (ii) to evaluate the challenges and hindrances Maasai-Mau residents face in the adoption of biomass briquettes in Maasai-Mau region and (iii) to investigate the availability of biomass briquette making materials in Maasai-Mau region. The study used two sampling techniques; systematic and purposive sampling to get information from the key informants and households in the study area with a target sample of 100 respondents. The findings obtained were analysed through Excel and Statistical Package of Social Sciences. Data results were presented in graphs, pie-charts, and tables. From the results, the hypothesis was analysed by Chi-square (\( \chi^2 \)). The study failed to reject the null hypothesis of a relatively low level of education hinders the adoption of biomass briquette, where (\( \chi^2=9.866, \text{DF}=6, P=0.13 \)). The study concluded that the level of biomass adoption in Maasai-Mau region was relatively low with only 28% of the households using briquettes daily as compared to other sources of energy. The other conclusion from the study was that biomass briquette making materials were readily available with saw dust chippings and charcoal dusts ranking 84.61% and 79.49% respectively. Finally, the study found out that lack of funds and lack of briquette making skills were the highest challenge to adoption of briquette making technology in the region, being ranked as 88% and 77.6% respectively. The primary recommendations were that the Massai-Mau region residents be educated on biomass briquette making skills, and ensuring that their biomass briquette initiatives are funded to solve the challenges they face while adopting this clean energy mechanism as an alternative source of energy.

EFFECTIVENESS OF RAINWATER HARVESTING AS A STRATEGY FOR FLOOD MITIGATION IN RUAI AREA, NAIROBI COUNTY, KENYA.

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Harvesting of rainwater is a strategy which primarily benefits the local human livelihoods and ecosystems. Ruai has gone through development boom and densitification, increased infrastructure such as roads, both single and multi dwellings leading to changes in the physical characteristic of the area hence increased surface run-off. Further Ruai and its environs are flat hence encouraging flooding. There has been a range of incidences of flooding in the area causing loss of property, disruption of socio amenities such as schools, hospitals and roads. Structural measures such as drainage ditches, infiltration trenches have been advanced and used to reduce flooding effects during rainy seasons. However, these measures have not been effective due to large population growth and increased infrastructure in Nairobi. This study investigated rainwater harvesting effectiveness in Ruai as an effective method of flood mitigation and control. The objectives achieved were to evaluate the socio-economic effects of floods in Ruai area, to examine strategies used by the households and community and their success in avoiding loss and damage from floods in Ruai area, to assess household’s RWH adoption and farming-related uses in Ruai, to find out the socio-economic determinants of RWH adoption and to assess RWH's impact on flood mitigation in Ruai. Using a descriptive research design the study sampled 99 household heads and 6 key informants through purposive sampling. The study employed questionnaires for households and interview schedules for key informants. The household questionnaire survey generated both descriptive and numeric information. Closed questionnaires generated quantitative data, whose presentation and analysis entailed tabulation in terms of and other techniques such as frequencies, percentages and the mean. Interviews and open-ended questionnaires helped gather qualitative data that was analysed through coding and classifying (categorising and indexing). The results indicated that floods led to destruction of property, disruption of social amenities, water borne diseases, with 56 of 94 respondents migrating to higher areas at Ruai during floods. Structural drainage systems such as dykes and culverts were used in controlling floods with only a third of the respondents using rainwater harvesting as a strategy to control floods. Socio-economic factors such as gender, age, household size, education level, income level and land ownership determined the adoption of water harvesting in a bid to control floods. More than 60% of the respondents indicated that rainwater harvesting reduced lag time for storm formation while 86% showed a reduction in overland flow. The study recommends the need for all the stakeholders in Ruai and Nairobi County to seek Rainwater harvesting strategies in ending the perennial flood problem. Rainwater harvesting is a strategy that if well instituted and implemented can help reduce and mitigate floods in Ruai and be an alternative during water scarcity period. Community awareness should be done to encourage households to think of and embrace rainwater harvesting as a strategy for flood prevention and mitigation and not only to capture water for domestic use.

ANTHROPOGENIC IMPACTS ON LAND USE AND LAND COVER CHANGE IN OMBEYI WETLAND, KISUMU COUNTY, KENYA

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Dr. Gladys’ Gathuru

Land use and land cover change dynamics and associated human-induced transitions studies are very critical in the formulation of sustainable land management strategies, land use systems and policies. The study aimed at generating a characterized area estimate of Ombeyi wetland’s land use and land cover change schema for the period between 1990 and 2017, examining the spatial and temporal characteristics of anthropogenic impacts and their relationship with land use and land cover change in Ombeyi wetland, and to evaluate the impact of existing plan/program used for sustainable
management of Ombeyi wetland. The study adopted a mixed-method design consisting of remote sensing and GIS-based analysis, key informants interview, and a household survey of 384 households. Remote sensing analysis revealed that between 1990 and 2017, the area covered by papyrus vegetation has decreased from 1017.01 Ha to 4.04 Ha while agricultural land and built-up area increased from 2966.5 Ha to 3450.8 Ha and 52.46 Ha to 581.2 Ha, respectively. Key informants attributed the changes to population increase (29.2%) and their associated demand for land and natural resources. Analysis of household-survey results validated the observed patterns during the remotely sensed data analysis phase, as majority of the respondents (90.1%) own land within the wetland through inheritance. The respondents reported farming (92.2%) as their main occupation with 72.4% of the same respondents attaining primary level education and below. Most of the respondents (24.7%) are aged between 21 and 30 years with 88.3 %, earning Kshs >2,500 or more monthly from wetland utilization. Wetland conservation was not popular as 70.1% of the respondents were against conservation while 98.1% have never participated in any conservation efforts. Results from the evaluation of the integrated management plan 2014-2018 objectives were, afforestation and re-afforestation in catchment areas (50%), improve environmental education and awareness (50%), halt pollution and improve water quality (45.45%), improved food security and household income (41.67%), and enhancement of participatory monitoring and evaluation (50%). Hypothesis testing for; there is significant spatial and temporal change in Ombeyi wetlands’ land cover types using T-test resulted in a p-value of 0.999, while correlational test for hypothesis; anthropogenic impacts significantly correlate with changes in land use and land cover resulted in a r-value of 0.892. Both hypotheses were accepted. The respondents proposed land use zoning (30.2%) as the most suitable conservation measure. The current state of land cover and its dynamics have had negative impacts on the livelihoods of residents and resources management.

ATTITUDES AND PERCEPTIONS AMONG ISSEY AND MASESE COMMUNITIES TOWARDS CONSERVATION OF FOREST RESOURCES IN MAU FOREST COMPLEX, KENYA

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Forests cover approximately 30% of the earth’s land surface area and provide critical ecosystem goods and services to mankind. However, forest cover in Kenya is among the lowest in the world, currently at around 7.6%. The Mau Forest Complex is the largest water tower in Kenya, but is threatened because of land use change and rapid human population growth in the adjoining areas. The overall objective of this study was to assess community attitudes and perception towards conservation of the Mau Forest, and relate them to alternatives to forest resource use. Methodology for data collection involved a case study survey. Semi-structured and structured questionnaires were used to collect data from the local residents and Community Forest Association officials, respectively. The hypotheses tested were that communities living in the periphery of Mau Forest Complex have positive attitudes and perceptions towards the forest and alternatives to forest resources, and that proximity influences the community’s attitudes towards the forest and people-wildlife conflicts. Pearson correlation was used to find relationships between variables, and Chi-square test was performed to determine statistical significance differences (p < 0.05) in responses between the study areas (Masese and Issey). A total of 200 residents from Issey and Masese areas of Bomet were interviewed. Men and female respondents interviewed were 86% (n = 172) and 14% (n = 28), respectively. There were positive attitudes towards the forest among most (89%) of the
As a result, respondents were practicing some form of conservation of resources on their farms, such as tree planting, and soil and water conservation. However, 60% of the respondents indicated that they have had a bad experience with the forest, and people wildlife-conflicts were causes of negative attitudes towards the forest. This study gives a number of recommendations that can be used to foster forest conservation in Kenya, such as training of residents about the environment, encouraging the use of alternatives to forest resources, fostering local decision making and participation in forest management, and compensation of losses as a result of wildlife invasion of farms and homes. As elsewhere, these recommendations have the potential to create positive attitudes towards the Mau Forest Complex and an apparent increase in positive forest interactions and behavior that will ultimately lead to forest conservation and well-being in Kenya.

**ASSESSMENT OF PHYSICO-CHEMICAL AND MICROBIOLOGICAL PROPERTIES OF SHALLOW WELL WATER IN KAWANGWARE LOCATION, NAIROBI CITY COUNTY, KENYA**

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Lack of access to clean drinking water adversely the public health. Kawangware location is undergoing rapid expansion in population, economic growth and urbanization. One of the challenges of this growth is pressure on public water supply. The inconsistent and inadequate water supply for the inhabitants has led to majority of the population relying on ground water for domestic and commercial uses more so, on shallow wells which seem to be relatively cheaper to construct. This has increased the vulnerability of underground water sources to sewage and waste water contamination and therefore exposing the population to infections by various water borne pathogens such as bacteria, viruses and protozoa. The aim of this study was to determine the quality of shallow well water used by households in Kawangware Location and compare it with the Kenya Bureau of Standards for drinking water. Water samples were from the three sub-location that is Kabiro, Gatina and Kawangware. Cross-sectional Survey research design was used and was accompanied by laboratory tests to analyze the level of each parameter from twenty eight shallow wells. A total of 112 samples were collected. Water samples were collected in the morning and evening in the month July and August 2017. The collected samples were analyzed for temperature using a mercury thermometer; pH, electrical conductivity, turbidity and Total dissolved solids was determined using portable meters. Zinc, iron, cadmium and lead were analyzed using Atomic Absorption Spectrophotometer, potassium and sodium using a flame photometer, total hardness was analyzed using titration, nitrates, phosphate, and bacteriological analysis were tested in accordance with the Standard methods for the Examination of water and waste waters. Derived values of tables and graphs were adopted for data presentation. The measurements physico-chemical parameters were as follows: in Gatina all parameters were within KEBs drinking water standards except for turbidity value which ranged from 0.6-78 μS/cm, NO3- value ranged from 17-19.5 mg/L, PO32- ranged from 0.02-15.8 mg/L, Cd ranged from 0.03-0.06 mg/L and Pb ranged from 0.01-1 mg/L. In Kawangware site all the parameters were within KEBs drinking water standards except for turbidity value which ranged from 0.0-50.1 μS/cm, NO3- value ranged from 17.5-19.7 mg/L, PO32- ranged from 0.02-42.8 mg/L, Cd ranged from 0.03-0.05 mg/L and Pb ranged from 0.06-0.09 mg/L. In Kabiro site all the parameters were within KEBs drinking water standards except for turbidity value which ranged from 0.0-100.9 μS/cm, NO3- value ranged from 14.3-20.1 mg/L, PO32- ranged from 0.04-14.0 mg/L and Cd...
ranged from 0.03-0.06 mg/L. The result obtained for the microbial analysis indicated that all the water samples analysed from the shallow wells in Kawangware location were contaminated with both total coliform and faecal coliforms. The highest counts of total coliform was 1637 MPN/100 ml and was recorded at Kabiro whilst the lowest counts of 1013 MPN/100 ml was recorded at Kawangware. At the same time, the water from all the sub-location had faecal coliforms with Gatina sub-location recording higher numbers (434 MPN/100 ml) followed by Kawangware (298 MPN/100) and finally Kabiro (271 MPN/100 ml). The results of the study also revealed that the physico-chemical parameters of ground water were significantly different (P≤0.05) from the recommended levels by the KEBS (2010). Parameters like Nitrates, phosphates, turbidity, lead, cadmium, coliforms levels and faecal coliforms exceeded the KEBS standards with the rest being within the acceptable levels. The difference was not significant (ps≤0.05) between the levels of turbidity, Iron and phosphates and that of KEBS. The ground water in the area is not safe for drinking due to elevated levels of Nitrates, phosphates, turbidity, lead, cadmium, total coliforms levels and faecal coliforms which poses a great health risk to the public therefore there is need to supply safe water for domestic purposes.

ASSESSMENT OF SELECTED TRACE ELEMENTS IN SOIL AND VEGETABLE (Spinaca oleracea) IN RUAI, NAIROBI CITY COUNTY, KENYA

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Urban farming makes a substantial influence on the household economy of the urban poor especially in developing countries. Urban soil the hot spot of urban farming is a natural sink for contaminants especially the potentially toxic trace elements derived mainly from anthropogenic activities. The sources of trace elements include effluents from sewerage drainage system, unprocessed wastewater from neighboring manufacturing industries in addition to farming activities along polluted rivers and other streams. This study quantified the concentrations of selected potentially toxic trace elements (Cr, Mn, Cu, Ni, and Zn) in top (0-20 cm) and sub (21-50 cm) soils and selected vegetable (Spinaca oleracea) from gardens in Ruai sewage area, Nairobi City, County. Grid soil sampling method was used to collect soil samples while plant samples were sampled randomly in tandem and their total concentrations was determined using a portable X-ray Fluorescence Spectrometer. Data analysis was performed using R version 3.3.3. The study revealed that the topsoil had higher concentration of trace elements than sub soil. The topsoil concentration in mg/kg were; 61.62 ± 6.14, 4042.58 ± 380.45, 30.82 ± 1.21, 43.90 ± 12.05 and 456.43 ± 71.61 for Cr, Mn, Ni, Cu and Zn respectively. The subsoil concentration in mg/kg were; 54.67 ± 5.85, 3791.38 ± 572.11, 30.32 ± 1.37, 27.83 ± 12.54 and 370.32 ± 74.42 for Cr, Mn, Ni, Cu and Zn respectively. It also noted that concentration of the trace elements was higher during dry season than wet season but not significantly different (P ≥ .05) for all the elements. The study also revealed that hazard quotient for all the elements were below 1. Values for Wet season were 0.0012, 0.4929, 0.0552 and 0.1167 for Cr, Mn, Cu and Zn respectively whereas dry season had 0.0013, 0.3552, 0.0627 and 0.0914 for Cr, Mn, Cu and Zn respectively. Calculated Transfer Factor were below 1 for both seasons with a trend order of Zn>Cu>Cr>Mn. The elemental estimation of daily intake rates through consumption of the sampled Spinaca oleracea was within the WHO permissible maximum tolerable daily intake. Thus, there is no imminent health risk in consuming Spinaca oleracea from the study area. However, it recommended that there is need to monitor levels of trace elements in soil and Spinaca oleracea to ensure they do not exceed acceptable levels.
The study sought to assess the adoption of talent management to competitiveness among five–star hotels in Nairobi City County. The concept of talent management comprises strategies for attraction, selection, development, engagement, and retention of knowledge and talented individuals. These individuals can create quality, diverse and exceptional products that form the competitiveness of the five–star hotels. The competitiveness of the hospitality industry in Kenya is held back due to a shortage of talent, loss of talent, and critical knowledge to other industries. The study investigated; conceptualization of talent management, hospitality core competencies required in talent, inherent approaches used in each talent management practices, the extent of talent management adoption, outcomes of talent management, and the relationship between talent management among five–star hotels in Nairobi City County. The study adopted a mixed-method research design and specifically a QUAN + qual reseach approach. Purposive sampling was used to select five–star hotels in Nairobi City County and the hotel executives’ respondents. A simple random sampling technique was used to select guest participants. Data were collected from 145 participants using a semi-structured questionnaire, Servqual structured questionnaires, and semi-structured interviews. The data analysis was done using; descriptive statistics, content analysis, thematic analysis, and inferential statistics. Linear regression results revealed that, among the significant predictors (talent selection, talent engagement, hospitality core competencies, talent and knowledge retention, and talent development), selection was the most significant. It meant that their competitiveness is hinged on the selection of talented individuals. Null hypotheses on the hospitality core competencies (β = -0.195, p =0.020), talent attraction approaches (β = -0.202, p= 0.009), talent engagement approaches (β = -0.224, p= 0.002), talent and knowledge retention approaches (β = -0.189, p= 0.024) were rejected and their impact was not enough to influence competitiveness positively. Null hypotheses on talent selection approaches (β = 0.512, p= 0.001), talent development approaches (β = 0.296, p= 0.002) and outcomes of talent management (β = 2.061, p= 0.018) were also rejected and they impacted competitiveness positively. The null hypothesis on the extent of talent management adoption (β = 4.414, p= 0.130) was maintained indicating that it did not influence competitiveness. Null hypothesis on the relationship between talent management and the competitiveness of five–star hotels; an executives’ perspective was rejected (β = 1.094, p= 0.001). A second null hypothesis on the relationship between talent management and the competitiveness of five–star hotels; a guests’ perspective was rejected (r = -0.277, p =0.009) but showed the need for improvement on talent management aspects to positively affect competitiveness. This thesis recommends that five–star hotels conceptualise talent management from the perspective of exclusive subject and positions. Hotels also need to enrich hospitality core competencies so that they create quality and diverse sustainable products and services to serve a wider clientele. Additionally, hotels need to enhance their employee brands to boost employee value proposition so that talent is attracted. Talent engagement levels also need to be improved to draw valuable knowledge and effort from talent. The retention of talent and protection of tacit knowledge
ought to be improved for greater competitiveness. Talent policies and budgets are put in place. This study has been conducted among the management teams and guests in five-star hotels; it is recommended that a related study is conducted on individuals considered talent in the same hotels.

ASSESSMENT OF INDIGENOUS FORESTS AS A TOOL FOR PRODUCT DIVERSIFICATION IN SUSTAINABLE TOURISM DEVELOPMENT IN TAITA-TAVETA COUNTY, KENYA

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The Kenyan tourism sector has over the years depended on beach and safari tourists visiting the country’s coastline and some selected wildlife conservation reserves respectively. This has exerted a lot of pressure on these resources resulting in bad environmental and social impacts. To deal with the negative impacts, there have been attempts to create and market alternative destinations such as forests. The purpose of this study was to assess forests and tourism product diversification for sustainability in Taita-Taveta County, Kenya. The study sought to identify the potential of indigenous forest as a tourism product that influence sustainability in Taita-Taveta County, to assess the influence of cultural tourism products associated with tourism sustainability in Taita-Taveta County, to identify the stakeholders involved in forest tourism development and establish their influence on tourism sustainability and to establish the challenges associated with forest tourism products diversification and their impact on sustainability in Taita-Taveta County. The study employed descriptive cross-sectional descriptive survey design. The target population for the study was 35 destination operators and 57 tourists visiting the forests. Purposive sampling was employed to choose 10 destination operators while census sampling approach was used to obtain 50 tourists visiting the forests. Tourists filled the questionnaires while destination operators participated in the interview session. Quantitative data was gathered using questionnaire while qualitative data was gathered using interview guide. Quantitative data collected using questionnaire was analyzed employing descriptive statistics and inferential statistics while content analysis technique was employed to analyze qualitative data gathered using interview guide. The study found out that forest tourism product, alternative cultural practices, stakeholders’ involvement in forest tourism development explained 43.2% of the variations in tourism sustainability. Results revealed that forest tourism product were related with tourism sustainability as supported by \( r=0.258, p=0.001 \). Likewise, the results revealed that alternative cultural practices were positively and significantly related to tourism sustainability as supported by \( r=0.334, p=0.001 \). Moreover, findings showed that tourism stakeholders’ involvement in forest tourism development had positive and significant relationship with tourism sustainability as supported by \( r=0.193, p=0.046 \). Basing on the results of the study, it was concluded that forest tourism products, alternative cultural practices/activities and stakeholders’ involvement in tourism were related to tourism sustainability. The study recommends that Taita-Taveta County needs to take an inventory of the diverse forest tourism products identified. It also recommends that it should be fully profiled and funds for its full establishment be allocated. The investment on the cultural practices should be prioritized in terms of preferences by the tourists.
ROLE OF FOOD MANAGEMENT SYSTEMS ON FOOD SAFETY IN 5-STAR RATED HOTELS IN NAIROBI CITY COUNTY, KENYA

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Ailments spread through food remains a common and persistent problem resulting in considerable illness and occasional mortality. The hospitality industry faces a unique set of risk management challenges as it strives to provide services and amenities that guests demand for their travels. Food Safety is important for the wellbeing and safety of hotel guests. In the recent past, there have been press reports of a number of cases related to food borne illness and the increased visibility of such cases highlights food safety in hotels. The purpose of the study was to evaluate the role of food safety management systems on food safety in 5 star hotels in Nairobi City County. The specific objectives were to; evaluate the application of standard food safety systems on food safety in the 5-star hotels in Nairobi City County, determine the effect of compliance to food safety system on food safety in the 5-star hotels in Nairobi City County and establish the effect of implementation of food safety system on food safety in the 5-star hotels in Nairobi City County. The study adopted cross-sectional survey design. Nairobi City County has several classified hotels located conveniently and the research surveyed 5-star hotels. Research instruments used include, questionnaires, interview schedule and observation checklist. For this, food handlers and managers were targeted. Descriptive statistics were used to analyze the data and findings presented in figures, tables, narrative and descriptive forms. Paired t-test results established that there is statistically significant change in provision of safe food as a result of applying food safety practices, complying with food safety procedures and implementing food safety systems. Regression results showed that application of standard food safety systems had a positive and statistically significant relationship with food safety of hotels in Nairobi City County (β=.202, p = .012). It was also established that compliance to food safety system had positive and statistically significant relationship with food safety (β=.214, p = .000). Further, implementation of food safety system had a positive and statistically significant relationship with provision of safe food in Nairobi City County (β=.318, p = .001). From the study findings, it was concluded that application of standard Food safety systems, compliance to food safety system and implementation of food safety system impact the provision of safe food in hotels. From the study findings, it was concluded that application of standard Food safety systems, compliance to food safety system and implementation of food safety system impact the provision of safe food in hotels. The study recommends that regulatory agencies in Nairobi City County focus on a more proactive approach to food safety compliance by records verification rather than product testing and developments in food safety regulation based on HACCP principles spark a move towards a more strict approach to food safety. While Hotels should observe proper food safety handling procedures with close monitoring and supervision of the state of food offered in hotels to ensure the safety of food.

SOCIAL MEDIA MARKETING ACCEPTABILITY AMONG RESTAURANTS ON CUSTOMERS RELATIONSHIP IN KATSINA STATE, NIGERIA

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Social Media has become a good marketing and quality management tool for restaurants and other hospitality sectors. Restaurants continue to be a difficult place for entrepreneurs to explore business opportunities, but by understanding common challenges, owners may be able to develop unique strategies to increase their chances of success on maintaining customer relationship. The major aim of the study was to identify how acceptable social media is in creating restaurant employees and customers’ relationship. The state is made up of three zones namely; Katsina, Funtua and Daura zones. Social media become an important source of information for restaurants and its platforms that smooth the progress of sharing information have been developed. Psychological ownership and social penetration theories of relationship were reviewed in the study to see how relationship developed from non-intimate to intimate. Cross-sectional descriptive survey was adopted in conducting the study and quantitative and qualitative data were collected from both primary and secondary sources. The study targeted 2907 staff and guests of these restaurants in the study area. From the 98 total registered restaurants in the study area, systematic sampling was adopted in sampling 49 restaurants from the three zones in the study area from which sample size was selected. The staffs from the selected restaurants were segregated into operational and managerial categories using cluster sampling method. Purposive sampling was used in sampling the managerial staff while simple random sampling was used on operational staff. From the study population confidence interval approach formula for sample size was adopted to select 481 respondents as the sample size. Two questionnaires were used as instrument for the study, one for operational staff and the other for guest. Pre-test of the instrument was done to avoid any ambiguous and bias questions. The questionnaire which is self analytical likert scale type questions were personally administered to respondents and responses collected were used for the quantitative analysis while qualitative data was collected from the results of the interview conducted with the managerial staff and used for the analysis. The data collected was analyzed in SPSS 21, using descriptive statistics, inferential and regression analysis and Chi-square was used for testing the hypothesis. The research found that there was positive correlation between social media marketing acceptability and restaurant customers’ relationship which was statistically significant (p<0.05). Findings also indicated that both staff and guests of the restaurants rated social media marketing acceptability highly acceptable. The most important social media marketing factors were ‘frequency of usage,’ ‘tools in use,’ and ‘social -interactive engagement.’ Exploring the social media marketing predictor variables of customers’ relationship, this research revealed that ‘frequency of usage’ and ‘creators’ is ranked among the high predictors of customer relationship followed by ‘tools in use’ and ‘social media consumption.’ Overall, it was concluded that both staff and guests of the restaurants regards effective and efficient social media sites as the leading factor of their acceptance of social media as a marketing tool. It was reiterated that satisfied staff and guests posed positive perception about social media marketing acceptability, while dissatisfied ones developed negative perception and disregard social media as a good marketing tool.

WELFARE INITIATIVES AND JOB STABILITY OF CATERING EMPLOYEES IN SELECTED UNIVERSITY CAMPUSES WITHIN NAIROBI CITY COUNTY, KENYA.

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The study aimed to develop a body of knowledge on welfare initiatives applicable in university catering there by informing catering managers, universities management and hospitality human resource departments. The researcher used the descriptive research design as it is timely, cheap and accurate. The study was carried out in 5 out of 46 University campuses in Nairobi City County, Kenya. The study targeted 300 University catering employees and a sample size of 189 respondents was obtained using the Israel"s (1992) sample size calculation formulae. 5 study areas were selected using simple random sampling while 189 individual respondents were selected using a stratified sampling procedure. Questionnaires with both open and closed ended questions were used to collect the primary data. Out of 189 questionnaires distributed, 152 were fully filled and returned giving a response rate of 80.42%. The generalized regression model results shows that 27.6% of job stability of all the university catering employees is explained by welfare initiatives while 72.4% is explained by other variables. Gender accounts for 10% of the variation of job stability of university catering supervisors. There is a generalized strong significant positive relationship (0.942) between adequacy of welfare initiatives and job stability of all university catering employees. There is a moderate significant positive relationship (P-Value, 0.581) between commitment and job stability of all university catering employees. Welfare initiatives accounts for (26%) of the variation of job stability of university catering subordinates. In conclusion, the current welfare initiatives do not fully address the real needs of universities catering employees. The study therefore recommends that, Universities management should establish staff welfare authorities with representatives from diverse occupational field in order to adequately address employee welfare needs.

INFLUENCE OF MANAGEMENT OF CONTRACT CATERING SERVICES ON CUSTOMER SATISFACTION IN SELECTED UNIVERSITIES IN NAIROBI CITY COUNTY, KENYA

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The rapid growth and increase in contract catering services in Universities in Kenya, seeks to lower costs and respond to high level of competition. The main purpose of this study was to examine the influence of management of contract catering services on customer satisfaction in selected universities in Nairobi City County, Kenya. The study was to specifically seek to: assess the effect of policy guidelines, identify challenges, assess the effect of service quality, establish the management culture and assess the relationship between management of contract catering services and customer satisfaction in selected universities in Nairobi City County, Kenya. The study adopted descriptive cross sectional survey design. The target population was selected universities in Nairobi City County, Kenya. Purposive and stratified random sampling technique was adopted in selecting the target population of universities. The target population was segmented into two groups based on the category of the university either public or private university. The sampling technique for management staff respondents was purposive sampling while the students respondents was calculated by using of Cooper and Schindler formula. The study adopted interview guide and questionnaire data collection instrument. Data was collected from 276 respondents. Multi-level random sampling of 276(students, contract catering manager, university director of catering services and university procurement manager) returned 257 (75.72%) valid responses. Expert review
was used to pretest the questionnaire before the actual study. The study adopted Cronbach’s alpha formula to test reliability of the instrument and coefficient ranging from 0.65 to 1 were considered adequate for data analysis. The study collected primary data which was analyzed through descriptive statistics and inferential analysis about the management and students’ views and perceptions. Data were then reported in tables, bar graph, and percentages and verbatim quotes. For inferential statistics, Pearson correlation analysis was used to examine the relationship between the independent variables (demographic factors, policy guidelines, management culture, challenges and service quality) and dependent variable (customer satisfaction) of the study to test the hypotheses. Multiple regression results revealed that at 5% level of significance and 95% level of confidence, the tested variables had p-value confidence levels of 0.022 for policies, 0.012 for management, 0.009 for challenges and 0.000 for service, had positive statistically significant with customer satisfaction. The study concluded that management of contract catering services influence customer satisfaction where positive independent variables like policy guidelines, service quality and management culture enhance customer satisfaction as compared to negative one that is challenges has a high probability in customer dissatisfaction. The study recommends that university management requires management culture in contract catering services that mitigate the challenges in management of contract catering services in order to attending to customer needs to achieve effectiveness in service quality and customer satisfaction. Further, similar studies to be done in other universities and colleges in Kenya with the aim of evaluating influence of management in contract catering services on customer satisfaction. This should aim at establishing if similar challenges in management of contract catering services are a replica in other institutions of the world.

**ROLE OF GREEN PRACTICES ON CONSUMER BUYING BEHAVIOR OF 4-5 STAR RESTAURANTS IN NAIROBI CITY COUNTY, KENYA**

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As customers’ have the ability to shape and influence products options with their buying power, it is critical for restaurant shareholders to understand consumer motivations and their decision-making processes. There are few empirical studies on green consumer behavior in restaurants with a special focus on green promotion and consumer behavior and green certification and customer purchasing behavior. The aim of the study was to investigate the contribution of green practices on consumer buying behavior in 4-5-star restaurants in Nairobi City County in Kenya. The research findings contributed to new knowledge on the area of the influence of environmental practices on consumer purchasing. Cross-sectional descriptive survey design was used by the researcher to acquire data describing the current situation on the phenomena. The target population was 20 4-5-star restaurants which comprised of restaurant managers, supervisors, waiters and waitresses in Nairobi City County, Kenya. The researcher conducted a census because of the small target population. Purposive sampling was used on restaurant managers, supervisors, waiters, and waitresses to attain crucial data whereby 79 respondents were sampled. The researcher used content validity and Cronbach’s alpha coefficient to assess appropriateness of research instruments and examine internal reliability of research instruments consecutively. Well-structured questionnaires, observation schedules and secondary data such as articles and newspapers were used as research instruments. Data was analyzed using Pearson Moment product correlation to measure the associations between
the variables and multiple regression analysis to measure the effect of one variable on the other. Additionally, data were analyzed using descriptive analysis and qualitative analysis. Descriptive Statistics was used to measure intervals and tendencies. Anova was used to test the mean difference between green practices and mean consumer buying behavior. The results were presented in tables, pie charts, and graphs. The response rate was at 71%. The results of the study show that there is a relationship between green practices and consumer buying behavior in 4-5-star restaurants in Nairobi City County; hence consumer buying behavior is determined by green product, green certification, and green promotion respectively. Hypotheses of the study were formulated and tested at 0.05% level of significance. The results show that the study rejected all the null hypotheses and concluded that at 95% confidence level a significant relationship exists between green practices and consumer buying behavior in 4-5-star restaurants in Nairobi City County. In conclusion, the study found out that; consumer buying behavior has a positive association with green practices.

**VALUE CO-CREATION ON GUESTS’ LOYALTY IN CLASSIFIED VACATION HOTELS IN MOMBASA COUNTY, KENYA**

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Value co-creation is a business strategy that can enhance the performance of modern hospitality firms. However, its adoption and applicability in the hotel industry more so in Kenya has not been given much attention. The aim of this research was to establish how value co-creation influences guests’ loyalty in classified vacation hotels in Mombasa County, Kenya. Specifically, the study sought to: find out how dialogue influences guests’ loyalty in classified vacation hotels, determine how risk taking return influences guests’ loyalty, examine how access to hotels through ICT influences guests’ loyalty, find out how transparency influences guests’ loyalty and finally, to find out the mediating role of guest satisfaction in the relationship between value co-creation and guests’ loyalty in classified vacation hotels in Mombasa County, Kenya. The study was guided by the Dialogue, Access, Risk Taking return and Transparency (DART) model of value co-creation and the confirmation-disconfirmation theory. The researcher adopted the embedded mixed method research design involving both quantitative and qualitative surveys. The researcher also adopted pragmatism paradigms and philosophical assumptions which allowed the researcher to use what is deemed as value to them in bringing about positive consequences to the study. The target population included the general managers and guests in classified vacation hotels in Mombasa County, Kenya. The sampling frame consisted of classified vacation hotels in Mombasa County, Kenya. General Managers (n=7) participated in interviews and were selected using purposive sampling from the other managers whereas the guests (n=100) were selected using simple random sampling with 14 guests being targeted from each hotel. However, two hotels were used for pre-testing. The relationship between value co-creation and guests’ loyalty was measured using Spearman’s Rank-Order Correlation coefficient, while the mediating role of guest satisfaction in the relationship between value co-creation and guests’ loyalty was analysed using multiple regression analysis. Data was presented using tables, graphs and charts. The study established that dialogue, risk taking return, access to hotels through ICT and transparency had a significant and positive relationship with guests’ loyalty in classified vacation hotels. The study further found that guest satisfaction played a mediating role between value co-creation and guests’ loyalty. This means that value co-creation increases guest satisfaction, and in turn guest satisfaction increases guests’ loyalty. From these findings, the study recommended that hotel managers and staff should have interactive dialogue with the guests either
online or face to face. This will give room for discussion between the two parties hence allowing guests to specify their desires, and needs in the hotels; among other recommendations.

EVALUATION OF CHILDREN PARTICIPATION IN PHYSICAL ACTIVITIES DURING RECESS IN SELECTED PRIMARY SCHOOLS IN NAIROBI CITY COUNTY, KENYA

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There is a global concern that children are insufficiently active to experience health benefits of physical activity (PA). The World Health Organization recommends that children should engage in at least one hour of moderate to vigorous intensity PA (MVPA) daily, or accumulate at least 12,000 steps a day to achieve health benefits associated with the PA. This study investigated the contribution of recess PA towards alleviating the burden of overweight and obesity among children in Nairobi City County, Kenya, to help form the basis for intervention. The current cross-sectional design study evaluated PA participation using pedometers to count steps accumulated by learners during recess periods in relation to gender and the type of school attended (socioeconomic status) in selected primary schools in Westlands Constituency, Nairobi City County. The participants were grade/class five pupils (N = 262: Male n = 137; 52.3%; Female n = 125; 47.7%). Most of the participants (n = 164; 62.6%) were pupils in public schools compared to those enrolled in private schools (n = 98; 37.4%). Data was collected using belt clip piezo-electric pedometers. The dependent variable was the average steps collected twice a day for three days using a pedometer. The independent variables were the socioeconomic status of schools (represented by private and public schools), gender (male and female) and the duration of recess (short and long). Consent was sort from the pupils, parents, Headteachers, KUERC, NACOSTI and MoE before carrying out the research. Data was analyzed using IBM statistics SPSS version 24. Independent-Samples t-Tests were conducted to test the first two hypotheses associated with the study while the Paired-Samples t-Test was also conducted to test the third hypothesis with the confidence level for the three tests set at alpha = .05. There was no significant difference in mean three-day steps during recess between public and private primary school pupils, t(259.79) = 1.69, p = .09. The mean steps between male and female participants was significant, t(259.50) = 4.85, p = .001. Male pupils (M = 4,775.19, SD = 1,208.88), on average, accumulated more steps compared to female pupils (M = 4,097.29, SD = 1,055.24). The mean steps for short and long recess were significantly different, t(261) = 23.17, p = .001. The participants on average accumulated significantly more steps during long recess (M = 2,708.49, SD = 834.15) compared to short recess (M = 1,743.27, SD = 484.09). The researcher recommends replicating this study in more schools within Nairobi City County to establish whether the results obtained in this study are a true reflection of the whole population (urban schools), conduct a similar study to establish PA participation level during recess in rural public schools, and to evaluate PA participation level during PE lessons, before/after school, and during non-school days to comprehensively evaluate PA trends of Kenya’s school children. Based on the results from this study, the researcher recommends that schools in Westlands Constituency, Nairobi City County should encourage recess time PA since it contributes to 37% of the recommended 12,000 steps per day.
EFFECTS OF CONCEPT MAPPING TEACHING STRATEGY ON SECONDARY SCHOOL STUDENTS’ PERFORMANCE IN CHEMISTRY IN NAROK COUNTY, KENYA

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Concept mapping is a teaching and learning approach where learners use V-shaped diagrams to represent key ideas contained in the structure of knowledge. The key ideas usually referred to as the concept mapping or heuristics form the point of focus in knowledge creation in the objects or events that learners observe. Chemistry is an important subject yet its performance is poor. The purpose of this study was to use a Concept Map Strategy (CMS) in teaching chemistry and hence determine if it could mitigate students‟ performance in Chemistry in County secondary schools of Narok County in Kenya. This study was guided by the following objectives; to compare the effects of using conventional teaching methods and Concept Map strategy on reactions involving selected hydrogen halides and alkenes, to compare boys and girls in performance of addition reactions involving selected hydrogen halides with alkenes when Concept Mapping is used against the conventional teaching approaches, to compare the effect of using conventional teaching methods and Concept Mapping learning strategies on students‟ performance in polymerization of selected alkenes in both boys and girls. The study employed quasi-experimental design using pre-test and post-test with control and experimental groups. Purposive assignment of subjects to the groups was done. The target population was secondary school students in Narok County. The accessible population was form three Chemistry students in County secondary schools, from which a study sample was drawn. The study used four schools, two boys and two girls‟ schools. The research tools included a Chemistry Performance Test (CPT). The study generated quantitative data which was analyzed using the Statistical Package for Social Sciences (SPSS) software. Mean and frequency distribution was used for descriptive data while t-test and chi-square analyzed the inferential statistics. The results indicated that the mean difference between the two group (control and experiment) was large enough and the equal variance independent-samples t-test confirmed that the difference is statistically significant at 5% level of significance and 95% confidence level (interval), showed that concept mapping instruction has a positive effect on students‟ achievement in chemistry. Therefore, the study recommended that teachers of chemistry be encouraged and supported to use interactive methods like concept mapping.

INSTITUTIONAL TRAINING CHARACTERISTICS AND EMPLOYABILITY AMONG UNIVERSITY GRADUATES IN THE BANKING SECTOR IN KENYA

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Despite the significant monitoring of training offered by universities in Kenya, the number of unemployed graduates due to perceived lack of quality and work-related skills is rising. Key policy makers are reluctant to admit the extent of Kenya’s graduate unemployment, while employers apportion more blame to the universities. In turn, the universities blame employers for “locking out” students from opportunities to gain relevant work experience. The purpose of this study was to determine the relationship between Institutional training characteristics and graduate employability in the banking sector in Kenya. The study’s overall objective was to determine the relationship between graduate course experiences and graduate support strategies and graduate employability in the banking sector. This study was based on multiple theories, i.e. Adam Smith and David Ricardo’s classical theory of Value and Alfred Marshall’s Neoclassical theory of value, which relates the product’s quality (employability of a graduate) and production process (Training at the Higher Education Institutions) to the consumer (the labor market). Correlational research design was used for this study with questionnaires used to collect data from graduate employees. The study targeted working graduates in the banking sector from both private and public universities in Kenya from which a sample of 393 graduates were randomly selected. Two questionnaires were used to collect the data. The Course Experience questionnaire had a reliability Cronbach α = 0.817 while Graduate Support Initiative questionnaire had a reliability Cronbach α = .769. The validity of the questionnaires was established through extensive review of pilot data. Both descriptive statistics and inferential statistics were used to analyze the data. Correlation analysis was used to generate correlation coefficients between the predictor variables (Graduate’s course experience and graduate support strategies) and graduate employability measured in ratio scale as time spent in active job search between graduation and first employment while regression analysis was used to determine if any differentials in employability could be attributed to differences in graduate’s course experiences and support offered to them during training. The study found that banking sector graduates were satisfied with their university course experiences with a score of 61.73 out of 90 but far from impressed with the level of graduate support they received with an average score of 19.59 out of a maximum score of 40. Also, 58.8% of respondents were employed within 18 months of graduation. Graduate Course Experience correlated with employability at r = 0.492 while Graduate Support correlated with employability at r = 0.476. Graduate course experiences accounted for 24.2% of the differences in employability while graduate support Strategies accounted for 22.6% of the differences in employability. Respondents who indicated to have received enough graduate support spent less than 18 months in active job search. The study concluded that graduate employability can be linked to the nature of graduates’ course experiences and level of graduate support received. This study recommends that universities should adopt as many graduate support strategies as possible, key among them: adoption of graduate e-portfolios, provide opportunities for Work Integrated Learning and engage the alumni.

FACTORS IMPEDING TEACHING PERFORMANCE OF TEACHERS WITH VISUAL IMPAIRMENT IN PUBLIC PRIMARY SCHOOLS IN MERU COUNTY, KENYA

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The rights and responsibilities of students who have disabilities have received much attention but the staff members who have disabilities have received far less attention. In the scholarly context, there has been a steadily growing body of literature which addresses issues related to the education of young people with disabilities leaving out teachers with
disabilities. This study therefore sought to determine factors that impede teaching performance of teachers with visual impairment in public primary schools in Meru County. Specific objectives of the study were to: identify the professional challenges affecting the performance of visually impaired teachers teaching in public primary schools in Meru County; determine the availability of resources needed by teachers with visual impairment; and establish the number of teachers with visual impairment teaching in public primary schools in Meru County. The study also identified strategies aimed at overcoming challenges encountered by teachers with visual impairment teaching in public primary schools. The study may be of significance to the government and relevant stakeholders as it revealed factors impeding teaching performance of teachers with visual impairment in public primary schools. The study was based on capital theory of school effectiveness by Hargreaves” (2001). The study employed descriptive survey research design to target 25 headteachers and 25 teachers with visual impairment in public primary schools in Meru County. Census sampling technique was used to select all the teachers who participated in this study. Questionnaire and an interview guide were used as the main tools for data collection. Data used for the study involved both qualitative and quantitative data. Qualitative data was analyzed thematically in line with the research objectives while quantitative data was analyzed using descriptive statistics such as frequency counts and percentages. Results of the analysis were presented using frequency tables, bar graphs and pie charts. The study established that the most available resources in the sampled schools were Brailled textbooks, large print books, typewriters and white canes. Raised line check books, hand-held lenses were not available. The major challenges faced by teachers with visual impairment were lack of teaching and learning materials, such as projectors, poor access to teaching and learning materials, negative attitude and discrimination among the teachers, lack of support from the school administration and unfriendly school physical structures. The study recommends that all the school administrators should ensure that teachers with visual impairment have access to and usage of computer and other accessories like computers, pen drives and projectors in schools since teachers with visual impairment considered these to be fundamental material resources required to enhance their teaching.

EXPLORATION OF MATHEMATICS TEACHING STRATEGIES TO LEARNERS WITH DYSCALCULIA IN PUBLIC DAY SECONDARY SCHOOLS IN KERICHO COUNTY

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Supervisors: Prof. G. Karugu

Prof. L. O. Odongo

Mathematics all over the world plays a pivotal role in individual or learner’s lives, it is a bridge to science, technology and other subjects offered in any formal educational system. Mathematics has long been recognized worldwide as important in the understanding of other subjects like chemistry, biology, and physics. Learning disability is a dynamic and expanding condition that is found across all ages. The purpose of this study was to investigate the mathematics teaching strategies used in teaching mathematics to learners with dyscalculia in Kericho County. Guided by Jean Piaget’s theory, the study adopted a descriptive design which used mixed model research with both qualitative and quantitative approaches. The study was carried out in Kericho County. Semi-structured questionnaires were used to carry out the study. The pilot study was done in 35 randomly selected public day secondary schools in different localities within the County to effectively analyze the methodologies of teaching the subject in the region. Data from the research instruments, namely mathematics teachers’ questionnaires and mathematics students’ questionnaires was coded and analyzed using the Statistical Package...
for Social Sciences (SPSS v25) to obtain descriptive statistics. To ensure validity, face and content validity was conducted. Also, the Cronbach Coefficient Formula was applied to guarantee reliability. The results revealed that thirty eight percent (38%) of the mathematics teachers in Kericho County assessed students’ records to identify dyscalculia problem. The findings also revealed that 19 out of 300 randomly sampled students, which represent 6.3% of the total sampled students, suffered from dyscalculia. Further, lack of experienced special needs teachers and poor cooperation from the relevant stakeholders such as parents, guardians, and other staff among others were major challenges that teachers faced when dealing with dyscalculic learners. Also, reviewing the previous lessons and maximizing the use of homework were some of the major interventions that helped in increasing dyscalculic learners’ performance. Besides, some of the major teaching strategies include peer tutoring and ensuring presence of mathematics symbols and terms displayed in mathematics lessons. The study concluded that majority of the students who score less than 25% marks were struggling with mathematics and not dyscalculic. Also, majority of the teachers may have confused dyscalculic students with those who struggled. The researcher recommends that progressive records should be used to establish if the learners are dyscalculic or they are merely struggling with mathematics. The government should ensure a conducive environment to enhance performance of dyscalculic students. It should also ensure that schools have enough teachers with special needs skills.

USE OF LEARNER-CENTERED TEACHING METHODS TOWARDS IMPROVING STUDENT PERFORMANCE IN SECONDARY SCHOOL PHYSICS IN MIGORI COUNTY, KENYA

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STEM Subjects and specifically Physics plays a major role in national development its knowledge is crucial in the manufacturing, healthcare and housing industries. This therefore calls for proper acquisition of knowledge and skills in the subject. However, the performance in the subject is low. The purpose of the Study was to establish the use of Learner-centered teaching methods to improve performance of Physics in Migori County. The main objectives of the study were; a) To establish the frequency of use of Learner-centered methods in Physics lessons b) To find out teacher and learner attitude towards Learner-centered methods c) To establish the challenges of Learner-centered methods in teaching Physics d) To find out the relationship between experience in teaching and use of learner-centered teaching methods. The study deployed Descriptive Survey design. The target population was 577 Form Three Physics students, 71 Form Three Physics teachers and 36 Heads of Physics subjects. Piloting of student and teacher questionnaires was done in one school. Stratified random sampling was used to categorize the schools into different strata according to levels (National, Extra-County, and County & Sub-County) from which simple random sampling was used to select the sample schools. Simple random sampling was used to sample at least 20% of the target student population. All Form Three teachers and all heads of subjects in the sampled schools formed the sample population. Ten (12) schools, two eighty two (282) students and twenty (20) teachers were sampled for this study. Data was collected using questionnaires, interview schedules, Term test performance and a checklist. The data collected was then processed and analyzed using Statistical Package for Social Sciences (SPSS) and presented in descriptive statistics using frequency tables, percentages and graphs. The study findings revealed that Experiments, collaborative learning and Multimedia were predominantly used to enhance performance in Physics. Trips, Web-based learning and Resource-based learning was not used at all in most instances. Teachers and
learners attitude towards learner-centered methods was generally positive. Teachers seemed divided on whether or not learner-centered methods enhanced syllabus coverage. Over half of the teachers felt that learner-centered methods consumed a lot of time. Lack of appropriate facilities was a major hindrance to implementation of the learner-centered methods. Only one sampled school had a Learning Resource Centre. Most schools had no internet access with over three-quarters of the schools lacking apparatus like a ripple tank, a mercury barometer and a cathode ray oscilloscope. The study also revealed that there is no difference in use of learner-centered teaching methods in physics between experienced teachers and new teachers. The study recommended that for enhancement of learner-centered methods; schools should be equipped with key resources.

**ANALYSIS OF THE FUNCTIONS AND THE CHALLENGES FACED BY EDUCATIONAL ASSESSMENT RESOURCE CENTRES IN FIVE SELECTED COUNTIES IN KENYA**

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Educational Assessment Resource Centers (EARC) are set to cater for persons with disabilities. EARC have vast functions and thus there are a lot challenges facing the centres. Such include lack of qualified personnel who can conduct an assessment of all categories of disabilities, lack of valid assessments due to poor tools, lack of clear assessment procedures, weak policies and legislation as well as lack of parental consents. The purpose of the study was to analyze the functions and the challenges faced by educational assessment resource centres in five selected Counties in Kenya. The objectives of the study were to assess the identification of disabilities in the centers, identify tools and equipment used in disability assessment, evaluate the available placements in selected counties, examine the involvement of EARC in identification and placements, and find out the challenges faced by EARC. The study was guided by CIPP evaluation model which assisted in determining the worth and the value of EARC. The researcher employed a descriptive survey research design approach. The study location was in 5 EARC in the following counties; Kakamega, Baringo, Trans Nzoia, Uasin Gishu, and Elgeyo Marakwet. Purposive sampling was used to select 5 EARC in Kenya and 5 EARC coordinators. Convenient sampling was used in selecting 80 special needs education (SNE) teachers. The researcher gathered the information using questionnaires and observation schedules. The tools were administered on the pilot group and examination of the item relevance to variables and objectives were done by the researcher to determine the validity. Data was coded edited and organized through the statistical package for social science (SPSS) software and open-ended questions were analyzed using descriptive statistics by calculating in terms of frequencies and percentages. The finding showed that 60% of the EARC often provided audio-visual aids to learners with special needs (M=2, SD=0.71). 40% of the EARC rarely co-ordinated seminars that involved all the stakeholders in the field of special needs (M=2.8, SD=1.3). 80% of the sampled EARC often coordinated evaluation and assessment in schools (M=2.2, SD=0.45). Forty percent of the EARC often provided hearing aids to learners with hearing impairment and an equal number sometimes availed the aids to the learners (M=2.2, SD=0.84). 60% of the EARC were sometimes involved in visiting schools to advise teachers on how to identify children with special needs and do an assessment (M=3.6, SD=0.55). The study established that EARC had inadequate tools and equipment, there was low parental involvement in assessment, and there were few special schools for placement of learners with special needs. Seminars were not conducted for the stakeholders and there were few
EARCs. The following recommendations: training for more special needs teachers, ensure there is adequate multi-disciplinary team in the EARCs, seminars should be organized for the stakeholders. Government to build more special schools in addition to enabling all-inclusive educational environment and to provide adequate tools and equipment to the EARCs and finally, parents/guardians should be involved in the assessment process.

DETERMINANTS ENHANCING TEACHERS’ PROFICIENCY IN ENGLISH BRAILLE: CASE OF PRIMARY SCHOOL FOR THE BLIND, KIAMBU COUNTY - KENYA

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Dr. Chomba Wa Munyi

The purpose of this study was to identify determinants enhancing teacher’s proficiency in English Braille teaching in a primary school for the blind, Kiambu County, Kenya. Specifically the study sought to identify teachers’ attitude towards the Braille literacy, identify teachers’ competence in using Braille code, determine the level of teachers’ training in Braille code, and identify the extent of availability and suitability of Braille teaching materials. The findings of this study may be useful since determinants for enhancing teachers’ proficiency in teaching English Braille in the study area are identified. Since this was a case study, a school for the blind in Kiambu County was purposively selected for the study. Descriptive research design was used to describe the factors affecting the learning of English Braille from the teachers. The target population of the study was 224 consisting of 35 teachers and 189 upper primary learners. The researcher used a sample size of 68 respondents to represent the whole study population. The primary data was collected using questionnaire and interviews guide. Questionnaires for those who could read print and interview guides for the respondents who could not. The data collected was first organized then coded and keyed into the computer for analysis. Descriptive statistics was used to analyze the data which was reported in form of frequency tables and calculated into percentages. Bar graphs and pie charts were also used in presentation for clarity. The study found out that, teachers had mixed attitude towards teaching of Braille the reason being heavy workload, pre-braille experience and the teacher’s level of academic qualification. Teachers’ competence in teaching of Braille was affected by proficiency in Braille writing and reading, professional & academic training and experience of years in teaching. Workshops, refresher courses as well as seminars on Braille need to be organized to enhance teachers’ competence on effective Braille teaching. The level of training sufficient for a Braille teacher was found to be diploma plus visual impairment professionalism and a diploma in special needs. The area of study had no adequate or sufficient Braille materials for enhancement of Braille literacy. The Braille materials were not locally available and had to be ordered nationally or internationally which comes with exorbitant prices. The study recommends that Braille teachers be given in-service training to raise their competence and proficiency in Braille. The government to be involved provision of adequate and sufficiency Braille equipment’s.

TEACHERS’ PERCEPTIONS TOWARD DE-BRAILLING OF WORK BY STUDENTS WITH VISUAL IMPAIRMENT IN SECONDARY SCHOOLS FOR VISUALLY IMPAIRED LEARNERS IN KENYA

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The purpose of this study was to investigate teachers’ perceptions toward de-brailing of work by students with visual impairment in special secondary schools for learners with visual impairment in Kenya. The study sought to establish teachers’ perceptions toward relationship between original Braille work and de-brailed work, the qualifications of de-brailing personnel, challenges involved in de-brailing, and strategies that can enhance competence of de-brailing personnel. The study was based on the evaluation theory by Michael Scriven (1967). Descriptive research design was used. Piloting was done using 5 teachers of learners with visual impairment at St Francis Secondary School for the Visually Impaired, Kapenguria, in West Pokot County. The study was conducted in four secondary schools for learners with visual impairment and nationally. The target population was 102 teachers and former de-brailists of KNEC. A sample of 34 respondents: twenty-six subject teachers, four teachers in charge of Braille from the schools and four former de-brailists of KNEC derived. Schools and teachers in charge of Braille were purposively sampled while 26 subject teachers were sampled through stratified random sampling. The former de-brailists were sampled through snowballing. Questionnaires and interviews were used to collect data. Interview schedules were organized for the former de-brailists of KNEC and teachers in charge of Braille. Quantitative data was analyzed using Statistical Package for Social Sciences (SPSS) and results presented in tables, charts and graphs. Data from interviews were analyzed qualitatively by thematic analysis and the results presented in narrative form. Findings revealed that the original Braille work and de-brailed work were utterly different owing to errors associated with the de-brailing process, the de-brailists or the student. Findings also revealed that the de-brailing personnel should have professional qualifications, training and other vital qualities that they need to effectively play their roles: be trained and certified, have knowledge of Braille and skilled in presenting various types of test materials, accuracy and subject knowledge/training. The findings further showed that major challenges involved in de-brailing were the competence of the personnel de-brailing students’ work coupled with qualifications that did not match their competence, inadequate or lack of Braille personnel, complexity of the Braille code, lack of clear Braille standards in the country among others. Finally, it was established that there was a difference between qualification and competence and there existed low levels of braille proficiency among teachers which called for further frequent professional trainings and refresher courses. From the findings, the following recommendations were made: Institutions that train personnel in SNE (visual impairment) and especially in Braille should ensure adequate resources: both human and material; the Teachers Service Commission to ensure that qualified and competent teachers of the VI are posted to secondary schools for learners with visual impairment; the de-brailists/teachers should be subjected to frequent training and refresher courses to enhance their competence in Braille; the teachers in institutions for learners with VI should ensure high standards of Braille among learners right from pre-braille skills; and teachers should mark students’ Braille work and assignments in their original Braille form.

INFLUENCE OF THE KENYA EDUCATION MANAGEMENT INSTITUTE’S PROFESSIONAL DEVELOPMENT OF PUBLIC SECONDARY SCHOOL PRINCIPALS ON SCHOOL MANAGEMENT IN NYAMIRA COUNTY, KENYA

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Professional Development of secondary school principals in Kenya is necessary in equipping them with the requisite skills and competencies in school management thus effective in their role as school managers. Within the intricate functioning of educational establishments in the 21st century, the principal is central in initiating school progress and management efficacy and thus, there exists a necessity of ensuring that the principal has the managerial skills to enable one undertake the duties efficiently. On this basis, this study sought to find out the influence of Kenya Education Management Institute’s professional development of public secondary school principals on school management in Nyamira County, Kenya. The study sought to determine the influence of skills acquired by principals in financial management, human resource management and curriculum implementation from the Kenya Educational Management Institute on management of public secondary schools in Nyamira County, Kenya. The study was anchored on the Peter Principle Theory that explains the influence on a worker’s effort followed by an upgrade to a fresh and new post, with new sets of demands that may lead to failure if not accompanied by requisite skills. The theory stipulates that a teacher who is promoted to principalship without the necessary management skills is likely to fail. Descriptive research design was used as the framework for the study. The target population was all the 168 principals in Nyamira County. Simple random sampling method was employed to get a sample size of 105 respondents from the 168 target population. Data were collected using questionnaires. The study was piloted in Nyamira County in institutions with similar characteristics as those under study. Reliability was tested by use of Test-retest. Content Validity was determined through use of expert judgement. Qualitative data were analysed thematically using themes generated from literature related to the study objectives. Quantitative data were analysed by use of SPSS (Anova and Pearson Correlation) and summarized into percentages and frequencies. The study is significant in that it may identify the strengths and weaknesses of the KEMI training with a view to making it more effective. The study establishes that there is a positive influence of KEMI Training on the Principal’s management of financial resources, human resources and curriculum implementation on school management. The findings reveal that the KEMI diploma course statistically predicts management of schools. The study concludes that KEMI training by the principals has a statistically significant influence on school management by principals in public secondary schools in Nyamira County, Kenya. The study recommends that the training on management practices be made part and parcel of the pre-service training curriculum for teachers by the Ministry of Education, Science and Technology (MoEST).

INFLUENCE OF EMOTIONAL AND BEHAVIOUR DISORDERS ON ACADEMIC ACHIEVEMENTS OF LEARNERS IN SELECTED INTERNATIONAL SECONDARY SCHOOLS IN NAIROBI COUNTY KENYA

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The purpose of this study was to examine the influence of emotional and behaviour disorders on academic achievements of learners in selected international secondary schools in Nairobi County, Kenya. The following objectives guided the study; to find out academic achievement levels of learners with EBD in selected International Secondary schools, to find out triggers of EBD within the school environment among learners in selected International Secondary schools in Nairobi County, to find out common EBD types among learners in selected International Secondary schools in Nairobi County, to
find out current instruction strategies provided to learners with EBD in selected International Secondary Schools in Nairobi County. Qualitative and quantitative research design was used. The target population was eight international secondary schools in Nairobi County with programmes for learners with EBD which was randomly selected. The study target population was comprised of forty students with emotional and behavioural disorder, eight guidance and counselling teachers or school counsellors, eight special needs education teachers, eight school head teachers/key stage coordinators from the selected schools. The sample size for the study was comprised of five school head teachers/Key stage coordinators, five school guidance and counselling teachers/school counsellors, five special needs education teachers, and twenty students with EBD. School head teachers/key stage coordinators, school guidance and counselling teachers were selected through Purposive sampling. Questionnaires and interview guides were used to gather data. Pilot study was carried out at St. Austin’s Academy a selected international school within Nairobi County. The research instruments were tested for their validity and reliability the pilot study built up on the same. Data collected was categorized, coded and data analysis done using both qualitative and quantitative techniques. Quantitative data was analyzed using descriptive statistics including frequencies and percentages, and then presented using pie charts, bar graphs, and tables after the analysis. Qualitative data was analyzed after thematically arranging responses according to the research questions and objectives. The researcher found that academic achievement of learners with EBD ranges from average to poor despite well-established instruction strategies and relevant programmes for them. The study also found out that externalizing EBD types such were more common as compared to internalizing EBD types. ADHD was more common followed by anxiety depression disorders, conduct disorder and oppositional defiant disorders respectively among the learners with EBD within the schools under study. The latter were more common in male learners as compared to female learners. The study recommends a study that examines inclusive versus exclusive setting and its effect on academic achievements of learners with EBD as well examining influence of parental and home involvement on learning of learners with EBD.

SCHOOL FACTORS INFLUENCING PROVISION OF QUALITY EARLY GRADE EDUCATION FOR PUPILS WITH LEARNING DISABILITIES IN NAIROBI CITY COUNTY, KENYA

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Quality early childhood education especially for pupils with learning disabilities (LD’s) must provide nurturing environments that foster their physical, socio-emotional and cognitive development while at the same time responding to the needs of their families. Despite this knowledge, reviewed studies show a decline in children’s learning performance, while others drop out of school, which causes concern over the quality of education they received. Thus, this study aimed at finding out the school based factors affecting the provision of quality education to this group of learners with learning disabilities in their early grade years in Kasarani sub county Nairobi City County, Kenya. The research study was based on seven objectives: to find out the prevalence of children with learning disabilities in early childhood years and to establish the influence of teachers’ qualifications; their salary; school infrastructure; teaching/learning materials; lesson supervision and curriculum content on the provision of quality early childhood education to this group of learners. The theory of social constructivism by Vygotsky (1978) was adopted. Descriptive survey design guided the study using mixed methods. The target population comprised of 25 head teachers and 55 classroom teachers. Simple random sampling technique was used.
to purposively select 8 (32%) early grade schools, 16 (29%) teachers and 8 (32%) head teachers. The research instruments included interviews for the head teachers, questionnaires for teachers and learning task for PP 2 pupils. Four schools were utilised for piloting the research instruments in order to validate the study content based on the study objectives while test-retest reliability technique at coefficient of 0.7 was used to determine their soundness. Quantitative data collected was analysed using descriptive statistics such as frequencies, means and percentages while qualitative data was summarised and analysed according to specific study themes. The study established that provision of quality early grade education in Kasarani Sub-county has been hampered by many challenges such as lack of enough teaching and learning materials, trained personnel in special education and low salary for teachers. The study also found out that there was inappropriate curriculum for LD, inadequate physical facilities and supervision, subsequently affecting the quality of ECE for pupils with learning disabilities. It has thus been recommended that there be more training of teachers to handle learners with LD. It has also been recommended that curriculum review process should ensure it makes the content more appropriate for learners with LD. The government should also increase budgetary allocation in preprimary schools in order to improve the infrastructure as well as teaching/learning materials for use by pupils with learning disabilities, among others. These findings will create awareness to the Ministry of Education, policy makers and educators about the school based factors influencing the performance of learners with LD in preprimary schools so that appropriate measures may be taken to improve the current situation. The study will also form the basis on which other researchers could develop more related studies.

**RELATIONSHIP BETWEEN STUDENTS’ MATHEMATICS FINAL GRADE AT SECONDARY SCHOOL AND PRIMARY TEACHERS EDUCATION: CASE OF THOGOTO TEACHERS COLLEGE, KIAMBU COUNTY, KENYA**

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Supervisors: Dr. Marguerite Miheso O’connor

Dr. Nasibi M.Were

The importance of a teacher’s mastery of subject matter for effective teaching of Mathematics has long been recognized. Questions have been raised regarding adequacy of teachers’ knowledge of facts, concepts, theories and principles in Mathematics. This, in turn has focused attention upon the quality of Teacher Education Programs. This study, therefore set out to evaluate the relationship between students’ Mathematics final grade at secondary school (Mathematics content masterly) and at Primary Teachers Education (Mathematics pedagogical skills and knowledge masterly): case of Thogoto Teachers College, Kiambu County, Kenya. The objectives of this study were: (i) To establish the difference in students’ performance by gender in Kenya Certificate of secondary school Mathematics among Pre-primary School teachers. (ii) To establish the difference in students’ performance by gender in Primary Teachers Education Mathematics among Pre-primary School. (iii) To compare the time allocated to Mathematics content knowledge versus Mathematics pedagogical knowledge and skills, and (IV) To determine the extent to which prospective teachers’ KCSE Mathematics’ grades predicts PTE Mathematics grade. The study was conducted at Thogoto Teachers’ Training College. The study adopted correlation survey research design based on ex-post facto research methodology where secondary data of KCSE and PTE Mathematics scores of 160 randomly selected students from two consecutive academic years were obtained from examination archives. The study also adopted a descriptive survey research design to collect data by use of a guided questionnaire to interview 6 purposively selected Mathematics lecturers at Thogoto TTC. The data collected was sorted, coded and analyzed with the
aid of SPSS software version 22. Data was analyzed using both descriptive and inferential statistics; Pearson Product Moment Correlation Coefficient and multiple regression analysis. The results were presented in terms of tables, graphs and charts. The study revealed that performance in Mathematics among female students is low compared to male students. The study also revealed that the PTTC Mathematics syllabus is designed for the purpose of teaching pedagogical knowledge among the Pre-Service teachers as opposed to subject matter content knowledge. It was also revealed that KCSE Mathematics performance predicts PTE Mathematics at 30-50%. The study recommends that PTTC lecturers should put into consideration Pre-service teachers entry grade in order to accommodate poor students in Mathematics subject matter during classroom instructions. The study also recommends that PTTC placement board should revise their selection criteria and include a minimum requirement of C- in Mathematics for admission to PTTC. The study also recommends that Centre for Mathematics and Technology Education in Africa (CEMASTEA) should particularly target the newly recruited teachers for the in-service courses to improve their mathematical skills and finally the study recommends that the ministry of education, TTC administrators and parents should in conjunction provide incentives to female students to boost their performance in Mathematics.

RELATIONSHIP BETWEEN UTILIZATION OF ASSISTIVE HEARING TECHNOLOGY AND ACADEMIC ACHIEVEMENT OF LEARNERS IN SCHOOLS FOR THE DEAF IN KAKAMEGA COUNTY, KENYA

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Dr. Fransiscah Wamocho

The purpose of this study was to find out the relationship between utilization of assistive hearing technology and academic achievement of learners with hearing impairment. Studies indicate that learners with hearing impairment lack assistive hearing devices and also achieve lowly academically not only in Kenya but in the whole of Africa continent. In Kenya, academic achievement of learners with hearing impairment tend to trail behind that of their hearing counterparts. When it comes to ranking of the schools academically, the schools for the deaf are always last. Very many factors have been explored by researchers to affect academic achievement of these learners. Despite the fact that prior research reveals that assistive hearing technology are missing in schools for learners with hearing impairment, no single study has been done to explore the relationship that exists between the assistive hearing devices and the academic achievement of learners with hearing impairment. It was thus of great urgency to find out the effect that utilization of assistive hearing technology has on the learners’ academic achievement. The central problem of this study was to unearth the relationship that exists between utilization assistive hearing technology and academic achievement of learners with hearing impairment. The specific objectives were to; find out the assistive technology need among learners with hearing impairment, identify the types of assistive hearing technological devices available in schools for the deaf, establish the academic achievement of learners with hearing impairment and to evaluate the challenges faced by learners with hearing impairment while using the assistive hearing technology. The study was guided by the learning theory and a survey design. The design was used because it helps in describing phenomena as it is naturally. The target population consisted of learners with hearing impairment and the two head teachers in St. Martins School for the deaf and Kakamega School for the deaf. Using purposive sampling, a sample of learners with hearing impairment was selected. The data in this study was collected using questionnaires, conducting interviews and reviewing documentations. Pilot study was done in St. Anthony
School for the deaf. Quantitative data was analyzed quantitatively using SPSS while qualitative data was analyzed qualitatively. The possible beneficiaries of this research may range from policy makers, teachers of learners with hearing impairment, experts in the area of hearing impairment, nongovernmental organizations to parents of learners with HI. The research would contribute to the existing knowledge by providing information about the relationship between utilization assistive hearing technology and academic achievement of learners with hearing impairment. The study revealed that a majority of learners in schools for the deaf are hard of hearing and thus need assistive hearing devices individual hearing aids were the only assistive hearing device in schools for the deaf in Kakamega County. Another finding was that academic achievement of learners with hearing impairment is low, hearing aids being noisy, there are no technicians in the schools to fix the aids as well as fine tune them, they are very expensive and their parents are poor thus can't afford them, they advertise their deafness and makes all people to know that they have a hearing impairment, they call for unnecessary attention and that they don’t want to be seen with hearing aids and lastly, they break. There is also a positive relationship between utilization of assistive hearing technology and academic achievement of learners with hearing impairment and finally there is a significant positive relationship between assistive hearing technology need and assistive hearing technology available in schools for the deaf in Kakamega County.

INFLUENCE OF SOCIALIZATION ON ACADEMIC PERFORMANCE OF LEARNERS WITH HEARING IMPAIRMENT IN THAWABU INCLUSIVE SCHOOL IN EMBAKASI, NAIROBI CITY COUNTY, KENYA

Everlyne Achieng Owuor-M.ED

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Dr. Syprine A. Otieno

The purpose of this study was to determine influence of socialization on performance of learners with hearing impairment in an inclusive Thawabu Primary School of Embakasi, Nairobi City County, Kenya. The study was guided by research objectives which sought to; establish modes of communication that promote socialization between learners with hearing impairment and hearing peers; enhance academic performance in Thawabu inclusive public school; establish strategies for boosting socialization of learners with hearing impairment and hearing peers to enhance their academic performance in Thawabu inclusive public school and establish challenges facing teachers in enhancing socialization to improve academic performance of learners with hearing impairment in Thawabu inclusive public primary school. The study targeted all learners with hearing impairment in Thawabu public primary school in Embakasi sub-county. The research design used in this study was case study design. Structured questionnaires and interviews were used to collect data. Purposive sampling technique was employed to select the school and learners with hearing impairment while hearing learners were randomly selected. Key informants were a headteacher, deputy headteacher, 10 teachers, learners with hearing impairment and hearing learners from Thawabu School. Pilot study was conducted in Wangu Primary school of Nairobi County. Piloting consisted of one (1) school head/teacher, two (2) teachers, five (5) hearing learners and (5)five learners with hearing impairment. Content validity was adopted where unclear directions, cluster questions, and wrong phrasing of questions were opened and cross-checked. Reliability was established through test re-test method which involved administering the same questionnaires at an interval of two weeks to the same group of respondents, and then comparing the two scores. A total of 32 respondents participated in the study. The data was analyzed using Statistical Package for Social Sciences (SPSS) computer program version 11.5, and frequencies and percentages used to summarize the data. The study found that:
modes of communication among learners with hearing impairment, hearing learners and teachers create social and educational change for improvement of academic standards in the school and narrows the gap between those with hearing impairment and their hearing counterparts. Strategies like family support program (assisting children and families in language learning), family-infant-toddler program, and competent and consistent administration system promote learning. Socialization influences incidental learning of learners with hearing impairment to put them at par with their hearing peers on matters related to both academic performance and social advancement. Socialization makes learners with hearing impairment comfortable, self-esteem, and self-actualized, hence improving educational performance. The study recommends that the government should add specially qualified teachers of learners with hearing impairment in Thawabu inclusive public school to help promote socialization and to increase inclusivity of learners with hearing impairment.

INFLUENCE OF INTEGRATION OF INFORMATION AND COMMUNICATION TECHNOLOGY IN TEACHING BIOLOGY ON STUDENTS’ PERFORMANCE IN MAKUENI COUNTY SECONDARY SCHOOLS, KENYA

Ndolo Leonard Musau-M.ED

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There are great technological advancements in global application of ICT and hence the need for its use in teaching Biology. Lack of application of ICT in pedagogy might have led to poor performance in science subjects like Biology. The study sought to investigate the influence of integration of ICT in teaching Biology on students’ performance in secondary schools. The specific objectives of the study were: to find out the ICT resources available in the schools for use in teaching Biology; to examine the use of ICT in teaching Biology; to find out the challenges faced by teachers in integrating ICT in teaching Biology; to determine the attitude of teachers towards integration of ICT in teaching Biology and to establish whether the use of ICT in teaching Biology influences students’ performance. The study was underpinned by Technology Acceptance Model which is an information systems theory that models how users come to accept and use technology. The study adopted a descriptive survey design. It targeted Form 3 Biology students, Biology teachers and the school administrators in Mbooni-East Sub-County secondary schools. The research used purposive and random sampling techniques to sample the respondents. To collect data, the study used questionnaires for students and Biology teachers, interview schedules for the school administrators and Biology teachers and observation checklists. Pilot study was conducted in a school which was not involved in the main study. The data collected was analyzed using SPSS and presented in tables, charts and graphs. The study found the main ICT resources used in teaching Biology as desk top computers, projectors, laptops and smart phones but some schools did not have any ICT. The study also found out that, though some ICT resources were available in teaching Biology, most of the teachers rarely used them or actively engaged their students in the use of the ICT in Biology. The study identified the main challenges faced in integration of ICT in teaching Biology as: Lack of or insufficient ICT; Poor electricity supply; Limited space or no laboratories present in the school; Lack of skill or knowledge in the use of ICT; Financial constraints in acquisition of ICT resources; Insufficient time in the use of ICT and inadequate ICT. Most of the teachers were found to have negative attitude towards the use of ICT in teaching Biology. All these affected students’ performance which was found to be good when ICT was used. The study recommends: School administrators to ensure that there is a variety of ICT; Teachers to vary the use of ICT in every Biology course.
Integration of ICT to be done in every Biology lesson for effective conceptual understanding; Teachers to be sensitized on the role of ICT integration in Biology; The school administration to ensure that there is equipped and spacious ICT Resource Centre; Need for regular workshops and seminars for teachers or in-servicing of teachers on effective integration of ICT in teaching Biology and consider ways of improving the teachers’ attitude towards the use of ICT.

AN ANALYSIS OF DETERMINANTS OF PSYCHO-EDUCATIONAL ASSESSMENT FOR LEARNERS WITH LEARNING DISABILITIES IN BRNO CITY, CZECH REPUBLIC

Athiende Joseph Omoga-M.ED

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A comprehensive psycho-educational assessment for learners with learning disabilities (LD) is a significant event for parents, psycho-educational assessors, teachers and learners. This research study aimed to analyse the determinants of psycho-educational assessment for learners with learning disabilities (LD) in Brno City in the Czech Republic. Psycho-educational assessment for learners with LD remains a challenge in Czech Republic, hence, there is an extensive debate as to how to best improve psycho-educational assessment outcomes. There were several determinants of psycho-educational assessment psycho-educational assessment outcomes for instance psycho-educational assessment plans and legislation. The challenges facing psycho-educational assessment process were also examined. The views of psycho-educational assessment on the overall assessment and the psycho-educational assessor’s recommendations had a great impact on the decisions that were made for learners with LD. The choice of educational trajectory was contesting and transparent hence not only professionals, but parents had the opportunity to take part in the study. In-depth Interviews were used to investigate issues and to discover how the psycho-educational assessors and teachers thought and felt about the whole process. Interview data from parents of school-age children with LD who had psycho-educational assessments done within the past one year were crucial for the proposed study to find out their experiences with assessment process. Teachers from elementary and primary schools and psycho-educational assessors were interviewed to find out their view about the psycho-educational assessment process for learners with LD and why they held certain opinions. This study used descriptive research design. Mixed method was used in which both qualitative and quantitative data was collected from primary and secondary sources. In this study critical disability theory (CDT) was used within the paradigm of transformative perspective. The theory recognises disability as a complex socially constructed interrelationship between impairment, response to impairment and the environment. ATLAS.ti computer software was used for conceptualization, coding and categorizing of the qualitative data. The analysis process was enhanced by IBM-SPSS and Microsoft Excel for quantitative data especially for experimenting with different codes, testing relationships and facilitating diagrams of emerging theories. The emphasis of this study was on the determinants of psycho-educational assessments of LD with a focus on the plans, legislative influence, placement options and the challenges facing psycho-educational assessment process of learners with LD. Findings showed that the main challenges in psycho-educational assessment were linked to lack of proper stakeholder collaboration and interests, inadequate funding and resources, time taken in assessment and
community backgrounds of the learners. Finding also showed that more boys were diagnosed with LD compared to girls even though they all ended up in similar placements mainly group and individual integration. Most parents did not want their children with LD placed in group integration (dysclasses) due to the stigma association. This study recommends that the government through the Ministry of Education and Sports should address the critical challenge of funding to ensure enough resources including personnel. The education regulations need to be explicit to all stakeholders to ensure maximum degree of inclusion and access to psycho-educational services by learners with LD without discrimination.

USE OF INFORMATION, COMMUNICATION AND TECHNOLOGY IN PROMOTING LEARNING FOR HEARING IMPAIRED LEARNERS IN SPECIAL SCHOOLS IN MOMBASA COUNTY, KENYA

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Information and Communication Technology plays an important role in teaching of learners with hearing impairment. Despite the significant role of ICT in promoting learning among learners with hearing impairment, its usage in promoting learning among learners with HI across the country however has been on a small-scale especially in remote areas with limited infrastructure that supports ICT. The purpose of this study was to determine the use of information communication and technology and its impact on promoting learning for the hearing impaired in special primary schools and units in Mombasa County. The specific objectives of the study were to; examine the extent of use of ICT in special schools and units in Mombasa County, determine the importance of Information Communication and Technology (ICT) in promoting learning for learners with hearing impairments, establish the impact of ICT in promoting learning in schools for learners with hearing impairment. The study was anchored on the theory of Diffusion of Innovation and Capability Theory. The study adopted descriptive survey design. The study was conducted in special schools and units for learners with hearing impairment within Mombasa County. The target population comprised of all learners with HI and their teachers in 3 public and one private primary schools in Mombasa County. There was a total of 223 learners with HI and 30 teachers. Simple random sampling was applied to select the target population and get the study sample size. That was 77 respondents comprising of 66 Hearing Impaired Learners, 6 Teachers and 2 Head teachers/Deputy Head teachers. The study collected primary data using questionnaires and interview guides. The study revealed that laptops and desktops were inadequate, ICT enabled locally relevant teaching materials, in local languages, to be created and disseminated quickly and affordably, whether learners using voice communication aids were able to gain confidence and social credibility at school and in their community and schools had limited infrastructure. The study concludes that desk computers and laptops were inadequate. ICT enabled education to be tailored to individual learning needs and abilities. Learners using voice communication aids were able to gain confidence and social credibility at school and in their community. Computers were used to control hyperactive children. There was lack of education/school administrators of ICT support. The study recommends that all schools promoting education for learners with hearing impairments should implement and invest in ICT in order to ensure that learners get sufficient ICT facilities required for their education to ensure there is uninterrupted learning in schools. The Ministry of Education needs to strengthen policy and regulatory framework with regard to implementation of ICT in schools with specific references to special schools and units. All special schools should
Implement voice communication aids to help learners gain confidence and social credibility at school and in their community. All schools should have adequate Information and Communication Technology (ICT).

**RELATIONSHIP BETWEEN MOTHERS’ DEMOGRAPHIC CHARACTERISTICS AND THEIR INVOLVEMENT IN PRE PRIMARY SCHOOL CHILDREN’S HOMEWORK IN NAIROBI CITY COUNTY, KENYA**

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Extensive studies have been done on the importance of parental involvement in children’s homework, yet relatively few studies have explored the contributions that either mothers or fathers make to their children’s schooling. However, this study is interested in the involvement of mothers in their pre-primary II children’s homework. Homework is assignments given to children by their teachers that are supposed to be done at home. This interest stems from the fact that traditionally in Africa, mothers were assumed to be the housekeepers of their families, but of limited importance in academic aspects of children’s wellbeing and development. Homework can be a double-edged sword having a positive influence, or one that is destructive and damaging to academic achievement. It is also clear that most of the studies on this topic have been carried out in developed countries. Most of the existing studies do not focus on mothers. In Kenya, mothers occupy a strategic position in children’s lives and it is therefore important to establish their involvement in the child’s homework. Studies on the involvement of parents in children’s homework are few. Homework is common among learners at all levels and thus offers an opportunity for parents’ involvement. The objectives of this study, therefore, were to establish the relationship between mothers’ educational level, occupation, work schedule and their involvement in children’s homework as well as to find out the challenges faced by mothers in their involvement in children’s homework, in selected private preschools in Nairobi County, Kenya. The findings of the study may provide relevant information that can be used by scholars, non-governmental organizations, government, School managers, institutions, Child Welfare Organizations (CWOs) and other stakeholders. The study was guided by Epstein’s framework of parental involvement. A mixed methods approach was employed in this study whereby the correlational research design was used. The research also used quantitative research methods to investigate the mothers’ involvement in their children’s homework. Purposive sampling was used to select Nairobi City County, simple random sampling was used to select six private pre schools and stratified random sampling was used to select 192 children, whom their mothers were included in the study. Results from this study have shown that there was no relationship between mothers’ involvement in their children’s homework and their educational level, occupation and work schedule. Most of the mothers encountered more than one challenge. Various recommendations were suggested for various stakeholders including, school Managers, Administrators, and KICD and future research.

**HEAD TEACHERS’ LEADERSHIP STYLES AND TEACHERS’ WORK PERFORMANCE IN THE INTEGRATION OF LEARNERS WITH VISUAL IMPAIRMENT IN LAMU COUNTY, KENYA**

Barghash Abdalla Ahmed-M.ED

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Leadership style can be a major factor in not only in production industry but in all spheres where human effort is required for better output. School academic output and performance can be attributed to various causal factors. Persistent academic under performance has for a while been characteristic of most learners in Kenya and particularly Lamu County. Lamu County is among the bottom performing regions in Kenya as per studies by Uwezo (2012; 2014). This is more pronounced in integrated schools. The purpose of this study was to explore the implication of head teachers’ leadership styles on teachers’ work performance in the integration of learners with visual impairment (VI) in the integrated public primary schools in Lamu County, Kenya. The study was guided by four objectives; to determine the leadership styles employed by head teachers in the integrated public primary schools in Lamu County; to establish teachers’ perspective on leadership styles employed by head teachers in integrated public primary schools in Lamu county Kenya; to determine whether head teachers’ leadership styles affect teachers’ work performance in integrating learners with visual impairment in public primary schools in Lamu County, Kenya and to determine strategies head teachers employ in promoting effective leadership styles. The study employed descriptive research design. The population of the study was all schools implementing integration of learners with visual impairments (VI). Head teachers and teachers of the schools formed the study population. Purposive sampling was used to draw a sample of 9 and 42 head teachers and teachers respectively. Douglas McGregor’s model - (Theory X and Theory Y), (1961) guided the study. Data was analysed using descriptive and inferential statistics. Descriptive statistics involved the use of frequencies and percentages. It was established that head teachers perceived theirs a democratic leadership while teachers indicated that they used autocratic leadership. The study further revealed that leadership styles have a significant influence on teachers’ performance. The study recommends that teacher education curricula needs to be enhanced to include effective leadership styles. There is need for further research on this subject on a larger population to determine the extent leadership affects inclusion in education.

INTEGRATION OF INFORMATION AND COMMUNICATION TECHNOLOGY IN TEACHING AND LEARNING OF BIOLOGY IN SECONDARY SCHOOLS IN SOUTHERN REGION, ERITREA

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Technology has become indispensable in pedagogy world over. Integration of ICT in education improves the quality of education and academic performance. This study sought to investigate the integration of ICT in teaching and learning of Biology in secondary schools of Southern Region, Eritrea. The objectives of study were: to determine availability of ICT resources for teaching and learning Biology in secondary schools of Southern Region, Eritrea; to ascertain teachers’ ICT integration skills; to establish teachers’ attitude towards ICT integration in teaching and learning; to establish the instructional methods used by the teachers of Biology in classrooms; and to explore the challenges facing teachers and students in ICT integration in secondary schools of Southern Region, Eritrea. The study was guided by the Technology Pedagogy and Content Knowledge (TPACK) model. The study was carried out in secondary schools of the southern region,
Eritrea. A descriptive survey research design was adopted. The study targeted 27 public secondary schools in the region. Stratified random sampling technique was used to get a sample of 12 secondary schools from 12 sub-regions. The sample of respondents of the study was drawn from these 12 secondary schools of 12 sub-regions. The respondents were 12 school directors, 34 Biology teachers and 175 grade eleven students. Questionnaires, interview and observation schedules were used as instruments for data collection. Questionnaire for Biology teachers and students, Interview Schedule for school Directors, were employed. Piloting and consultation were conducted to establish validity and reliability before the instruments were used for the actual data collection. The data collected included both qualitative and quantitative data. The quantitative data were analyzed using Statistical Package for Social Sciences (SPSS). The qualitative data obtained from the open-ended questions were analyzed thematically based on research objectives. The analyzed data was presented in the form of tables and figures. This study found that ICT resources were inadequate in the school; teachers were not well trained on how to integrate ICT in education, and the majority were using a teacher-centered approach in their teaching. The study also indicated that Biology teachers had a positive attitude towards ICT integration in education. Therefore, there was a low level of ICT integration. The study recommends that adequate ICT resources be available in schools for teaching and learning of Biology, teachers need to get adequate pre-service and in-service training on ICT integration in education, the learner-centered approach needs to be implemented in classroom instruction. Finally, ICT needs to be integrated into teaching and learning practices so that learning and performance of learners would be improved.

KENYAN SIGN LANGUAGE AND ITS EFFECTS ON ACADEMIC PERFORMANCE: A CASE OF ELDORET SCHOOL FOR THE DEAF, UASIN GISHU COUNTY, KENYA

Linner C. Maina-M.ED

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The purpose of this study was to determine the use of KSL and its effects on academic performance of Eldoret School for the deaf in Uasin Gishu County, Kenya. The study sought to; determine the effects of KSL as a mode of communication for instruction on academic performance for learners with HI; establish strategies of enriching KSL to enhance academic performance of learners with HI; and evaluate the instructional resources used by teachers to enrich KSL to enhance performance of learners with HI and establish challenges that teachers face in enrichment of KSL to enhance achievement performance of learners with HI. The study was conducted at Eldoret School for the Hearing Impaired. The researcher chose Eldoret School for the Deaf in Eldoret East County. The school was chosen because it has KCPE candidates who are examinable hence shows strength of KSL for teaching and learning of learners who are deaf in the school as opposed to the other schools with no examination class. The study targeted a population of 150 respondents comprising of 135 learners and 15 teachers. The study population of 32 respondents was sampled for the study. Out of 32 respondents, there was a head teacher, deputy head teacher, 5 assistant teachers and 25 learners with HI from class four to eight. Data collection was done by use of questionnaires and interview schedule. Data was analyzed both qualitative and quantitative using descriptive statistics and thematic approach respectively. Statistical package for social sciences (SPSS) was used in quantitative analysis to give descriptive statistics such as percentages, frequencies and tabulations. The study found that mode of communication used by teachers when conducting lessons determines performance in any subject. It also
revealed that, teaching using Kenya sign language alone as a mode of instruction was the cause of dismal academic performance of learners with hearing impairment in the study school. It was equally found that modern assistive technology could be used alongside Kenya sign language to improve English grammar for learners with hearing impairment. The preferred assistive technology by learners with hearing impairment was Google glass, followed by Phonak Roger Pen and IPAD. Next generation text relay was rated third and hearing aids fourth by learners with hearing impairment in Eldoret School for the deaf.

**USE OF INFORMATION COMMUNICATION AND TECHNOLOGIES IN THE TEACHING AND LEARNING OF WELDING AND FABRICATION IN VOCATIONAL TRAINING CENTRES IN MANDERA COUNTY, KENYA**

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Dr. Michael Mchoki Waititu

Integration of Information, Communication and Technologies (ICT) in the teaching of the technical courses plays a great role in facilitating students’ acquisition of knowledge, skills and values. This study aimed at investigating the integration of ICT in the instruction of welding and at vocational training centers in Mandera County. The study was guided by the following objectives: to establish availability of ICT resources for instruction of welding and fabrication, to establish teacher’s skills in integrating ICTs in teaching and learning of welding and fabrication, to establish teachers and learners attitudes towards integration of ICT in teaching welding and fabrication, to identify challenges teachers faced in integrating ICT in teaching welding and fabrication. This adopted a descriptive survey design and used questionnaires, interview protocol and observation schedules for data collection. The target population of this study was the administrators of vocational training centers, the instructors of welding and fabrication, the trainees of welding and fabrications and the personnel concerned with ICT resources in the vocational training Centers. The study established that among the ICT resources available for instruction of welding and fabrication includes; an electricity supply, computer laboratory, desktop computers, televisions, printers, Radio facilities, tablets and I-pads and mobile phones that are available and fully functional. The study also found that the teachers have attended ICT integration training workshops offered by nongovernmental organizations. The teachers had been using ICT resources in making presentations, research and making engineering drawing, tying and giving assignment. The learners were happily using the resources that had improved their training experience. The study also found out that there were challenges of out-dated ICT equipment, viruses, lack of experienced technical staff, unreliable internet and inadequate ICT resources. The study concluded that there are ICT resources used in training welding and fabrication, instructors integrate the ICT equipment through typing, drawing, making presentation and researching, the teachers and students were happily using the ICT resources and there has been improvement with class work. The study also concluded that there are challenges with weak internet, out-dated ICT equipment and inadequate trained staff to integrate the ICT in the curriculum as well as frequent power backups and loss of data. The study recommended for the increase and introduction of ICT resources and to make it available to all trainees such as more computers and introduce projectors in classrooms as well as local area network, the institution also need to bring up to date ICT resources to cope with challenge of breakdown, the institutions also need to configure good access points and also find reliable internet providers, the institutions should also hire technicians on repairs as well as instructing/training the users to ensure their productivity.
IMPACT OF INTEGRATING ASSISTIVE TECHNOLOGIES IN LEARNING MATHEMATICS AMONG THE VISUALLY IMPAIRED LEARNERS IN ST ODA SCHOOL, IN SIAYA COUNTY KENYA

Onyancha Nyakwara Fred-M.ED

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Prof. Ondigi Rosana Samson

Assistive Technologies (ATs) is defined as a piece of equipment or a product system or a hardware/software or service used to increase, maintain or improve functional capabilities of learners with visual impairment. This study focused on how the ATs could support the learning of Mathematics for the Visually Impaired Learners in St. Oda School for the Blind in Kenya. The study was guided by four objectives: (a) to investigate available forms of ATs used to support the learning of Mathematics among the Visually Impaired Learners (b) to establish the challenges experienced by the Visually Impaired Learners in learning Mathematics using ATs in St. Oda School for the Visually Impaired Learners (c) to determine the level of integration of ATs in the teaching and learning of Mathematics for the Visually Impaired Learners in the school understudy and (d) to establish the impact of integrating ATs in learning Mathematics among the Visually Impaired Learners in St. Oda School for the Visually Impaired Learners. The target population comprised of the Visually Impaired Learners in St.Oda School for the Visually Impaired in Kenya. The study used a descriptive survey design. A stratified random sampling technique was used to sample the learners according to class and gender, and the sample size was taken at 13.6 percent. The purposeful sampling technique was used to get the Mathematics teachers who gave the ATs facilities and services to the Visually Impaired Learners. The questionnaires, interview schedules, observation schedules and observation checklist were employed for data collection. In assessing the reliability and validity of the research instruments, piloting was done at Kibos School for the Blind and the data collected was coded and analyzed manually using descriptive statistics. The measures of central tendency, percentages, frequency distribution tables, and graphs were used. The study established that Assistive Technologies for the teaching and learning of Mathematics in the school were inadequate. The research indicated that the learners had challenges in utilizing ATs that supported learning of Mathematics like the abacus. The study also established that there were other challenges like the thirty-five-minute Mathematics lesson proved tedious. Based on the data collected, the level of integration and the impact of ATs in the learning of Mathematics ranged between average (50 percent) and zero. With these findings, the impact of ATs in the learning of Mathematics for the Visually Impaired Learners ranged between average (50 percent) and zero.

EFFECT OF KENYAN SIGN LANGUAGE ON ACADEMIC PERFORMANCE OF LEARNERS WITH HEARING IMPAIRMENT: CASE OF KEDOWA SPECIAL SCHOOL, KERICHO COUNTY, KENYA

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Prof. Geoffrey Karugu
The purpose of the study was to establish the effect of Kenyan Sign Language (KSL) on academic performance of hearing impaired learners in Kedowa Special School, Kericho County, Kenya. The government has done all it could to make KSL an acceptable mode of communication to the deaf and the hearing. This includes its recognition in the new Constitution and its inclusion as an examinable subject in the National examinations. Despite all these efforts, it has been noted that learners with hearing impairments continue to lag behind their hearing peers in the national examinations like Kenya Certificate for Primary Education (KCPE) and Kenya Certificate for Secondary Education (K.C.S.E). The objectives of the study was establish the extent of Kenya Sign Language use by teachers on academic performance of hearing impaired learners in Kedowa Special School; determine the availability of Kenya Sign Language teaching and learning resources on academic performance of hearing impaired learners in Kedowa Special School Kericho County; establish the effects of teachers training in Kenya Sign Language on academic performance of hearing impaired learners in Kedowa Special School Kericho County and establish the effects of social factors in use of Kenyay Sign Language on academic performance of hearing impaired learners in Kedowa Special School Kericho County. The study employed a case study as its research design and used interviews, archival records, questionnaires and observation as its instruments. The reliability of the instruments was determined using the test-re-test method while its validity was determined by the help of KSL experts and the researcher's lecturers and supervisors. A purposive sampling technique was used to arrive at the sample size of 181 respondents. Data was analyzed using the SPSS version 21 by first categorizing the responses from the different respondents, editing them and then computing them in respect to the objectives and research questions of the study. The findings of the study, shows that KSL was not used in the schools due to lack of teaching materials and resources like books. KSL has a positive influence on learners' academic performance and on other subjects. The teachers who teach in KSL did not have adequate training in Kenya Sign language. This is a big setback in the desire for effective academic performance of learners. The study recommends that the Ministry of Education should provide adequate teaching and learning resources for special schools for the deaf for successful implementation of KSL. Teachers need to display on the wall the charts and diagrams so that learners can read over and over again in order to enhance academic performance. Teachers in special schools should be trained through workshops, seminars or in- serviced on methods of teaching deaf students using KSL and Teachers Service Commission (TSC) should post teachers who have been trained in KSL to special schools for the deaf. Further research can be done in other schools and on the Teachers’ attitude towards the use of Kenya Sign Language as a language of instruction to learners with hearing impairment, or on availability and utilization of teaching and learning resources in special schools for the deaf on the implementation of Kenya Sign Language.

PUPILS GOVERNING COUNCILS AND THEIR INFLUENCE ON GOVERNANCE IN PUBLIC PRIMARY SCHOOLS IN NAIROBI COUNTY, KENYA

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In an attempt to enhance school governance, the Ministry of Education introduced Pupils Governing Council (PGC) guidelines which require primary school children to form pupils’ councils. This has seen some schools over the last few years enhance their governance. However, formation and operations of these councils have been under the mark whereby studies show that few schools still are experiencing governance challenges. The purpose of the study was to find out how
public primary school in Nairobi County have implemented and complied with PGC guidelines to bring about better school governance practices. The study’s objectives were; To find out the extent to which primary schools comply with the practices of democratic participation to influence governance in Nairobi County, To find out the duties of the PGC to influence governance, To determine the role of the stakeholders in the PGC to influence governance, To establish the facilitating and hindering factors to PGC functionality and the influence on governance. Significantly, the study findings may help schools comply with the PGC guidelines as required and provide policymakers with research-based evidence to enhance learner participation in governance. To ground the study the Social Change Model of Leadership was used under the theoretical framework. Descriptive survey design was adopted. The target population was 28454 people in 197 public primary schools comprising of the 197 head teachers, 197 teachers in charge of CG, 11 SCDE, 1970 CG elected leaders and 26079 standard seven pupils. 20% of the schools were used. By taking 15% of the standard 7 pupils in the sampled schools, and 20% of head teachers, teacher in charge of the Council and Council leaders the sample size was 939 stratified into 39 head teachers, 39 teachers in charge of CG, 78 Council leaders, 11 SCDE and 772 standard seven pupils. Cluster and purposive sampling ensured respondents representativeness. For Council leaders and standard seven pupils, simple random sampling and convenience sampling were used respectively. Piloting was done to determine whether the instruments can gather the intended data. To determine validity the researcher ensured representative sample groups and asked interview questions in an inverse format. Self-administered questionnaires were used as the main tool to collect data supported by interviews and focus group discussions. Qualitative data was coded and text analysed thematically while quantitative data analysed by use of descriptive statistics. Tables, bar graphs and pie charts with text were used in data presentation. The study found out that many school have complied with the PGC guidelines on democratic participation practices and pupils are well involved in governance. In conclusion, PGC are relevant to the daily life of learners for they enhance life and leadership skills. The study recommends that the Ministry of Education should include PGC activities in the calendar of events and teachers to take these activities more seriously.

EFFECT OF TEACHING METHODS ON ACADEMIC PERFORMANCE IN MATHEMATICS AMONG LEARNERS WITH HEARING IMPAIRMENT IN MERU COUNTY, KENYA

Nabea Mpanda Kathare-M.ED

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Supervisors: Prof. Geoffrey Karugu

Prof. Singh S. P.

The purpose of the study was to establish the impact of teaching methods on academic performance of learners with hearing impairment in Mathematics in Igembe District, Meru County, Kenya. The study was based on Burhus Fredric Skinner’s theory of motivation in learning. The argument here was that learner’s motivation to undertake a task depends on expected rewards that is, achievements in accomplishment of task. This study will adopt a descriptive survey design which will allow the researcher to gather, summarize, present and interpret the information/data for the purpose of clarification. The location of the study was Igembe District of Meru County, Kenya. The target population of this study was Head teachers, Teachers teaching mathematics to hearing impaired learners and Quality assurance and standard officers in Igembe District. A sample of 53% of accessible population was purposively sampled for this study. The researcher used three (3) types of research instruments to collect data, these are, questionnaires, interview guides, and observation checklists. The research instruments were constructed based on the objectives of the study. The researcher applied test -
retest method during the piloting stage to establish reliability. This was carried out in one special unit of Tigania District which will be purposively sampled to ensure validity of the research instruments. They were developed with consultation of fellow post graduate students and my supervisors. The data gathered from the field was sorted out, coded and analyzed in form of table, charts, frequencies, percentages and texts. The researcher obtained research permission from national commission for science, technology and innovation through, The Dean, graduate school, Kenyatta University before administering the research instruments in the field. The researcher made preliminary visit to the respondents and discussed the relevance of the intended study. Issues of informed consent and respect of the respondents were also discussed. The study established that the use of varied teaching methods enhances academic performance of learners with hearing impairment in mathematics. The study also found out that total communication and sign language are the main modes of communication used by the teachers while teaching mathematics to learners with hearing impairments. The study also established that effective communication, availability of learning/teaching resources, effective teacher training and student attitude impact on academic performance of mathematics by learners with hearing impairments in special schools and units in Igembe District. The study also found out that interactive teacher – learner teaching/learning such as personalized teaching and interactive learner – learner teaching/learning such as peer tutoring are used by the teachers to alleviate specific mathematic difficulties in learners.

EFFECTS OF HANDWRITING DIFFICULTIES ON ACADEMIC PERFORMANCE OF LEARNERS WITH LEARNING DISABILITIES IN PUBLIC PRIMARY SCHOOLS IN NAIROBI CITY COUNTY, KENYA

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Handwriting is described as a language by hand. It is a mirror through which individual creativity, abilities, patience, and organization is reflected. To a large extent it’s a predictor of learning abilities. Unfortunately, 30% of learners worldwide experience handwriting problems against the background of fading handwriting lessons from the official school programs. Over 60% of learners experiencing handwriting difficulties also suffer from a given form of learning disability. It’s against this backdrop that this study was done to assess handwriting difficulties among learners with learning disabilities and determine the effects on academic performance in Makadara Sub County, Kenya. The study objectives were: To assess handwriting characteristics among learners with learning disabilities, to establish knowledge of factors influencing handwriting development among learners with learning disabilities, to find out measures taken to address handwriting problems and lastly to determine the effects of poor handwriting on academic performance. The study employed Logan and Crump's hierarchical two-loop theory for the production of handwriting, that was conceptualized in 2009. This was a two-tier study employing both qualitative and quantitative techniques of data gathering and analysis. The study method used was a mixed research design method which examined in breadth and depth the perspectives, practices, experiences of teachers and learners on the study problem. Purposive sampling was used to get the sample size of 254 respondents which consisted of 5 examiners, 21 language teachers, 25 class teachers, 3 headteachers and 200 learners with learning disabilities who had handwriting difficulties. Qualitative data was collected using in-depth interviews and observations.
Quantitative data, on the other hand, was collected using open-ended and closed-ended questionnaire guide. Data was analyzed by the use of SPSS computer software version 19 and results were presented in graphs, tables, pie charts and frequencies. The adversely affected schooling behavior was assignment completion and submission, lesson attendance, participation in learning activities and aggregate mean score. This was vindicated by the ANOVA test that yielded a p-value of 0.027 against a significance value of 0.05 implying that handwriting difficulties had a negative impact on the academic performance study. The findings indicated that the majority of the respondents believe that learners with learning disabilities can develop good handwriting. An average number of respondents had a negative perception of learners with handwriting difficulties. 82% had a perception that handwriting difficulties impacted on the learning behaviors of learners with learning disabilities. Over fifty percent strongly agreed that handwriting difficulties affected the academic performance of learners with learning disabilities. The study recommended that teachers should acknowledge the existence of handwriting problems in the regular classroom and have a positive attitude towards learners who have handwriting difficulties; acceleration of research on good practices and pedagogies on handwriting development and lastly the need to institutionalize handwriting lessons in the national curriculum and part parcel of the official learning program.

EDUCATIONAL STAKEHOLDERS’ PERCEPTIONS ON INCLUSION OF LEARNERS WITH EMOTIONAL AND BEHAVIOURAL DISORDERS IN REGULAR PRIMARY SCHOOLS, CHIWOKO ZONE, LILONGWE, MALAWI

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Supervisors: Dr. George Mathenge
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This study aimed at investigating how educational stakeholders view the inclusion of learners with EBD in the regular primary schools in Chiwoko zone, Lilongwe district, Malawi. The study objectives were to examine the perceptions of head teachers, regular teachers and parents on the inclusion of learners with EBD in regular primary schools. It was also to investigate the perceptions of learners on the inclusion of peers with EBD in regular primary schools. Based on the theoretical construct of Weiner and Weiner (2016), an attribution theory of Achievement, Motivation and Emotion was the study developed. A mixed-method approach using an explanatory sequential design was used to examine the quantitative and qualitative data collected from head teachers, teachers, learners, and parents. The study targeted 514 education stakeholders where five head teachers and 20 parents were sampled using purposive sampling, 20 students and 80 regular primary schools were tested using simple random sampling. To collect data from head teachers and teachers’ questionnaires were used, whereas the structured interview schedule was used to collect data for learners and parents. A focused group discussion was used to collect data from regular teachers and learners who were sampled using convenience sampling techniques. Piloting was at Kawale primary school. Validity and reliability of the study instruments were determined by test-retest technique. Quantitative data was coded and feed into SPSS programme version 22.0. After that, the quantitative data were analysed by descriptive statistics using tables, graphs, figures, percentages, mean, and frequencies; a t-test and multiple regression tests were conducted to determine the variances in perceptions of the respondents. The analysis of Qualitative data from the focus group discussion was done thematically and reported narratively. The study findings showed that school heads, teachers, parents and learners have an overall positive perception towards the inclusion of learners with EBD in regular schools. The results revealed that class had a statistically significant influence on the perception of learners regarding the inclusion of peers with EBD in regular schools. Findings...
from the focus group discussions indicated that even though the teachers and learners supported the inclusion, they had pertinent issues which they wanted resolved to facilitate active inclusion of the learners with EBD to the rest of the learners in regular school. Based on this, the study recommends increase in-serving training and advocacy to equip regular teachers with the necessary skills to teach children with and without EBD. The research also suggests the implementation of best programs and practices in supporting learners with EBD and other special needs learners in all schools in Malawi. The study recommends that the government of Malawi through the Ministry of Education and the head teachers to take appropriate measures to increase the ability of regular schools in sensitizing teachers, learners and parents about educational needs of learners with emotional and behavioural disorders and all other categories of special needs.
This is a case study on motor speech skills in children with Cerebral Palsy (CP). The objectives of this study were to identify the types of speech impairments in children with CP, to describe the impact of impaired motor skills on speech development in the children and to analyze the effects of speech impairment on their psychosocial development. Motor Speech Theory as proposed by Lieberman and Mattingly (1985) was used to guide and explain the findings of this study. The study was done in Karatina Special School. Purposive sampling was used to select five subjects coded as CP1, CP2, CP3, CP4 and CP5. Recording, interviews and participant observation methods were used to collect data. Analysis was done qualitatively. Findings of this study were; that CP causes articulation disorders in the form of substitution, omission and insertion and that speech of CP children is characterized by notable slowness, devoicing and vowel lengthening. Further, the study showed that children, whose speech is impaired by CP exhibit withdrawal, are highly irritable, dull, selfish and tend to shy off. Key implications of the study findings are the addition to the existing knowledge of Motor Speech Disorders, help in CP Care Programs and use by Speech and Language Pathologists when dealing with speech disordered children. The findings are applicable as well in identifying ways of interacting with CP children.

Every historical period is usually accompanied by emergence and growth of states in connection with socio-economic and political circumstances. Like other flag-bearers of the seat of the Sokoto Caliphate, Jama’are Emirate emerged as a result of migrations and the nineteen century Sokoto religious reforms (Jihad). Jama’are Emirate is among the fourteen emirates that received a flag of office from the Sokoto Caliphate, and played a vital role towards the actualization of the Caliphate’s two hundred years Dynasty. There is a dearth of literature exploring the history of the emirate. The objective of this study was to trace the migrations and settlement of Jama’are people in the emergence and growth of Jama’are Emirate of Bauchi, Northern Nigeria from 1850 to 1960, and to examine the socio-economic and political transformations that occurred in the emirate within the stated period (1850 to 1960). Structural-functionalist and Social Conflict theories guided the study. The descriptive research design was used, which adopted historical methodology and qualitative approach was adopted as the primary approach. The target population of the study comprised Jama’are people both male
and female, and the sample size for the study was 20 participants aged 50 years and above. Purposive sampling technique was adopted in the study. Data were collected from both primary and secondary sources. The data was analyzed thematically since it was recorded in narration form. The study findings indicated that migrations and settlement of Jama’are people played a fundamental role in the formation of Jama’are Emirate. It was that the Fulani migrants initially migrated from Senegal around the twelfth century to a place called Dilara. Those who moved from Dilara in Senegal were the first cohort of people to migrate to Jama’are, they were followed by the Katsina the last group to settle in Jama’are. It was also noted that each group came to Jama’are with diverse economic, social and political practices which together contributed to the emergence of a Jama’are culture. With this agriculture, education, political practices as well as social activities became vibrant. The emergence of colonialism led to the tremendous changes in the economy, politics and social lives of the Jama’are peoples. There was the introduction of Islam as a religion, a new language and a new culture. Today Jama’are emirate has a rich and vibrant economy, political system and a social practice that is very specific to the emirate.

YOUTH INVOLVEMENT IN SOIL FERTILITY MANAGEMENT IN EMBU AND VIHIGA COUNTIES, KENYA

Molla John Dave-M.A

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Supervisors: Dr. Francis Kerre
            Gian Linard Nicolay

Kenya and generally Sub-Saharan Africa has been experiencing a severe decline in soil fertility which has resulted in low crop productivity, thereby threatening country’s and the region’s efforts to overcome some of the challenges including food insecurity, malnutrition, poverty, and general unemployment. While efforts have been put in place to improve the declining fertility of soils including development and importation of new soil fertility management (SFM) techniques and technologies, they have suffered limited adoption. This is because major focus has been on the biophysical aspects of soil fertility with limited attention paid to the societal aspects. This study sought to explore the societal factors that influence SFM, with focus on youth who comprise a significantly large proportion of the population in the country and the region, and also have invaluable characteristics critical for the adoption of sustainable SFM practices and adaptive technologies. The objectives of the study were to establish the SFM practices of youth farmers, and to examine the influence of the socio-cultural, economic and political factors on their involvement in SFM guided by Luhmann’s social systems theory. The study adopted a cross-sectional analytical survey design employing a mixed methods approach. The study was conducted in Mbeere South and Sabatia sub-counties. The primary respondents in the study were youth farmers; 200 youth farmers were sampled. The study also targeted key informants including agricultural extension officers, representatives of agricultural NGOs, CBOs, and financial institutions offering credit to farmers. FGDs were also held with youth farmers in farmer groups. To collect data, semi-structured interview schedules, KII guides, and FGD guides were used. The quantitative data was analyzed using SPSS 21.0 to produce both descriptive statistics in the form of frequencies and percentages, and inferential statistics such as chi-square tests and Cramer’s V. The qualitative data was analyzed thematically. The study established that most (56%) of the youth farmers in Mbeere South practiced either organic or inorganic SFM method, while the remaining practiced mixed organic and inorganic SFM method. In Sabatia on the other hand, most (59%) practiced mixed organic and inorganic SFM method, while the remaining practiced either organic or inorganic SFM method. Among the socio-cultural factors examined, education level, gender, membership to farmer groups, and perception of farm fertility were found to influence youth involvement in SFM in both study areas. Among the
economic factors, satisfaction with farm income influenced youth involvement in SFM in both study areas, while distance to markets was of influence in Sabatia only. Among the political factors, land ownership, access to extension services, and access to government subsidized fertilizers influenced youth involvement in SFM in both study areas. The study concludes that youth involvement in SFM is influenced, variably across different areas, by the societal factors including the social, cultural, economic, and political aspects. It is therefore important that efforts at soil fertility improvement take into account these societal factors. The study recommends that deliberate efforts should be made to encourage youth involvement in sustainable SFM measures, through improved access to the influential societal factors.

CONTRIBUTIONS OF THE NATIONAL INDEPENDENT CHURCH OF AFRICA TO SOCIOECONOMIC DEVELOPMENT IN KIBUGU PARISH, EMBU COUNTY, KENYA

Wilfred Mwenda M’arimi-M.A

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The growing interest by scholars on the role of the Church in transformation of the society prompted this study to investigate the contribution of the National Independent Church of Africa (NICA) to socio-economic development in Kibugu Parish, Embu County, Kenya. Specifically, the study discussed the Biblical and pastoral basis guiding involvement in socio-economic development besides examining how NICA carries out socio-economic activities in the study area. Further, the study identified the challenges and the strategies adopted by NICA to overcome them. The study was justified by the need to find out how NICA fulfils Jesus’ mission of being the healer, comforter and feeder of the hungry by contributing to their social and economic development. It is hoped that the study findings will assist faith-based non-governmental organizations (NGOs) and other religious groups whose aim is to engage in sustainable community development in rural areas. The study’s conceptual framework was drawn from the Structural Functionalism Theory of Religion. This theory holds that society is composed of various institutions such as religion which play the role of social control, cohesion, provide meaning and purpose to life. In this respect, the study used the theory to look at how NICA contributes to transforming the lives of Christians from a state of disempowerment to socio-economic empowerment. The researcher used the descriptive case study design because it intensively and exhaustively investigates the social unit. Purposive and simple random sampling methods were used to select a sample size of 124 respondents from a target population of 371. Qualitative data from the respondents was obtained using focused group discussions (FGD) and interview schedules while questionnaires were used in gathering quantitative information. The researcher adhered to ethical considerations while gathering responses from the informants. Collected data was analysed using descriptive statistics, narratives, and verbatim responses. Then it was coded and processed using the Statistical Package for Social Sciences (SPSS). From the obtained data, the findings of this study revealed that NICA Parish engages in socio-economic development through sponsoring education, nurturing talents, extending love as well as praying and paying medical bills for the sick in hospital. Furthermore, the study revealed that NICA has no schools, vocational training institutions and hospitals in the area of study. Lack of adequate funds and long period of stay of a pastor in one Parish were among the challenges facing the Parish. The findings further suggest that NICA lacked a clear strategic plan that is critical in outlining her vision and goals. Despite the challenges, NICA’s efforts and commitment to changing the socio-economic welfare of people in the study area is commendable. This study recommended that the Church should formulate a clear strategic plan and have a long-
term plan of establishing its own educational and health institutions. The strategic plan will enable the Church to understand her weaknesses, strengths, area where it has potential and the threats to its socio-economic development. Besides, NICA should organise seminars and workshops to educate the believers on better and modern farming practices as a way of economically empowering them.

L’INTÉGRATION DES TIC DANS L’ENSEIGNEMENT DU FRANÇAIS DANS LES ÉCOLES SECONDAIRES PUBLIQUES ET PRIVÉES À NAIROBI, KENYA

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à résoudre les problèmes informatiques complexes qui peuvent survenir. L’étude a été réalisée dans un seul comté; une étude similaire pourrait être réalisée dans d’autres comtés du Kenya.

The potential benefit of ICT integration in teaching and learning in schools have been widely discussed in the academic literature worldwide. In recent years in Kenya, there has been an increased progress towards the integration of ICT in teaching and learning in secondary school education. The Government of Kenya has further put in place many initiatives to enhance the same. However, studies show that ICT has not been fully adopted in teaching and learning in most secondary schools. Many researchers argue that unless we address the teacher factors that largely influences the integration of ICT in schools the installation of infrastructure will not automatically lead to integration of new technologies in classroom teaching. It is on this premise that this study was based to examine the state of the integration of ICT in teaching and learning French in Secondary schools in Nairobi County. Technology Acceptance Model (TAM) by Davies (1989) was used to guide the study. The study adopted a descriptive survey design. The target population was 60 French teachers and 60 Principals in secondary schools offering French in Nairobi County. The study employed simple random sampling technique to sample French teachers in the secondary schools. Purposive sampling technique was used to sample school Principals. The sample size was 78 respondents comprising of 47 French teachers and 18 School Principals. Questionnaires and interview schedules were used to collect data. Test re-test reliability was used for the reliability of the instruments using Cronbach’s Alpha coefficient test. Quantitative data was analyzed using descriptive analysis such as means and standard deviations. The qualitative data collected from the interviews was analyzed using content analysis technique and presented thematically. The findings revealed that French language teachers have a positive attitude towards ICT but lack adequate skills and knowledge to enable them integrate ICT fully in the curriculum. Teachers’ level of training was low with regard to advanced technologies. The study recommends advanced training for all teachers specifically to enhance their ICT knowledge and competence level. Training institutions should equip future teachers with relevant ICT skills for the effective integration of ICT in teaching & learning French. The Ministry of Education should provide all schools with adequate infrastructure including computer labs with wireless fidelity (Wi-Fi). Technical support should always be available on the ground in each school to help teachers solve complex computer problems that may arise. The study was conducted in only one county; a similar study could be carried out in other counties in Kenya.

**ROLES OF STAKEHOLDERS IN THE IMPLEMENTATION OF RE-ENTRY POLICY GUIDELINES ON ADOLESCENT MOTHERS IN SECONDARY SCHOOLS: CASE OF MACHAKOS COUNTY-KENYA.**

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Dr. Casper Masiga

The government of Kenya through the Ministry of Education developed the Re-entry policy on Adolescent mothers in 1994. The policy allowed adolescent mothers to go back to school after delivery. It was intended to reduce pregnancy-related school dropout rates amongst girls. This study sought to examine the roles that stakeholders were playing in implementing the Government Re-entry policy guidelines on adolescent mothers in secondary schools in Kathiani Sub-County, Machakos County. The specific objectives of the study were: to establish the numbers of adolescent mothers who dropped out of school between 2014 and 2017; to examine the roles of stakeholders in implementing the Re-entry policy
guidelines; to determine the gaps in the re-entry policy guidelines. Finally, this study suggested strategies that could be used to implement the re-entry policy guidelines. The proposed theoretical framework for the study was the Ecological Systems Theory by Bronfenbrenner (1979) which looks at a child's development within the context of the systems of relationships. The study adopted descriptive survey research design. The target population was the 28 mixed day secondary and the 4 girls' boarding secondary schools in the Sub-County making a total of 32 secondary schools. Additionally, Principals in these 32 secondary schools, teacher counselors, form 4 class teachers, adolescent mothers in these schools, adolescent mothers out of school, parents of adolescent mothers and the Ministry of Education (MOE) officials were targeted by this study. Random sampling technique was used to sample 14 mixed secondary schools (50%) and 2 girls' secondary schools (50%) making a total of 16 secondary schools. All the 16 principals, 16 counselors, 16 Form 4 class teachers were involved in the study so they were purposively sampled. Purposive sampling technique was also used to sample 1 MOE official, 15 adolescent mothers in school and 10 parents of adolescent mothers. 10 adolescent mothers out of school were sampled using purposive and snow ball sampling techniques. The sample size for this study was 84 respondents. Data collection instruments included structured questionnaires and interview guides. Qualitative data was organized in thematic categories according to the study objectives and then analyzed thematically. Quantitative data was analyzed using descriptive statistics. Adolescent mothers were the main beneficiaries of this study since they are the main targets of the Re-entry policy. Besides the adolescent mothers, the findings from this study were expected to be useful to policy makers in the field of gender and education, policy implementing agents who are referred to as stakeholders in this study, school principals, teachers, parents, and the community in Kathiani Sub County and other areas. The study established that between 2014 and 2017, an average of 65 girls dropped out of secondary school annually in Kathiani Sub County as a result of adolescent pregnancy. Stakeholders were not adequately carrying out their roles in the implementation of the re-entry policy guidelines. However, teacher counselors played a key role in helping adolescent mothers to cope despite the fact that they lacked relevant skills needed to handle issues of adolescent sexuality. The policy guidelines lacked clarity on some important matters which affected the implementation process negatively. The study recommends the following: the Ministry of Education should regularly monitor the implementation process of the Re-entry policy so as to reduce pregnancy-related school dropouts among girls; all stakeholders should actively participate in playing their roles in the implementation of the Re-entry policy guidelines; the Re-entry policy guidelines should be reviewed to make them more clear and specific and the best strategies should be used in the implementation of the Re-entry policy for better results.

AGRICULTURAL CHANGE AMONG THE KEIYO OF ELGEYO-MARAKWET COUNTY, 1894-1990

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This study focused on agricultural change among the Keiyo of Elgeyo-Marakwet County in the period between 1894-1990. It examined the pre-colonial era in order to determine the Keiyo people’s knowledge about their agriculture and to help bring out the changes that came in with the advent of colonialism. The study examines how the capitalist economy established by British colonialism altered the pre-existing modes and relations of production in Keiyo. By analyzing the changes that transpired during the colonial and post colonial period, the research hoped to provide hints of solving the
present challenges facing the economy of the Keiyo. The study intended to achieve a number of objectives, for instance; to give an account of the agricultural practices of the Keiyo prior to colonial rule, give an analysis of the agricultural changes that took place in Keiyo during the colonial period, identify and evaluate the responses of the Keiyo people to colonial agriculture and examine the relationship between the Keiyo’s indigenous pre-capitalist economy and the colonial capitalist economy and finally to provide an analysis of the agricultural changes from independence to 1990.

Underdevelopment theory was utilized in the study to analyze the penetration of colonial capitalism in Keiyo’s pre-capitalist economic system. Articulation concept was applied to link the two modes of production in regards to the ownership of means of production such as land, labour and tools as well as technology. Qualitative research design was adopted. Being a historical study, purposive and snowball sampling techniques were used to sample the intended population/sample that was believed to possess the required information. The study utilized both primary and secondary data sources. Oral data was collected from informants in Elgeyo-Marakwet County whereas archival materials at the Kenya National Archives were also consulted. The findings will be of value to economic Historians in understanding trends, challenges and social economic impact of agricultural changes of the Keiyo in the period 1894-1990.

TRANSFORMATION OF GENDER POWER RELATIONS IN IGEMBE CENTRAL, MERU COUNTY, KENYA BETWEEN 1895 AND 2010

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Dr. Wafula Wekesa

This study set out to explore the changes in gender power relations among the people of Igembe Central, Meru County in Kenya. It focuses on the pre-colonial power relations between men and women, the transformation of gender power relations during the colonial and post-colonial eras among the Ameru. The study aimed to achieve the following objectives; to examine the concept of power relations between men and women before colonialism, investigate the transformation of gender power relations during the colonial and post-colonial periods among the Ameru of Igembe central. The study was based on gender role and Social Construction Theories. Descriptive survey design was used for the study. Purposive sampling and snowballing techniques were used to sample respondents for the study. The study used both primary and secondary methods during data collection. Primary data and secondary data were derived from field research, archives, libraries, published books, journals, unpublished thesis, and internet. Question guides and interview schedules were used as instruments to collect data. Question guides were used to collect information from the local targeted population. Interview schedules were used to collect data from relevant local administrators, religious leaders, and village elders. Data was qualitatively analyzed and presented in narrative form. It was established that during the pre-colonial era the community had distinctive male and female identities which produced complementary relationships. The twentieth and the twenty-first century have seen a shift in gender relations. The study further indicates that changes brought about by the colonial institutions had eroded the traditional laws that guaranteed balance in the society. Gender power relations underwent changes emanating from socio-economic and dynamics to fit within the capitalist production system. The study established that the needs of the contemporary society are changing and so as the gender power relations. Therefore, there is need to ensure that the socio-economic and political undertakings creates harmony in the society.
INFLUENCE OF DEFINITIONS OF MALARIA ILLNESS ON HEALTH-SEEKING BEHAVIOR IN HOMABAY COUNTY, KENYA

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Malaria poses a great challenge to countries in the world. In sub-Saharan Africa, malaria is among the leading causes of mortality and morbidity. This disease kills many people despite the interventions that have been put in place. This study explored the influence of definitions of malaria illness on health-seeking behavior in Homabay County, Kenya. The objectives of this study were to document the socio-demographic characteristics of residents of Homabay County, to establish the definitions of malaria illness held by the residents of Homabay County, to determine the health-seeking behavior adopted during malaria illness and to analyze the relationship between definitions of illness and health-seeking behavior for malaria. The study adopted the Symbolic Interaction Theory, Health Belief Model (HBM) and Suchman Stages of Illness and Medicare Model. The study employed a cross-sectional survey research design utilizing both qualitative and quantitative approaches in data collection. It utilized a sample size of (384) respondents from Suba South Constituency in Homabay County. Qualitative data was collected using key informant interviews and focus group discussions. Four key informant interviews and four focus group discussions together with the open-ended questions in the questionnaire provided qualitative data. Closed-ended questions in the questionnaire provided quantitative data which was analyzed descriptively using Statistical Package for Social Science (SPSS) version 21 and presented in form of tables and charts. Qualitative data, on the other hand, was transcribed and presented in themes as per the objective of the study. The study revealed that a majority of the respondents had the correct definition of malaria illness which they linked to mosquito bites however there were misconceptions surrounding the disease such as malaria being caused by staying long in water and drinking dirty water among others. The study also revealed that respondents used pain killers together with other drugs bought from chemists as their first point of action when they had symptoms of malaria. The use of health facilities in rectifying ill health was considered when over the counter drugs did not cure illness. This study also revealed a relationship between the definitions of malaria illness and health-seeking behavior through analysis of the number of respondents’ definitions of malaria illness and the action they took. Those who defined malaria to be caused by mosquitoes went to local shops or chemists and health facilities to seek treatment. This study, therefore, concluded that respondents had the correct etiology of malaria coupled with other definitions arising out of social experiences with the disease. The study recommended the need for sensitization of malaria through vernacular radio stations and the participation of community members during health talks to improve on knowledge, health-seeking behavior and demystify misconceptions. Through this, interventions geared towards mitigating malaria can be accepted and be more effective.

PARTICIPATION OF WOMEN IN NDIA ELECTIVE POLITICS, KIRINYAGA COUNTY, KENYA: 1963-2015

Thongo Mary Nyawira-M.A

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Dr. Lazarus Ngari

The study examined the gendered participation of women in Ndia elective politics in Kirinyaga County, Kenya, 1963-2015. The research set out to do the following: to discuss the role of the Ndia women in the pre-colonial settings and the impact of colonial policies on women in Ndia from 1887 to 1963; to determine the patterns of gendered participation of women in post-independence Ndia elective politics from 1963 to 1978 and finally to examine gendered participation of women, constraints affecting women participation and the prospects towards an all-inclusive participation in Ndia elective politics from 1978 to 2015. The study was flexible enough to cover periods prior to 1963, particularly the pre-colonial and colonial period. It was limited to Ndia constituency. The study employed Patriarchy and gender theoretical approach in analyzing women participation in elective politics in Ndia. The study employed qualitative research design. It relied on both secondary and primary data. Primary data was obtained from interviews and archive sources from the Kenya National Archives-Nairobi. Secondary Data was collected from published and non-published work from libraries and government institutions. The study target population were men and women registered as votes as on 25th January, 2016. A total of 60 informants were interviewed. Informants were selected from the constituency using Stratified Random Sampling and targeted 20 respondents from each of the three wards of Ndia constituency. In addition two focus group discussions of five members each were held. Data collection was done through interviews for informants, candidates, and office holder. Focus group discussion was also used. The data collected was qualitatively analyzed, compared, and interpreted in respect to the study objectives and the historical period. The study established that, although women participation has been insignificant they have made some progress at the civic and parliamentary level. The study revealed the there were challenges that continue to impede women participation in Ndia elective politics. The study established that colonial socio-economic and political policies and structures altered the position of the Ndia women. Missionary education relegated women to domestic duties. Women’s participation in these independence struggles did not change their status and they therefore remained marginalized by men in the society. The study also ascertained that the attainment of independence in Kenya did not translate into a better political place for Ndia women whose relative position in politics was better before the advent of the colonialists and the patriarchal nature of Kenyan politics could not allow for women to flourish in the Kenyan political sphere and so they were subsequently ignored. The study concluded that colonial policies and administrative structures undermined the relative societal balance that existed in pre-colonial Ndia by eroding the bases of women’s power. This eventually resulted in deterioration of women’s status. This research recommended prospects to engender women participation in Ndia elective politics as well as the need to devise strategies to redress their discrimination and inequality. The study also suggested that work should be done to promote and endorse fairly patriarchal organizations such as religious organisations to endorse processes, practices and services that enhance ideals of equality of the sexes.

RESOURCE UTILIZATION AND CONFLICT IN CULTURAL HERITAGE MANAGEMENT IN KENYA: THE CASE OF KAYA RABAI FOREST, 1990-2015

Evans Ochieng Ochola-M.A

Department: History, Archaeology and Political Studies

Supervisors: Dr. Ngari Lazarus

Dr. Ndiiri Washington
This study examined resource utilization and conflict in the conservation and management of Kaya Rabai forest. Kayas are endangered due to changes arising from modernity. This has led to the fading of Traditional Ecological Knowledge that initially safeguarded the Kayas. This research sought to study the management efforts of Kaya Rabai and the attendant politics. The study was informed by the following objectives: to examine the history, characteristics and organization of Kaya Rabai; to establish the conflicts in management and conservation of Kaya Rabai and to explore the strategies in the conservation and management of the Kaya Rabai sacred forests. The study utilized Cultural ecology theory and Modernisation theory. Methodologically, the study employed descriptive research design. The target population included elders and knowledgeable people in the Mijikenda rituals and traditions, National Museums of Kenya staff, Kenya Wildlife Services staff and Kenya Forest Services Officials. The research instruments included interview schedule, questionnaires and participatory observation checklists. The findings of this study are useful to policy makers and practitioners in cultural heritage management. The study filled the gaps in archaeological approach in the conservation and management of living heritage. Moreover, it will help the Mijikenda community to connect with certain belief systems, social values, religions, customs as well as an opportunity to identify with others of similar mind-set. The study established that conservation efforts should involve both indigenous and modern mechanisms. The study recommended reforestation of areas destroyed by planting both indigenous and modern exotic trees.

MORPHOLOGICAL AND SOCIO-ECONOMIC EFFECTS OF SAND MINING ON RIVER TYAA IN KITUI COUNTY, KENYA

Muiruri Philip Gathogo-M.A

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Current global rate of sand mining in river channels is unsustainable, and in Kenya the activity going on unregulated. This study established the morphological and socio-economic effects of sand mining in river Tyaa by addressing the following objectives: To determine the extent of sand mining; morphological factors influencing abundance of sand; effects of sand mining on the morphology of River Tyaa and Socio-Economic effects of sand mining in river Tyaa. Random sampling technique came up with an active sand mining site. Systematic sampling was used on this section to select the areas to collect data. Stratified sampling was used to select respondents using the records from M.S.M.C.S. This sample size comprised of 100 households, 50 sand miners and 5 land owners. Data on channel depth, width, vegetation cover, erosion status, sand volume status, channel slope angles, and bank position were obtained through physical measurements in the field while data on sand quantity mined per year for a decade was obtained from secondary sources. Structured questionnaires were used to obtain socio-economic data. ArcMap GIS was used to map the spatial extent of sand mining along river Tyaa. Descriptive statistics was used to analyse the quantitative data and the results presented in graphs and percentages. The binary logistic regression analysis was employed to show factors influencing abundance of sand in river Tyaa’s channel. The multiple logistic regression analysis was used to examine the effect of sand mining to the river Tyaa channel morphology. Finally, chi-square test was used to test the hypotheses. Chi-Square test indicated that there were significant sand mining activities in river Tyaa (Df = 1, χ²= 9, P=0.003). The study established that river channel width (P=6.47e-05), depth (P=7.00e-07), slope angles (P=3.36e-06) and bank position (P=2.2e-16) were significant in influencing sand abundance in the river channel as indicated by the respective marginal effects and p-values. Additionally, sand mining had modified the river channel morphology through causing increase in depth (P=7.19e-02), width (P=9.95e-03)
and slope angles ($P=9.37\times10^{-3}$) at the active mining sites, compared with the control sites as shown by the respective $p$-values. Finally, sand mining had caused positive economic effects ($Df=3$, $\chi^2=201.65$, $P=0.000$) such as reduced school drop-out rates, infrastructural developments, enhanced livelihoods as well as affordability of medication. On the other hand, sand mining got associated with destruction of the riparian vegetation, lowering of water table in the sand reserves, prostitution, community conflicts and drug and substance abuse ($Df=3$, $\chi^2=42.33$, $P=0.000$). The study concluded that sand mining had over stretched on temporal, spatial and quantity basis; that sand abundance in a river channel is a factor of channel width, depth slope angles and the type of the bank. Further, the study concluded that sand mining had caused increased river channel depth, width and slope angle and that sand mining had caused significant Socio-Economic effects. The study recommended reduction in quantities of sand mined from river Tyaa through curbing illegal mining and closure of some mines; siting of mines on convex banks by regulatory authorities such as NEMA; Regular EIA as well as EA was recommended as a way of monitoring the activity. Lastly, the study recommended placement of an elaborate revenue collection system from sand mining industry by the county government to help give back to the community, and increasing involvement of the local area members in the sand mining industry to help resolve resultant conflicts.

**IMPLICATIONS OF NATIONAL POLICE SERVICE REFORMS ON RESPONSE TO TERROR ACTIVITIES: A CASE STUDY OF MANDERA COUNTY, KENYA**

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The study investigated the implication of national police service reforms on response to terror activities in Mandera County, Kenya. The study aimed at determining the extent to which police response to terror activates has become a national issue following the rolled our police reforms implementation. A case study design was used which combined qualitative and quantitative techniques of data collection and analysis. However, the study was more inclined to the qualitative research paradigm. The specific objectives of this study are: to examine the characteristics of security state in Mandera County, Kenya, to analyse the national police strategies and programs that have been implemented in Mandera County in response to terror activities and to evaluate the significance of national police reforms implemented in Mandera County in response to terror activities and to examine implications of National Police Service reforms on response to terror activities in Mandera County, Kenya.

This study was guided by James Q Wilson and George Kelling (1982) Broken Window theory which observes serious crime as the final result of a lengthier chain of events, emanating from a disorder and if the disorder is eliminated then serious crimes would not occur. The target population comprised law enforcement officials, County administrators, village elders and County Commissioner (Mandera County). Other informants included Key religious leaders, member of enterprise community, County Social Welfare Officer, Programme Coordinator (World Vision Kenya) and participants of county meeting. Stratified random sampling changed into used to sample one thirty-eight (138) respondents participated in the have a look at who made out of law enforcement officials all ranks and key protection respondents from local and county protection administrators. Data had been gathered through questionnaires, semi-structured interviews, in-depth interviews and evaluation of files. Qualitative records were analysed thematically through identification of themes and
sub-subject matters that emerged. Basic descriptive facts such as frequencies, chances and tables have been used within the analysis of quantitative statistics. The have a look at determined that there may be need to improve service transport, improving cooperation among police and the general public. The take a look at stated that locals attributed reforms to the reaction to put up-election violence. The look at determined that (54%) of the respondent felt that the police reform packages and strategies had not been fully implemented. This was attributed by response strategies that have arguably been branded slow or un-coordinated. Additionally, 36.4% of the respondents felt that there had not been enough sensitization carried out on the newly enacted police reforms. Further, 69.6% of the respondents indicated that police infrastructure has not been transformed according to the needs on the ground. Nonetheless, there were some positives in that, 81.9% of respondents indicated that the police have increased logistical capacity, 72.8% indicated that implemented reforms have increase the efficiency and effectiveness of response to terror activities. These findings mirror those of other studies that found that implementation of police reforms in African countries is often partial at best, but nonetheless offers improvement to service delivery. Based on the findings the study recommended that there should be increased cooperation between all stakeholders and members of the community to ensure effective implementation of police reforms.

**ASSESSING GENDER ROLES IN DAGAA FISHERY VALUE CHAIN AMONG FISHING COMMUNITIES ON LAKE VICTORIA BEACHES IN SIAYA COUNTY, KENYA**

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Fisheries in the East Africa region have suffered due to less emphasis given to some fishery specifically Dagaa (Rastrineobolaargentea), whose quantity is the highest of all the species in the Lake Victoria. Despite the importance of this resource in Kenya, there has been a concern of gender parity and inequality in terms of roles played by both gender in harvesting, processing, trading and marketing in the Dagaa fishery. This study analyzed gender roles in Dagaa Fishery Value Chain among fishing communities around Lake Victoria in Bondo Sub County, in Siaya County, Kenya. The study addressed the following objectives: Identified the various roles of men and women in Dagaa Fishery Value Chain, discussed factors influencing gender roles in Dagaa Fishery Value Chain, analyzed the barriers to women’s participation in certain Dagaa Fishery Value Chain and examined the strategies to overcome challenges in gender roles in Dagaa fishery value chain in Bondo Sub-County, Siaya County. The study adopted a cross-sectional research design. This study was guided by two models; gender analysis framework model that was developed by Sarah Longwe and supply chain model. Purposive sampling technique was used to select Bondo Sub-County and fishing community in Bondo Sub-County; random sampling technique was used to select five (5) fish landing sites/beaches where quantitative data were collected from 186 out of the targeted 188 primary respondents, from among the forty-four beaches of Lake Victoria in Bondo Sub-County. Quantitative data was analyzed using SPSS Version 25, and descriptive statistics such as frequencies and percentages were used in presenting analyzed data. The results were presented using tables and charts. The study findings revealed that majority of the boats and fishing gears were owned by men, motorized boats belonged to men while a higher percentage of females still had the paddled boats. While men dominated the fishing of Dagaa, women dominated processing and trading of Dagaa in the beaches. The study noted that men made higher returns than their female counterparts at all
levels of Dagaa fishery value chain. The study concluded that there is a still wide disparity among gender roles in Dagaa fishery value chain. Most of the activities in the value chain are still dominated by men. This study recommends that women be encouraged to take part in Dagaa fishery value chains, empowerment of women to take part in transportation and distribution of Dagaa and application of various strategies such as joining SaccoS to access loans at low interest rates, formation of groups for ease of access to credit services and weakening patriarchy to mitigate factors affecting Gender roles in Dagaa fishery value chains.

**HISTORY OF EMBAKASI RANCHING COMPANY IN NAIROBI CITY COUNTY, KENYA, 1963-2013**

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**ABSTRACT**

Land buying companies were investment opportunities that enabled people to purchase plots of land and construct homes in Kenya. This study analysed the history of land buying companies in Kenya with reference to Embakasi Ranching Company. The Company is located in Nairobi City County in Njiru sub-county. The objectives of the study were to:

- examine the factors behind the formation of land buying companies from 1963 to 1978,
- analyze how the expansion of Nairobi led to development of Embakasi Ranching Company from 1979 to 2002,
- and investigate the challenges faced by the Embakasi Ranching Company from 2003 to 2013.

This study was informed by Neopatrimonialism theory. Both primary and secondary sources were used. The primary sources contained first-hand information. The primary data was collected from the Kenya National Archives and Embakasi Ranching Company’s unpublished sources. More primary data was collected from the company directors, the shareholders and National Government officials in Njiru Sub-county. The informants living outside Nairobi were also traced and interviewed. Purposive sampling method was applied to identify and select informants. Interview schedules were used to carry out oral interviews. Secondary sources contained information originally presented in another source. The secondary data was obtained from published books, journals, magazines, newspapers and electronic media.

The data collected was analysed and presented in descriptive form. The findings of this study revealed that, Kenya’s post-independence government policies on land led to the formation of land buying companies in Kenya. It was further revealed that, the expansion of Nairobi and population migration trends led to formation of Embakasi Ranching Company. The company aimed at giving land to the landless widows of Mau Mau veterans, the Mau Mau veterans, Nyakinyua women group from Eastland estates of Nairobi City County, landless public servants and other landless poor in Nairobi. Although the company was able to accelerate socio-economic development, it experienced several drawbacks. However, most of the challenges emanated from lack of integrity. One of the major findings of the study was that, Embakasi Ranching Company was formed by political leaders not just to enable the poor access land in Nairobi but also to enable these leaders accomplish their political goals and accumulate wealth which was a feature of Neopatrimonialism paradigm.
Undugu Society of Kenya plays a major role in including CSWs in the current world-wide effort to emancipate the women through empowerment programmes. USK runs several empowerment programmes such as health, education, microfinance, guidance and counselling among others. Despite the efforts by USK to empower CSWs by doing all the positive things that should retain them, most CSWs keep going back to the sex trade. The study sought to assess the effectiveness of these programmes in empowering female commercial sex workers. The objectives of the study were; to identify USK empowerment programmes and activities for CSWs from 2012 when the programme started to 2015, determine the impact of the programmes and activities since 2012 to 2015, examine challenges faced by USK in empowering the CSWs and come up with strategies that could be put in place for effective empowerment of CSWs. The study was guided by the Liberal feminist theory. A descriptive survey design whose analyses were concerned with relationships between variables was used. The target population was all the 200 CSWs under the programme from 2012 to 2015, four social workers (1 from each centre) and one programme coordinator. Stratified random sampling was used to select a sample size of 40 CSWs from the target population (10 CSWs from each centre). Further, 4 social workers and the programme coordinator were purposively selected because they were believed to be more informed about the issue. Questionnaires and interview guides were used to collect data. Quantitative data was analyzed using statistical package for social sciences (SPSS) while qualitative data was analyzed thematically and interpreted in context. The findings of the study revealed that rehabilitation programmes mainly included education, microfinance, vocational training, health education, guidance and counselling as well as peer education programmes. It was also found that some of these rehabilitation programmes were effective in the social and economic empowerment of the CSWs. A regression analysis revealed that microfinance access had the highest influence in empowering CSWs, with the results being highly significant (p<0.05). Inadequate facilities, financial constraints, inadequate trained and support staff hampered empowerment efforts by the NGO. Stigma, poverty, low level of education and gender roles challenged the CSWs. The study recommends that USK should provide adequate rehabilitation facilities, avail adequately trained staff, provide adequate rehabilitation facilities, sensitizing community members, establishing more centres and continued follow-up activities to the reformed CSWs. USK should also avail adequate seed money to enable CSWs to start small businesses.

DYNAMICS OF PARLIAMENTARY DIPLOMACY AND KENYA’S FOREIGN POLICY; 1963 – 2014

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Globally, parliaments have a lot of influence not only on national legislation but also in shaping foreign policies of states. However, there is scarcity of studies interrogating the role of the Kenyan parliament in influencing foreign policy since independence in 1963. Therefore, the main objectives of the study were to interrogate the extent to which the National Assembly influence Kenya’s foreign policy from 1963 to 1978, analyze the mechanisms that have been used by National Assembly to influence Kenya’s foreign policy from 1979 to 2002, and to assess the impact of the National Assembly on Kenya’s foreign policy from 2003 to 2014 in Kenya. The study employed two theories; realism theory and two-level game framework that attempts to analyse dynamics of parliamentary diplomacy on Kenya’s foreign policy. Descriptive research design was employed in this study. The target population was current and former members of parliament, diplomats, ministers, and other experts in the field of foreign relations. The population sample was selected using purposive sampling technique in order to select knowledgeable key informants. Data analysis entailed transcribing the raw data from recordings and in-depth interviews, coding into themes then incorporating secondary sources for a critical analysis. The study findings revealed that, beginning of Kenyatta’s regime parliament had powers bestowed to them by the constitution allowing them to have significant influence on Kenya’s foreign policy. However, during Kenyatta’s regime (1963-1978), the law did not restrict the Executive ability to conduct foreign policy without involving Parliament. Power of parliament was muted and confined to back bench debates without firm executive resolution to address issues with foreign policy implications. During Moi’s regime, it was established that parliament was under the control of the executive arm of the government, and did not resist these amendments. However, several mechanisms were used by KNA to influence foreign policy i.e. oversight visits to Embassies/Missions abroad by the Committee on Defense and Foreign Relations; contemporary forms of parliamentary diplomacy operated within informal groups; and legislation, oversight and representation to budget making and vetting public office appointees, even though with political constraints. The analysis further revealed that during Kibaki’s regime, the period was marked with optimism and renewed hopes for a better economy as well as rewriting the constitution. Promulgation of 2010 constitution redefined the power of KNA e.g. affords them with powers to leverage country’s foreign policy. More so, MPs have enhanced their role on the conduct of Kenya’s foreign policy through parliamentary committees, Speaker of the National Assembly, and visitation/representation/fact-finding missions. The study concluded that the effectiveness of parliamentary diplomacy is anchored in the 2010 constitution and there before, diplomatic relations were more of succession politics. The study recommends the need to develop an efficient and comprehensive parliamentary strategic framework which guides parliamentary diplomacy and its linkage to governmental diplomacy. There is also need to harmonize national, regional, continental and international structures of parliamentary diplomacy into a single parliamentary committee supported by competent secretariat funded by the parliamentary service commission.

PARTICIPATIVE LEADERSHIP IN RELATION TO SEVENTH-DAY ADVENTIST CHURCH’S GROWTH IN KILIFI COUNTY, KENYA

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This research set to explore participative leadership in relation to SDA Church’s growth in Magarini Sub-county, Kilifi County, Kenya. Part of SDA’s policy recognizes that authority rests in the entire membership. However, the situation on the ground is different since ordinary members are not allowed to participate in leadership. The research sought first, to
examine the extent of members’ inclusivity in leadership to enhance growth; second, to explore the causes and analyze the effects of lack of participatory leadership thus correlating members’ involvement in leadership and church growth. SDA leadership style is exposed to forces and is affected by factors that undermine church growth. Team Leadership Model was considered an appropriate theoretical orientation for this study in order to highlight constant team analysis and improvement to cultivate church growth. The study adopted the descriptive survey design. To generate data, questionnaires were administered, besides FGD Guide and observation schedule. Nine SDA Churches took part in the study out of which 287 respondents satisfactorily participated. Data generated from field research were presented and analyzed as per the research objectives. It was observed that few members involved themselves in evangelism and opening of Sabbath schools respectively. However, not all Churches had up to date registers. Churches lacked serious Bible study divisions. Members and leaders lacked knowledge on team management. Obstacles to effective communication and socio-economic factors related to gender and family issues were prevalent. Leaders should work in groups by clarifying group roles and initiating more team independence, by taking actions that are goal-focused and which satisfy needs. They should resist forces that lead to exclusive leadership. Further, they should use a combination of various practices of leadership such as prayer life, Bible study, seminars/workshops, conducting time-frame schedules, visitation of members and attending revivals. Participative leadership motivates people and encourages them to be involved in activities; it engages in decision-making necessary for the growth of the church. It calls for team effectiveness where members manage activities corporately, respect church’s beliefs and counsels, share information, deliberate on issues and agree before implementation of activities to enhance church growth.

IMMIGRATION AND WOMEN’S SELF-IDENTITY IN SELECTED NOVELS OF ADICHIE, BULAWAYO AND BAINGANA

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This thesis investigates immigration and women’s self-identity in selected novels of Chimamanda Ngozi Adichie, NoViolet Bulawayo and Baingana. Significant in African diasporic literature is the effect of immigration on women’s self-identity. The study analyses African women immigrant characters in Adichie’s Americanah, Bulawayo’s We Need New Names and Doreen Baingana’s Tropical Fish to establish how their immigration to the USA affects their self-identity and their interactions with others in the society. The research employs the postcolonial concept of hybridity. It uses comparative textual analysis of the three novels and relies on other scholarly works to aid in analysis and interpretation of the primary data. The three writers have bearing on their representation of women characters who emigrate from Africa to the USA and whose movements oscillate between the two spaces. Selection of the three novels is done on basis of presence of common features such as immigration of African women characters to the USA and their identity transformation. The study examined identity transformation among African women characters who interact with American diasporic space, survival tactics they employ while in the USA, as well as how post-immigration women characters relate with both their hostland and homeland. The study concludes that there is a remarkable difference between the representation of African women characters’ self-identity before and after immigration to the USA. It argues that several factors determine adoption or rejection of new self-identity. It also finds that the altered self-identity of African diasporic women in the USA affects the way they interact with both American society and their society of origin. The study recommends further
research on the same topic using different novels to establish whether other diasporic texts agree with its findings. It also recommends further study on self-identity of male immigrants, as well as the insights of male African writers. Further study on the three texts may be done in line with tenets of feminism theory to establish the influence of immigration on African women characters’ femininity.

THE INFLUENCE OF FOUR SELECTED MUSLIM NON-GOVERNMENTAL ORGANIZATIONS ON EDUCATION AND HUMANITARIAN WORK IN MANDERA COUNTY, KENYA (1991-2018)

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This thesis is entitled the influence of four selected Muslim non-governmental organizations on education and humanitarian work in Mandera East Sub-County (MESC), Kenya (1991-2018). The study was specifically aimed at exploring the involvement of Muslim NGOs in education and other humanitarian sectors in MESC, finding out the challenges facing them while carrying out education and other humanitarian activities, and establishing the involvement of the local community in the education and other humanitarian activities. The data of this study was obtained from primary and secondary sources. The study population was 220 participants. 202 beneficiaries of the Muslim NGOs’ activities, 30% from each NGO, were randomly selected from a list given by the Muslim NGOs. The other participants were four representatives of the Muslim NGOs, seven school principals and three elected Members of the County Assembly representing the areas in MESC where the NGOs operate. The study was guided by the Islamic State Welfare Theory and the Alternative Development Theory. The study was also guided by the principle of altruism as championed by the Islamic State Welfare Theory. Alternative development is development from ‘below’ and below refers to both community and NGOs. The study used purposive sampling method in selecting the representatives of the four Muslim NGOs, the seven school principals and the three MCAs. The data was collected using questionnaires and interviews. SPSS method was used to analyse the questionnaires and coding categories was used to analyse the interviews. The collected data was presented using tables, graphs and figures. The study found out that sponsoring students in secondary schools and provision of relief food are the main activities carried out by the Muslim NGOs in Mandera East Sub-County. However, AMA engages in construction of classrooms and provides other limited facilities to schools such as books and furniture. AMA also engages in construction of wells and dams. Islamic Relief provides healthcare services such as training of medical staff, organizing medical camps, and immunization. The local community is not involved in the design and planning of the projects and selection of the educational beneficiaries of the Muslim NGOs. The Main challenges the NGOs face are lack of funds, insecurity, clanism, government restrictions and overdependence on donor. The study generally found out that few of the Muslim NGOs are engaged in capacity building measures and hence the methods they use in solving the humanitarian and educational needs of the local community lack sustainability.
SEXUAL ASSAULT AND ITS EFFECTS ON MALE PRISONERS' REHABILITATION: A CASE OF KAMITI MEDIUM PRISON, KIAMBU COUNTY- KENYA

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This study examined the effects of sexual assault on male prisoners’ rehabilitation in Kamiti Medium Prison. The study is based on the premise that there are underlying effects of sexual assault that negatively interfere with rehabilitation of male prisoners. This study therefore set out to explore the prevalence of sexual assault in Kamiti Medium Prison, investigate the effectiveness of the Kenya Prisons Rehabilitation Program on sexual assault survivors and perpetrators in Kamiti Medium Prison, examine the coping mechanisms employed by survivors of sexual assault in Kamiti Medium Prison and identify and interrogate mitigating factors and suggest strategies for sexual assault in Kamiti Medium Prison. It was guided by Travis Hirschi’s social control theory which posits that people’s relationships, commitments, values, norms and beliefs encourage them not to break the law and the risk-need-responsivity (RNR) model that emphasizes on programmes that speak to the risks, needs and responsivity of offenders. It targeted all male prisoners in Kamiti Medium Prison. Stratified and purposive sampling were used to select 223 respondents. Six officers served as key informants. Findings indicate that sexual assault in prison is a trivialized gender concern despite it being rampant and its effects adversely affecting the rehabilitation processes of victims and perpetrators. The study also found that rehabilitation programmes are not need-based, prisoners employ negative coping mechanisms due to lack of government initiated coping structures and there are no proper reporting mechanisms for sexual assault within the prison facilities. This study concludes that sexual assault affects male prisoners’ rehabilitation due to the effects it has on them which are not dealt with as there are no mitigating and responsive structures in the prison. Effects of sexual assault on male prisoners worsens due to the lack of effective need specific rehabilitation programmes that can deal with the effects and break the criminal mentality thereby contributing to the non-rehabilitation of male prisoners. To address these challenges, the study recommends these measures: declare sodomy in prison a serious gender concern that prevents rehabilitation, diversify and equip KPRP by developing risk-need-responsivity rehabilitation curriculum, review Prison Act to elaborately define response, reporting, recording, evidence preservation and referral mechanism to facilitate psychosocial and legal redress with the support of policy arms like National Council on Administration of Justice as well as enhance open door policy and leverage on in to partner with willing organizations in the fight against sexual assault in prisons.

JURISDICTION OF THE INTERNATIONAL CRIMINAL COURT AND KENYAN SOVEREIGN RIGHTS

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The notion underlying the jurisdiction of the International Criminal Court remains critical in the formulation of the Rome statute. Proponents of the international court claim that the International Criminal Court’s jurisdiction strengthens the international criminal law regime since it intervenes in situations of international human rights violation regardless of national jurisdiction. On the contrary, the Court’s opponents claim that it diminishes national sovereignty. This claim has emerged in the context of the Court’s apparent focus on Africa. As of December 2017, twenty three cases before the International Criminal Court pertained to crimes allegedly committed in five African states, Kenya, Sudan (Darfur), Uganda, the Democratic Republic of Congo (DRC) and the Central African Republic (CAR). This focus has led to claims that Africa has become a victim of a politicised process that ignores human rights violations in more powerful and resource rich states. Accordingly, the notion of International Criminal Court’s jurisdiction has not boarded well with most African countries, who have claimed that the Court is undermining sovereign rights. The central issue is the contestation between the scope of International Criminal Court’s jurisdiction and sovereign rights. This contestation is highlighted against the background of the indictment of former accused Uhuru Kenyatta and William Ruto for their alleged involvement in crimes against humanity during the 2007/8 post election violence (PEV) in Kenya. The opponents of the Court claim that by prosecuting the two, who later took the reigns of power, amounted to usurping Kenyan sovereign rights. Kenya signed the Rome statute that established the International Criminal Court on the 11th of August 1999 and ratified the same on the 15th of March 2005. With the case before the International Criminal Court, Kenya challenged the admissibility of the cases based on the complementarity principle of the International Criminal Court and raised questions of sovereign rights infringement, after failing the admissibility test. This work enters into this debate by raising questions regarding the extent to which the International Criminal Court’s intervention in Kenya violated Kenya’s sovereign rights. Various views were therefore gathered from experts in international law, international relations, foreign policy makers and politicians as well as ordinary citizens through questionnaires and interview schedules. In addition to this, secondary data was obtained from books, online sources, newspapers and general public opinions in various media. The data gathered was then analysed and presented through headings and chapters. The current study established that the jurisdiction of the International Criminal Court and Kenyan sovereign rights has been shrouded and shaped by political feelings and political affiliations that existed during the trial period. Moreover, African countries’ emerging resistance towards the Court greatly had a bearing on how Kenya as a country and Kenyan citizens absorbed and interpreted the intervention by the Court. Further to this perceptions and feelings from those who sympathized with the accused and those who supported The Hague based Court ultimately shaped the notion regarding the sovereignty of Kenya against the intervention of the International Criminal Court.

MEN AND WOMEN’S PARTICIPATION IN ALTERNATIVE DISPUTE RESOLUTION MECHANISMS IN KAPSOKWONY BUNGOMA COUNTY, KENYA

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Alternative Dispute Resolution (ADR) mechanisms have become a popular means of settling disputes outside court systems both locally and internationally. In Kenya, they are anchored in state laws and policies. This study assessed men and women’s participation in the process of resolving community conflicts through ADR mechanisms in Kapsokwony,
The study objectives were: examine various types of conflicts and the existing ADR mechanisms employed by men and women to resolve community conflicts, explain the levels of participation of both men and women in resolving community conflicts using ADR mechanisms, discuss gender related factors that compromise men’s and women’s participation in resolving community conflicts through ADR mechanisms and to identify effective gender responsive strategies to foster equality and inclusiveness in resolution of conflicts using ADR mechanisms. Guided by the Peace Research theory, Social Exclusion theory and theory of Participation, the study adopted a descriptive survey research design. The sample size for the research was 384 respondents. The respondents were selected using both probability and non-probability sampling techniques, notably through random and purposive sampling methods. Emphasis was put on the fact that the respondents were part of Nyumba Kumi system in Kapsokwony. Data was collected using three instruments, namely, questionnaire, interviews and FGD guide. Data analysis was done using descriptive statistics, cross-tabulations, frequencies, and correlational analysis. Qualitative data was analysed thematically. The study found that various types of conflicts are experienced by the residents of Kapsokwony. Findings also revealed that ADR mechanisms are used to resolve community conflicts despite people’s limited knowledge about them. Furthermore, despite the adoption of the 2010 Kenyan Constitution, the establishment of the National Gender Equality Commission and other relevant gender equality institutions are yet to be set up. Moreover, Kapsokwony women are yet to be fully integrated in conflict resolution; indeed, the levels of women’s participation are still lower than men. The study recognized the combination of causal factors as consisting of retrogressive cultural customs and practices, lack of control over dispute resolution mechanisms and low education levels. Other factors included religious beliefs and gender perceptions that conflict resolution was the responsibility of men. The remedies comprised adopting and implementing varied but effective gender responsive strategies. In this regard, the study provided five recommendations, namely; the need for legislative reforms with the view of sealing existing gaps on policies and legislation; the implementation of the 2/3 gender policies, coupled with the enforcement of laws and policies pertaining to gender equality by the relevant authorities both at the National and County levels. Besides, the study highlighted the need to also implement a comprehensive framework on civic and empowerment education programmes on crosscutting issues. These could aid in achieving individual and community social change. This in turn would help to put an end to harmful long-standing practices against women in Kapsokwony and capacitating them on aspects related to conflict resolution. Finally, the study recommended that women be included as active members of peace committee domiciled at the sub-county level. In this regard, the study strongly suggests that the membership of such committees should not only embrace women’s participation but gender parity as well.

INFLUENCE OF INTERFAITH MEDIATION CENTRE IN THE MANAGEMENT OF CONFLICT IN BAUCHI STATE NIGERIA: 1960-2015

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Conflict among social groups is one of the major challenges affecting peaceful coexistence in the world. In Africa, particularly Nigeria, conflicts are associated with religion, ethnicity, and post-election violence which result in adverse effects on people and their livelihood. Nigeria has witnessed conflicts like Kaduna crisis, Jos crisis, and Bauchi State crisis.
Bauchi State has experienced conflicts between herdsmen and farmers as compared to other states in Nigeria. The prevalence of conflict in Bauchi State has caused a public outcry. The conflicts have disrupted the local economy in general and agricultural production in particular. The resultant effects are high rate of crime, hunger, poverty and corruption among other sufferings. Therefore, these crises have adversely affected human security and economic development in Bauchi State. In line with that, this study investigated the influence of the Interfaith Mediation Centre in the management of conflict in Bauchi State, Nigeria with specific focus on the factors that led to the establishment of IMC, the activities of IMC in Management of conflict between herdsmen and farmers, and the role of IMC in post electoral conflict management in Bauchi State, Nigeria. The study was guided by the peace building theory by John Paul Lederach. Lederach argues that conflict societies are divided into three levels of actors: the top level, middle level and grass root level of leaderships. He assumed that it is the middle level of actors that influences the other actors in promoting or mediating peace within the conflict zone. This study adopted a descriptive research design based on semi-structured interviews and focus group discussions. The researcher used purposive sampling technique to select the respondents from the Interfaith Mediation Centre, Christians Muslims Peace Movement officials operating in Bauchi, stakeholders, community leaders, Imams and Church leaders. Both primary and secondary sources of data were used to extract data. The data obtained from the field was subjected to thematic content analysis through interpretation and transcription in line with the objectives of the study. The study findings revealed that the Interfaith Mediation Centre has demonstrated its readiness towards fostering mediation, reconciliation and dialogue between community members of different faiths in Bauchi State, Nigeria. The findings also indicated that the Interfaith Mediation Centre promotes voter’s sensitisation as well as media involvement towards managing electoral violence. The study is important as it enriches the historiography of conflict management not only in Bauchi State but also in other states across Nigeria and beyond. Therefore, the study concluded that interfaith mediation centre has been effective in mitigating Violence conflict in Bauchi State. Thus, the study recommends that interfaith mediation centre should be strengthened financially to carry out its functions hitch-free; report on dialogue should be utilized.
Crop production has continued to decline in sub-Saharan Africa due to soil infertility and increased cost of farm inputs. To enhance food security, farmers have adopted the use of both inorganic and organic fertilizers on their farms. The production and use of inorganic chemical fertilizers are not only expensive for family farming systems but also contribute significantly to environmental pollution. Biological nitrogen fixation using rhizobia has proven to be a cost-effective and environmentally friendly alternative to inorganic nitrogen fertilizers. Rhizobia interact with legumes symbiotically, improving soil fertility and legume plants productivity. The present study aimed at determining the morphological and genetic diversity, cross-inoculation ability, and symbiotic efficiency of native rhizobia isolates in sterile and non-sterile soils. Greenhouse experiments were set to trap rhizobia from soil from smallholder farms from Kitui, Embu, and Tharaka Nithi Counties using cowpea as the trap host. The cowpea crops were harvested after one month, and a total of 311 nodule isolates were purified from the crop nodules. Based on morphological characteristics, the nodule isolates were clustered into 42 different groups. The effect of the soil on cowpeas nodulation was determined using redundancy analysis where soil characteristics including P, Zn, Mn, and total organic carbon correlated positively with cowpea nodulation and nodule dry weight. Soil pH and Ca correlated negatively with nodule number and weight. In addition, 53 glycerol stocks nodule isolates (archived samples) from previous studies were revived. Revived cultures were clustered based on morphological characteristics into 11 different groups. The isolates were tested for symbiotic efficiency using common bean, cowpea, green gram and soyabean seeds planted in sterile and non-sterile soils in the greenhouse. Un-inoculated plants were used as controls, while the treatments included the revived native isolates and commercial rhizobia inocula. The experiments were laid out in a completely randomized design. Plants grown in both sterilized and non-sterilized soils and inoculated with the different isolates varied significantly (p<0.05) in the shoot, root, and nodule dry weights. Some of the isolates, including IsAS14, IsAS11, IsAS10, IsAMR6, IsAMR22, IsAMR23, IsAMR27, and IsAGR5 significantly (P<0.05) outperformed commercial isolates in influencing the plants growth parameters. Forty-six revived nodule isolates had the ability to infect, induce nodule formation and influence the growth of the non-original host. The best performing native rhizobia isolate IsAS14, IsAMR3, IsAMR27, IsAMR18 and IsAMR22 outperformed the commercial inocula in terms of symbiotic efficiency of 104.97 %, 136.86 %, 136.99 %, 138.88 % and 155.05 %. DNA from representative isolates was extracted using ZYMO research DNATM extraction Kit. The 16S rRNA region was then amplified using universal primers and sequenced using the same primers. Based on the sequencing of 16S rDNA of representative revived nodule isolates, most of the isolates were rhizobia but clustered with different species with the most dominant cluster being isolates related to Rhizobium leguminosarum and Rhizobium etli. Nodule number and nodule dry weight were dependent on soil physico-chemical characteristics. Rhizobia isolates also had the ability to form symbiotic interaction with non-original host
legume crops. These rhizobia isolates can be used as bio-inoculants to improve the production of the different legumes, and to enhance food security.

**ANALYSIS OF MICROBIAL LOAD AND DIVERSITY IN CRICKETS (GRYLLUS BIMACULATUS AND SCAPSIPEDUS MARGINATUS) USED AS A SOURCE OF PROTEIN FOR FOOD**

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Crickets are drawing interest as sustainable source of protein for food and feed worldwide. However, there is little information on microbial quality of edible crickets thus the need for a profound insight into their safety. The objective of the study was to determine the microbial load of two edible cricket species Scapsipedus marginatus and Gryllus bimaculatus and to evaluate the efficiency of different processing methods (boiling, sun-drying, freeze-drying, snap freezing and deep frying) in reducing microbial counts. The wild-caught crickets were obtained from Nguruman (Kajiado County) and Mbita (Homa Bay County) while the farmed crickets were reared at Animal Rearing and Containment Unit at the International Centre of Insect Physiology and Ecology (icipe). The cricket samples were screened for microbiota using culture-dependent method. Fifteen adult crickets were pooled together and homogenized in Phosphate-buffered Saline (PBS). The solution was used for mycological and bacterial isolation and analysis. Bacterial microbiota was isolated using Nutrient agar (NA) and MacConkey agar (MCA). Fungal microbiota was isolated using Sabouraud Dextrose Agar (SDA) and Potato Dextrose Agar (PDA). The isolates were characterized morphologically and through sequencing of bacterial 16S SSU rRNA genes and fungal internal transcribed spacer (ITS) rRNA gene. Most of the bacterial isolates (70%) on NA had characteristics typical of members of Bacillus spp. while on MCA, most bacteria (90%) had characteristics suggestive of members of E. coli. Majority (80%) of the fungal isolates on PDA had characteristics similar to those of Aspergillus spp. while most isolates (80%) on SDA were members of Trichoderma spp. Microbial counts of fresh cricket samples were generally high, with bacterial population ranging from 2.5 x 10^4 - 3.8 x 10^4 CFU/g fresh weight. The fungal populations ranged from 2.0 x 10^4 – 3.0 x 104 CFU/g fresh weight. Upon processing the microbial counts reduced considerably with bacterial counts ranging from 0.1 x 102 – 0.8 x 102 CFU/g dry weight (boiled) and 0.7 x 103 – 2.2 x 103 CFU/g dry weight (sun dried). The fungal counts ranged from 0.7 x 102 - 0.9 x 102 CFU/g dry weight (boiled) and 0.9 x 103- 1.7 x103 CFU/g dry weight (sun-dried). Freeze-dried and deep fried samples had no microbial counts. The diversity of bacteria and fungi species in wild-caught crickets was considerably high compared to the lab-reared crickets with most isolates belonging to species pathogenic to humans. Phylogenetic analysis revealed that most bacterial isolates from the wild-caught crickets related to members of Bacillus spp. (57%), Staphylococcus spp. (43 %) and E. coli (14 %). Fungal isolates related to Aspergillus spp. (57%) and Penicillium roseopurpureum (29%). From the farmed crickets, most of the bacterial isolates related to E. coli (60 %), Enterobacter (40%) and Lactococcus garvieae (20 %). The fungal isolates related to Trichoderma asperellum (75%), Aspergillus spp. (25%) and Tetrapisispora fleetii (12.5%). From the cricket samples processed by boiling and sun drying, the microbial diversity was very low with only two bacterial isolates related to Rickettsiella grylli (42 %) and Wolbachia spp. (29 %), while the two fungal isolates related to members of Aspergillus spp. (67%) and
Trichoderma asperellum (33%). Thirteen potentially novel bacterial and fungal isolates from wild and reared crickets had no close matches from gene bank and need further investigation. This study shows that crickets harbor diverse microbial communities some of which are potentially pathogenic. Deep-frying, freeze drying and snap freezing completely eliminated bacterial and fungal contaminants thus minimizing microbial risks in crickets meant for food.

VARROA-SPECIFIC HYGIENIC BEHAVIOUR AND POPULATION ABUNDANCE OF Varroa destructor IN COLONIES OF Apis mellifera scutellata IN KARURA FOREST, KENYA

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The ectoparasitic mite Varroa destructor is one of the parasite globally reported affecting honeybee health and causing high colony losses. Of notable importance is the association of the mite with viruses and their transmission to honeybees which causes great harm to bees. Kenyan beekeepers have reported that bee populations have been on decline in recent years and therefore the need for research to establish whether Varroa destructor is negatively affecting honeybee survival and development. The objectives of this study were to evaluate Varroa-specific hygienic behaviour of Apis mellifera scutellata, assess population abundance of V. destructor and determine the effects of V. destructor on local honeybee A. m. scutellata. The study was conducted at International Centre of Insect Physiology and Ecology (icipe) research apiaries located in Karura forest, Nairobi County. Thirty colonies were randomly selected and monitored from April to November 2016. Data collection on Varroa-specific hygienic behaviour was done from ten colonies and the response of A. m. scutellata to mite introduction were evaluated at intervals of 72 hours for a period of three months. The pre-pupa worker brood cells were uncapped and 10, 8 and 5 adult female phoretic mites were introduced repeatedly per colony and brood cells recapped. Assessing population abundance and the effects of V. destructor on colony size and productivity of Apis mellifera scutellata were done on twenty colonies. For each experimental colony, infestation of V. destructor on adult bees was measured twice a month using sugar shake method. Mite infestation in worker brood cells was assessed fortnightly by uncapping 200 purple eyed pupae and adult mites found were counted and recorded. Quantifying the amount of brood, adult bees and colony stores (pollen, nectar and honey) was done once every month. The data on Varroa-specific hygienic behaviour of Apis mellifera scutellata, population abundance of V. destructor and effects of V. destructor on Apis mellifera scutellata were analyzed using Generalized Linear Mixed Model and the means separated using Tukey’s HSD at P value = 0.05 (5% significance level). The mean percentage of untouched brood cells was significantly high in control experiments (80%, n = 579) compared to manipulated brood cells in which mites had been introduced (12.5%, n = 110) (P = <0.001). There were significant differences between the different densities of mites introduced and percentage response of Apis mellifera scutellata in untouched brood cells (UBC, P = <0.001) and where mites were removed and brood cells recapped (MRBR, P = <0.001). The population abundance of V. destructor varied within the months of study and was generally characterized by low mite infestation levels. The mites collected within the first four months of study (April, May, June and July) were significantly lower than those collected within the last four months (August, September, October and November) (P = <0.001). Colony stores also varied throughout the study period.
with the month of July recording the lowest mean numbers of nectar (38.8 ± 12.5 cm²), pollen (33.8 ± 8.8 cm²) and honey (45 ± 10.5 cm²). The number of adult bee population was positively correlated with overall V. destructor population with significant difference (P = 0.0014). The amount of honey was positively correlated with overall V. destructor population with significant difference (P = 0.03). In spite of the presence of the parasitic V. destructor in bee colonies, all the colonies appeared healthy. Therefore, control measures should be put in place by the government in order to curb any increase in infestation levels of V. destructor and maintain the apparent healthy status of honeybees in Kenya.

RADIOMETRIC ASSESSMENT OF NATURAL RADIOACTIVITY LEVELS AND RADIATION HAZARD INDICES FOR SOIL SAMPLES IN KERICHO COUNTY, KENYA

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Dr. Margaret W. Chege

Throughout their lives, human beings are continually exposed to radiation from terrestrial radionuclides particularly 40K, 238U, 232Th and their decay products. The radiation, usually in the form of gamma rays and alpha particles, is largely attributed to building materials for instance rock and concrete mainly used in developed countries and cities around the world, or soil which is principally used in most parts of rural Africa. Radiation exposure from terrestrial sources may be more of a concern in indoor settings under certain conditions. As an example, houses constructed using building materials high in 238U and 232Th content often contain elevated concentrations of radon which, according to the World Health Organization, is the leading cause of lung cancer among non-smokers. Owing to the potential risk, many countries especially in the developed world have quantified 40K, 238U and 232Th in their environments and mapped the radiation risk-prone areas. In Kenya however as in most parts of Africa, data on the terrestrial radionuclides is largely absent. The reported study involved measurement of specific activities of 40K, 238U and 232Th in surface soil of Bureti Sub-County, Kericho County, Kenya, for purposes of evaluating the risk indices that included radium equivalent activity (Raeq), external hazard index (Hex), internal hazard index (Hin), outdoor gamma dose rate and outdoor annual effective dose rate. Bureti Sub-County has a rural setting and as such, soil forms the main building material for house construction. The region is also a relatively rich agricultural zone with tea and maize being the main crops grown. Soil samples were randomly collected from twenty one sampling stations within tea and maize plantations and after requisite preparation analyzed for 40K, 238U and 232Th activity concentrations using calibrated NaI (Tl) gamma ray spectrometer and the associated electronics. The specific activities of 40K varied from 39 ± 2 to 2129 ± 106 BqKg⁻¹ with an average of 1086 ± 49 BqKg⁻¹, 238U ranged from 34 ± 2 to 265 ± 13 BqKg⁻¹ with a mean of 143 ± 7 BqKg⁻¹ whereas 232Th ranged from 3 ± 1 to 150 ± 9 BqKg⁻¹ with a mean of 95 ±4 BqKg⁻¹. The average values of 40K, 238U and 232Th exceeded the world averages by factors of 2.6, 4.3 and 2.1 respectively. Raeq varied from 130 ±7 to 590 ± 30 BqKg⁻¹ with a mean of 362±18 BqKg⁻¹ which is within the recommended range while Hex and Hin varied from 0.35± 0.02 to 1.60± 0.08 with a mean of 0.98±0.05 and 0.44±0.02 to 2.16±0.11 with a mean of 1.36±0.07 respectively. While Hex average value is within the reference level of 1, that of Hin exceeds the value by 36%. The estimated outdoor absorbed gamma dose rate ranged from 59 ±3 to 273±14 nGyh⁻¹ with a mean of 169 ±8 nGyh⁻¹, about 3 times the world average. The outdoor annual effective gamma dose rate averaged 0.41 ± 0.02 mSvy⁻¹ which though significantly higher than the world average of 0.07 mSvy⁻¹ is less than half the maximum dose constraint of 1 mSvy⁻¹ recommended by ICRP for the general public. Thus, radiation exposure in Bureti Sub-County is
within the acceptable safety limit. Nonetheless, soil when used as a building material may to some degree contribute to indoor radon concentration hence the need to quantify radon concentration in earthen dwellings in the region.

**NATURAL RADIOACTIVITY MEASUREMENTS AND EVALUATION OF RADIATION HAZARDS IN SOIL SAMPLES OF SHINYALU, KAKAMEGA COUNTY, KENYA**

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Radioactive elements are found everywhere in the environment. Detectable amounts occur naturally in soil, rocks, water, air and vegetation and may be ingested if they enter the food chain, or, inhaled. Inhaled and ingested radionuclides lead to internal exposure. In addition, humans also receive external exposure due to the radioactive materials located outside the body. Primordial radionuclides 238U, 232Th and 40K are the main sources of external radiation exposure to the general public. Exposure to enhanced radiation levels for long periods of time may lead to health related problems like cancer. This research project aimed at measuring the concentration of primordial radionuclides in soil samples from Shinyalu region in Kakamega County and evaluating the radiation exposure to the local population. Twenty three surface soil samples were collected from selected locations in study area and analysed for the content of 238U, 232Th and 40K using a NaI (Tl) gamma ray spectrometer. Radiation hazard indices, external dose rates and the radium equivalent activity were calculated based on the activity concentration of the primordial radionuclides. The mean activity concentration for 238U, 232Th and 40K were; 189±9 Bqkg-1 within the range of 58±3-349±17 Bqkg-1, 151±8 Bqkg-1 within the range of 33±2-364±18 Bqkg-1 and 902±45 Bqkg-1 within the range of 98±5-1718±86 Bqkg-1 respectively. The mean values of concentration for 238U, 232Th and 40K exceeded the world average of 33 Bqkg-1, 45 Bqkg-1 and 420 Bqkg-1 respectively. The values for radium equivalent activity, external gamma hazard and internal hazard indices were; 475±24 Bqkg-1 within the range of 151±8-910±46 Bqkg-1, 1.28±0.06 within the range of 0.41±0.02-2.46±0.12 and 1.75±0.08 within the range of 0.69±0.03-3.08±0.10 respectively. The average absorbed dose rate was found to be 216±11 nGyh-1 within the range 69±3 - 408±20 nGyh-1 which was below the hazard limit of 1500 nGyh-1. The annual effective dose rate was found to be 0.27±0.01 mSvy-1 within the range 0.08 - 0.50±0.03 mSvy-1 which is below the ICRP limit of 1 mSvy-1 for members of general public. These results reveal no significant radiological health hazards for inhabitants within the study area.

**ANTIPLASMODIAL ACTIVITIES AND IN VIVO SAFETY OF EXTRACTS AND COMPOUNDS OF SEVEN INDIGENOUS KENYAN MEDICINAL PLANTS USED TRADITIONALLY TO TREAT MALARIA**

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Among human parasitic diseases, malaria is the most important and it has global incidence of 300 to 500 million cases per year with about 1.5 million deaths among African children. Recently the disease has been subjected to massive control efforts with varying degrees of success. The development of parasite and vector resistance to conventional drugs and insecticides has complicated both treatment and control today. The main goal of this project was to identify viable phytomedicines traditionally employed for the treatment of malaria in Kenya that could be developed into antimalarial agents. Seven medicinal plants used by herbalists in Kilifi and Homa-Bay Counties were examined: Achyranthes aspera, Heinsia crinita, Bridelia cathartica, Citrus limon, Microglossa pyrifolia, Vernonia glabra and Carissa edulis. Both organic and aqueous plant extracts were obtained and tested for antiplasmodial activity against CQ sensitive and resistant strains of P. falciparum in vitro. Active extracts were subjected to bioactivity guided fractionation and isolation of compounds. Structural elucidation of isolated compounds was determined using standard spectroscopic techniques (IR, NMR & MS). The most active plant extracts against P. falciparum had the following IC50 activities: DCM extract of Citrus limon roots (7.017 μg/ml), aqueous extract of Carissa edulis roots (8.054 μg/ml), DCM and methanolic extracts of Bridelia cathartica leaves (11.537 μg/ml, 15.647 μg/ml) respectively and DCM extract of Heinsia crinita leaves (13.336 μg/ml). The others were as follows: hexane extract of Achyranthes aspera leaves (18.087 μg/ml), hexane extract of Microglossa pyrifolia leaves (21.376 μg/ml), methanolic extract of Heinsia crinita leaves (24.805 μg/ml), aqueous extract of Bridelia cathartica leaves (25.985 μg/ml), and DCM extract of Carissa edulis roots (30.074 μg/ml). Toxicity tests on crude DCM root extract of C. limon, indicated that 70% of the biochemical parameters studied using the rabbit model were not affected. Two pure coumarin compounds, suberosin (IC50 53.1415μg/ml α D6 strain of P. falciparum, 26.732μg/ml α W2 strain) and xanthyletin (IC50 1580μg/ml α W2 strain) were isolated from C. limon. Spinasterol (IC50 143.69 μg/ml α V1/S strain) was isolated for the first time from hexane leaf extract of Microglossa pyrifolia. Histology of the liver, heart, kidney and brain did not reveal any damage. Citrus limon is a potential antimalarial drug and owes its activity to the presence of suberosin and other compounds with which it works in synergy against falciparum. In conclusion, there were no significant toxic effects on rabbit tissue observed upon treatment with the crude DCM root extract of C. limon in the subchronic toxicity studies as about 90% of the parameters examined were not affected. Therefore a drug that can cure malarial infection can be synthesized modelled upon the structure of suberosin. Quinine and mefloquine have structures which are closely related to this compound. Further studies on C. limon required to be carried out in order to isolate and identify more compounds and test them against falciparum. In addition, compound isolation from aqueous extracts of C. edulis which also demonstrated high activity against P. falciparum requires to be carried out. This study has verified the use of these plants for the treatment of malaria by the traditional communities.

**ABUNDANCE AND CONSERVATION STATUS OF PRUNUS AFRICANA IN WESTERN MAU FOREST, KENYA**

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Dr. Rebacca Karanja

Prunus africana (Hook. f) Kalkman, 1965 (formerly Pygeum africanum Hook.f) is a geographically widespread tree restricted to highland forest of main land Africa and outlying islands. The species is commercially important for its bark, which is used in the treatment of prostate gland disorders. It also produces high quality timber used locally for building poles and furniture as well as fuel wood. The high demand for the bark has led to notable destruction of the species in
natural forests, leading to concerns on the long term sustainability of harvesting and the conservation of the species. Despite the fact that Mau forest is a protected area, the region experiences illegal exploitation with *P. africana* being one of the main targets. The tree is of great demand for its strong timber and highly medicinal bark making its population to be under threat. As a result *P. africana* is listed as vulnerable species under Appendix II of CITES. In this study, information on *P. africana* was obtained mainly from literature survey while population data was obtained by sampling methods. The study was conducted in Western Mau forest (longitude E35027.05’ to E35039.42’ and latitude 0010’46’S to 0017’42’S) which is found in the South Rift region, Kericho county. Transects were laid across four blocks in Western Mau forest and diameter at breast height (dbh) and height of mature trees measured. The level and causes of disturbances were collected using questionnaires and through observation and recorded for each of the plots. Saplings were counted and recorded in subplots and seedlings counted in micro plots. Densities of seedlings, saplings and mature *P. africana* trees were examined across the Western blocks of Mau forest. A socio-economic survey was further conducted to determine community perceptions on the status of the tree under study. The data generated were analyzed using both descriptive and inferential statistics. Data on height and dbh were summarized as mean ± SE and variations tested using one-way ANOVA. Socio-economic data were mainly analyzed in form of proportions and variations between sites tested using chi-square statistics. Data was presented in histograms, tables and graphs. Inferential statistics revealed significant variation in the density of saplings (p<0.05). Majority of the mature trees were of height between 20m and 40m though this height varied significantly between the blocks. As concerns dbh, most of the trees ranged between 40cm and 50cm with a significant variation between the blocks. The seedling numbers exceeded saplings and trees, suggesting potential for regeneration and population increase even though the population is not increasing. Observations showed that human activities, herbivory and diseases pose serious threats to *P. africana* tree. The local community was of the opinion that the main anthropogenic activities affecting the tree are unsustainable de-barking, logging, and animal grazing. It was recommended that awareness creation be organized regularly for all stakeholders on sustainable de-barking and logging be greatly regulated to save this tree of great value to mankind. The local community and more so those who rely on the tree for herbal medicine should be encouraged to grow the tree in their homestead gardens to reduce the pressure on wild trees thereby enhancing its conservation.

**ANALYSIS OF L-CITRULLINE, L-ARGININE AND L-GLUTAMIC ACID IN SELECTED FRUITS, VEGETABLES, SEEDS AND NUTS SOLD IN NAIROBI CITY COUNTY, KENYA**

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Dr. Margaret Mwihaki Ng’ang’a

L-citrulline, L-arginine and L-glutamic acid are some of the amino acids which are vital in the human body. L-citrulline boosts immunity, combats sarcopenia, detoxifies the liver and enhances male fertility. L-arginine boosts internal production of nitric oxide thus enhancing dilation of blood vessels, inhibits aging process, prevents abnormal blood clotting and accelerates healing of wounds. L-glutamic acid cleanses the central nervous system and improves overall brain health, attitude and mental performance. However, only young and healthy people endogenously generate enough of these vital amino acids while premature babies and old people do not generate enough of the amino acids. Oral supplements are very expensive and have side effects such as; headache, vision impairment, flushing, heart attack and
stroke. There is therefore the need for safe alternative and cheaper sources of these amino acids. Fruits, vegetables, seeds and nuts can be good sources of L-citrulline, L-arginine and L-glutamic acid. However, there is scarce data on the levels of these amino acids in the locally grown farm produce. The objective of this study was to determine the levels of L-citrulline, L-arginine and L-glutamic acid in selected fruits, vegetables, nuts and seeds sold in selected markets in Nairobi city County, Kenya. Thin Layer Chromatography (TLC) was used for identification and Liquid Chromatography–Mass Spectrometer (LC-MS) for quantification of the amino acids. The data was analyzed using one-way ANOVA. TLC profiles showed presence of both L-arginine and L-citrulline in most fruits, vegetables and nuts while L-glutamic acid was present in the seeds. The levels of the amino acids in the fruits and vegetables ranged as follows: L-citrulline ranged, 0.65-19.41 mg/100g in the button mushroom, cucumber, pumpkin, amaranthus, kales, 3.16-3.79 mg/100g in the watermelons and 1.57-10.21mg/100g in the macadamia nuts, pea nuts and cashew nuts. L-arginine was in the range; 1.73-16.48 mg/100g in the amaranthus, kales, button mushroom, butternut squash and cucumber, 5.44-6.56mg/100g in the fruits and 0.93-10.73mg/100g in the nuts and L-glutamic acid, 0.013-0.28 mg/100g in the seeds of; pumpkin, butternut and watermelons. The results showed that locally available vegetables, fruits and nuts contain significant levels of L-citrulline and L-arginine, whereas seeds contain significant levels of L-glutamic acid. The information obtained from this study is vital to the ministry of health and nutritionists towards measures on improving the quality of life by encouraging dietary supplementation of the amino acids through consumption of locally available farm produce. The research findings will contribute to knowledge on presence of the amino acids in fruits, vegetables and nuts grown in Kenya.

HYDROGEOCHEMICAL ANALYSIS AND MODELLING OF GROUND WATER IN MBEERE SOUTH SUB-COUNTY, EMBU COUNTY, KENYA

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Clean water is an essential commodity for a healthy nation. A fifth of all water used in the world is obtained from groundwater. In arid and semi-arid areas, groundwater is the main source of water for domestic and irrigation purposes. The semi-arid climate, few perennial water bodies and growing population in Mbeere South, Embu County has resulted into increased use of groundwater for both domestic and irrigation necessities. This has put pressure on these water sources leading to over-pumping. Excessive pumping may draw waters with different composition towards the aquifers, resulting to elevated levels of some minerals. Excess minerals in groundwater makes it unsuitable for domestic and agricultural purposes. For instance, high levels of nitrate in drinking water can cause ‘blue baby syndrome’ and gastric cancer while excess fluoride can cause dental and skeletal fluorosis. To investigate the hydrogeochemical characteristics of groundwater in Mbeere South, a total of 10 boreholes drilled at different years from different administrative locations were sampled. The samples were analysed for physico-chemical characteristics such as pH, temperature, total dissolved solids and major ions using standard analytical procedures. The chemical analysis results were then subjected to PHREEQC, Origin pro and AqQA computer software’s for modelling to obtain saturation indices, water types and hydrogeochemical processes respectively. The results showed that the dominant cations were Ca2+ > Na+ > Mg2+ > K+ > Fe2+ while the dominant anions were HCO3->Cl->SO42->NO3->F. The hydrogeochemical facies indicated that 40% of the samples belong to Ca-HCO3 water type and 80 % to mixed water type. The facies further illustrated simple dissolution,
mixing of the waters, anthropogenic activities and ion exchange as the major processes controlling ground water chemistry in the region. The Saturation Indices indicated that the samples were slightly saturated with aragonite, calcite and dolomite; slightly under-saturated with anhydrite and gypsum, moderately under-saturated with halite and under-saturated with hydromagnesite, trona and portlandite. This shows that the water chemistry in the area is significantly affected by carbonate minerals, i.e. calcite, dolomite and aragonite. The physical-chemical results were also compared with the WHO and East Africa standards (EAS 459-1:2007), in order to assess the suitability of the groundwater for domestic use. The findings showed that Kiambere H. C. (site A), Kinyaga (site F) and Kaseve (site I) boreholes had concentrations of Ca2+, Mg2+, Na+, F-, Cl-, Mg2+, K+, Na+, Cl-, NO3- and Mg2+ and NO3- respectively much higher than the WHO and EAS standards hence not suitable for domestic purposes with respect to these parameters.

**FREQUENCY OF SULFADOXINE PYRIMETHAMINE RESISTANCE ASSOCIATED GENE MUTATIONS IN PLASMODIUM FALCIPARUM CLINICAL ISOLATES FROM KWALE COUNTY, KENYA**

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Malaria persists to be one of the world’s complex and dynamic disease. The disease is more devastating in sub-Saharan Africa as it constitutes high cases of childhood mortality and morbidity. Management of the disease remains a problem as a result of the spread of parasites that are resistant to the available drugs. Due to the broadened spread of resistance to Sulfadoxine Pyrimethamine (SP), the artemether-lumefantrine which is a more effective and well-tolerated anti-malarial drug replaced the SP as the first-line regimen in treatment of uncomplicated malaria in Kenya. However, SP remains the suggested drug to treat and prevent malaria in expectant women and children under the age of five. This study sought to assess the presence of mutation in dihydrofolate reductase and dihydropteroate synthase genes associated with SP resistance a decade after Sulfadoxine-Pyrimethamine was withdrawn as the first-line anti-malarial drug of choice in Kenya. Smear-positive samples (N = 134) collected from a 2013 cross-sectional study in infants managed at Msambweni District Hospital were evaluated for mutations in dhfr and dhps (SP). The findings obtained were matched up with molecular data from infants in Western Kenya in a study carried out in 2003/05. In all the 134 samples, mutations at codons N51I, C59R, S108N had a high predominance at 80.6%, 72.4% and 93.3% respectively. The double mutant of Pf dhps A437G/K540E had an occurrence rate of 82.1% and 78.4% respectively. Compared to the molecular data of 2003/05 study, the Pf dhfr triple mutant (S108N/N51I/C59R) genotype decreased to 63.4% in 2013 up from 68%. However, this reduction was not significant (p=0.387). There was no significant change in the prevalence of Pf dhps double mutant (A437G/K540E) genotype (p=0.485). The percentage of isolates which had the Pf dhps A437G/K540E/ Pf dhfr N51I/C59R/S108N quintuple mutant linked with SP resistance did not change significantly over the two study periods under consideration (53.5% in 2003/05 versus 53.7% in 2013, p = 0.967). The high prevalence of SP resistance marker in the coastal Kenya could be attributed to circulation and SP drugs being sold over the counter which has maintained a selection pressure for the mutations and fixation in the key mutations in the inhabitants. Also the mutation could have a little effect on the fitness of fit of the parasite such that withdrawal of drug pressure did not offer any survival disadvantage hence the continued spread of resistant parasites. Further investigations should be done to determine the linkage between SP drug resistance associated mutations and efficacy of IPTi-SP since the mutation levels are still high. It is also recommended that doctors using SP for
IPTi and IPTp should be more cautious and their use monitored to ensure cases of poor response are managed with a different drug.

**DITHIOCARBAMATES AND ETHYLENETHIOUREA RESIDUE LEVELS IN TOMATO AND SWEET PEPPER FROM KIRINYAGA AND NAIROBI COUNTIES**

Karanja Elias Kiura-M.SC

Department: Chemistry

Supervisors: Prof. Jane Murungi

Prof. Hudson Nyambaka

Vegetables are a major source of essential nutrients such as minerals, proteins, energy and roughage. Some vegetables such as tomato and sweet pepper can be eaten raw or cooked. These vegetables are affected by pests and diseases that are controlled using pesticides among which are fungicides such as dithiocarbamates (DTCs) that are toxic to human and animals at high concentrations. DTCs are commonly used in different combinations in Kenya and one of their metabolites, ethylenethiourea (ETU) a carcinogenic compound, has a long residual time of between five to ten weeks. Cooking degrades DTCs to metabolites while proper cleaning can remove the residue considerably. This study investigated the levels of dithiocarbamate fungicides propineb and mancozeb, and the metabolite ETU in tomato (Lycopersicon esculentum mill) and sweet pepper (Capsicum annum l) during wet and dry seasons and also after different temperature and cleaning treatments. The analyte were extracted from vegetables using acetonitrile-dichloromethane-chloroform mixture and analyzed using HPLC. The results obtained showed residue levels of propineb and mancozeb in tomato which were significantly higher in the wet season in three out of the four markets. The levels of mancozeb in tomato were ranging from 2.56±0.12 mg/kg in the wet season to below detection limit (BDL) in the dry season while in sweet pepper the levels ranged from 2.69±0.57 mg/kg in wet season to 0.16±0.00 mg/kg in dry season. Propineb levels ranged from 3.97±0.50 mg/kg in wet season to BDL in dry season in tomato while in sweet pepper the range was 6.54±0.72 mg/kg in wet season to BDL in dry season. The ETU levels in tomato samples were significantly higher in dry season than wet season and ranged from 27.94±0.39 mg/kg to BDL in wet season while in sweet pepper the levels ranged from 8.88±1.55 mg/kg in dry season to BDL in wet season. Two out of four markets had propineb residues in tomato above maximum residue limit (MRL) set by WHO/FAO and EU of 3 mg/kg while there were no levels of mancozeb above MRL. ETU mean residue levels exceeding the MRL of 0.05 mg/kg were noted in all vegetable samples. The temperature treatment showed a significant increase of ETU residues from a low mean of 9.43±0.03 mg/kg at 25°C to a mean of 12.43±0.38 mg/kg at 90 °C showing an increase of ETU residues with cooking. Cleaning with sodium hypochlorite (chlorine water) showed a reduction of ETU residue by 99.9% in tomato and by 100% in sweet pepper. The mean residue levels of ETU in tomato reduced from a mean of 46±0.71 mg/kg to 0.05± 0.00 mg/kg while in sweet pepper a reduction from 2.14±0.02 mg/kg to BDL. Cleaning with water and chlorine water differed significantly in removing the ETU residue. Mancozeb mean residue levels in tomato cleaned with sodium hypochlorite reduced by 95.2% while propineb reduced by 80.4%. Cleaning with sodium hypochlorite showed a significant removal of fungicides than water only. The result from this study indicates high residue levels of mancozeb, propineb and ethylenethiourea in fresh and cooked tomato and sweet pepper. There is therefore a need for cleaning with chlorine water and rinsing with water before consumption and a regular surveillance of the fungicides and metabolite.
OPTICAL AND ELECTRICAL CHARACTERIZATION OF SnS – SnO2: Sb P-N JUNCTION FOR SOLAR CELL APPLICATIONS

Okinyi Dennis Ombagi-M.SC

Department: Physics
Supervisors: Dr. Mathew K. Munji
Dr. Walter K. Njoroge

For sustainability of future civilization, development of alternative clean energy technologies to replace fossil fuels has become one of the most crucial and challenging problems of the last few decades. Thin film solar cells is one of the major photovoltaic technologies that is promising for renewable energy conversion. The PV cells currently in use today are silicon based, though other cells have been fabricated using other semiconductors. Recent research is focused on fabrication of solar cells with high conversion efficiency. In this research, SnS and SnO2:Sb films were optimized for photovoltaic applications. The SnO2:Sb films were deposited by Spray pyrolysis technique and SnS films were deposited by Chemical Bath Technique. Solid spec 3700 DUV - VIS double beam spectrophotometer was used to study their optical properties. The four-point probe connected to Keithley 2400 source meter was used in studying the electrical properties of film samples obtained. The prepared SnS thin film samples had transmittance of between 1-30% and reflectance recorded was between 9-45%. The energy band gap of the absorber layer films obtained was ranging from 1.27 - 1.68 eV. SnS thin films obtained indicated resistivity decreasing from 407.8 - 33.5 Ωcm as the concentration of SnCl2 increased from 0.05M – 0.20M. The window layer (SnO2:Sb) had a transmittance which was ranging between 32-88 % and reflectance that ranged between 7-39 % within the visible region. Energy band gap for SnO2:Sb ranged between 3.52-3.93 eV for Sb doping of 0-5 wt. %. Resistivity of SnO2 and SnO2:Sb ranged between 2.97 – 14.71 Ωcm. The thin films that were optimized were used in fabrication of SnS - SnO2:Sb P – N Junction. The fabricated PV solar cell parameters were obtained and they include: Isc=0.0905 mA, I max=0.06934 mA, Voc=435.1 mV, Vmax=342.6 mV, FF=0.60 mA, and η=0.012 %. Therefore SnS and SnO2:Sb thin films are suitable for making solar cells.

DESIGN AND FABRICATION OF A GREENHOUSE MONITORING AND CONTROL SYSTEM BASED ON GLOBAL SYSTEM FOR MOBILE COMMUNICATION AND BLUETOOTH

Nyaga Stephen Gitonga-M.SC

Department: Physics
Supervisors: Dr. Mathew Munji
Dr. Raphael Nyenge

Greenhouse technology should be embraced as a way of minimizing food insecurity in Kenya. The insecurity is brought about by climate uncertainties. Greenhouses have attempted to solve this problem by enclosing crops in a climatically controlled environment. Each greenhouse has distinct parameters. Data on these parameters need to be collected at regular intervals. Depending on the type of crop, these parameters need to be controlled within the specified limits to achieve the maximum efficiency and yields. In the past, greenhouses utilized electromechanical devices such as thermostats to monitor and control the environment. Mechanical systems lack the flexibility and precision required for
greenhouse control. Some modern greenhouses use computers to control the environment. Computers based controllers are station based, bulky and costly. In this study a wireless prototype greenhouse monitoring and control system that is flexible, cheap, easy to maintain and easy to assemble was developed and implemented. The general objective of this research work was to design, fabricate and implement a microcontroller-based prototype to monitor and control greenhouse parameters using sensors, SMS technology and Bluetooth signals. The hardware consisted of ATmega328 microcontroller, Global System for Mobile communication (GSM) SIM800L module, HC05 Bluetooth module, HD44780U Liquid Crystal Display (LCD) module, 5 volt 4 channel relay module, Light dependent resistor (LDR) sensor and digital humidity and temperature (DHT11) sensor. The LDR sensor was utilized to measure light intensity while the DHT11 sensor was utilized to measure humidity and temperature levels in the prototype greenhouse. The DHT11 and LDR sensors, the relay, the LCD, the GSM and the Bluetooth modules were interfaced to the ATmega328 microcontroller. Through Arduino software, a program was written in C language, developed and uploaded to the ATmega328 microcontroller to run the greenhouse prototype. The program is designed to operate in automatic or manual mode. In automatic mode, the microcontroller constantly monitors the digitized values from the sensors and compares them with the optimized values and checks if any control procedures needs to be taken. In manual mode, the system could be operated wirelessly by use of GSM or Bluetooth module. The designed prototype greenhouse system is able to measure temperature, humidity and illuminance levels in the prototype greenhouse and display the values on the LCD. The system transmits the sensor measured values to owner’s phone via Bluetooth or a GSM and keeps these parameters at optimum levels by use of two fans, heater, bulb and a sprinkler. The GSM module is used for remotely monitoring and controlling the devices via a smart phone by sending and receiving Short Messaging Service via GSM network. If the user is in the vicinity of the prototype, the Bluetooth and software installed in the smart phone provides a wireless link between the prototype and the cell phone. This project therefore provides a cost effective and efficient means of monitoring and controlling greenhouse parameters. In addition the system allows mobility during monitoring and control process. The reliability of the designed system can be exploited to build a network of such monitoring and control systems for several greenhouses. A website can be incorporated in the designed system to monitor the actual greenhouse values and save the data in an online database for future reference. The designed prototype greenhouse can be applied in the agricultural sector in the design and implementation of greenhouses.

**ANTI-PLASMODIAL ACTIVITY OF ASTEMIZOLE-METHYLENE BLUE COMBINATION THERAPY AGAINST CHLOROQUINE SENSITIVE AND RESISTANT PLASMODIUM FALCIPARUM AND THEIR SAFETY IN BALB/C MICE**

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Department: Zoological Sciences

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Dr. Lucy Kamau

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Plasmodium is protozoa from the Apicomplexa phylum which causes malaria. In the tropics and sub-tropics, approximately 3.3 billion people are at risk. Artemisinin Combination Therapy (ACT), the current prime treatment, has been reported to have a possible emergence of resistance. This is a major obstacle that contributes to high mortality. Drug repurposing offers an appealing alternative to de novo drug development. Although astemizole and methylene blue have been
reported to have anti-malarial properties, their safety when used in combination has not been explored. This study aimed at evaluating the optimum growth of Plasmodium falciparum 3D7 and W2, efficacy of astemizole-methylene blue combination therapy these strains and the safety of the combination therapy. To establish this, the growth potential of Plasmodium falciparum 3D7 and W2 was assessed by maintaining a continuous culture. Afterwhich, eight concentrations of astemizole-methylene (1:1, 3:1 and 3:1) using drug concentrations of range 7.81 μg/ml to 1 mg/ml, were assessed in triplicate against the Plasmodium strains. The parasites were cultured in complete media containing human erythrocytes in 96 well plates at 36.80C. Parasitemia was determined by microscopy and non-linear regression was used to determine the interactions of the drugs. Combinations that had high efficacy AST-MB 3:1 and 1:3 were administered in Balb/c mice (N=25) intraperitoneally. Clinical symptoms, hematology, biochemistry, and gross pathology were assessed and results presented as mean ± standard error of mean. ANOVA was used to analyze the results. Differences were considered significant if P values were less than 0.05 (p<0.05), F values were more than 2.78. Astemizole-methylene blue 3:1 (31.25 μg/ml and IC50 of 22.28±0.24 μg/ml) was the most efficacious drug combinations against P. falciparum 3D7 (F= 8.439, p=0.017). Whereas astemizole-methylene blue 1:3 (31.25 μg/ml and IC50 of 15.07±0.60 μg/ml was the most efficacious drug combinations against P. falciparum W2 (F= 5.428, p=0.0035). In spite of this, all astemizole-methylene blue drug combinations showed antagonism (FIC>2). Also, astemizole was found to be less efficacious against both parasite strains in comparison to methylene blue. Frome the toxicity study, astemizole-methylene blue 3:1 drug combinations was associated with lower weight of the heart (F= 8.967, df=4, p=0.007) and liver (F= 4.339, p=0.0001) compared to the negative controls. This indicates abnormalities in these organs. Astemizole-methylene blue 3:1 reduced the platelet levels to undetectable amounts (F= 27.40, df=4, p=0.005). Both Plasmodium falciparum 3D7 and W2 had good and similar growth potentials, astemizole-methylene blue combinations were efficacious against both parasite strains and astemizole-methylene blue 3:1 adversely affected Balb/c mice. This study recommends evaluating methylene blue and astemizole combinations with lower concentrations of astemizole to counter the effects.

**SNAKE-ANTIVENOM ACTIVITY OF SELECTED MEDICINAL PLANT EXTRACTS FROM TURKANA AND UASIN-GISHU COUNTIES OF KENYA**

Yego Kennedy Kimurgor-M.SC

Department: Biochemistry, Microbiology and Biotechnology

Supervisors: Prof Eliud NM Njagi

Dr George O Orinda

Prof Joseph K. Gikunju

The present management regime of snake bites requires the use of antivenom immunoglobulins. However, these antivenoms have the limitations of being expensive, requiring cold storage facilities and have problems of hypersensitivity reactions in some individuals. A. spinosus, C. articulatus, C. spinarum, C. molle and R. usambarensis have been used traditionally in the management of snake bites in Turkana and Uasin-Gishu Counties, Kenya. However, their efficacy and safety have not been scientifically validated. The aim of this study was therefore to determine in vivo and in vitro efficacy and safety of these selected medicinal plants using the mouse model, agarose-erythrocyte-egg yolk gel plate and human citrated plasma methods. Relevant plant parts from these medicinal plants were collected, dried under shade, crushed into powder and then extracted with distilled water. The potency of the antivenom activity of the plant extracts was
estimated by determining the least dose of venom required to kill 50% of the mice (LD50) and the dose of the extract required to protect half the animals (ED50) in a statistically significant group of animals from two times the LD50. The antivenom studies suggest that the aqueous plant extracts possess antivenom activity against Naja subfulva venom both in vivo and in vitro. Evaluation of acute and sub-acute toxicity studies indicated no lethality after intraperitoneal administration of the extracts in mice at 1600, 2500 and 5000 mg/kg body weight. Repeated daily oral administration (sub-acute studies) of the five aqueous plants extracts at 10, 300 and 1000 mg/kg body weight to mice for 14 days demonstrated significant decreases in the average weekly body weight, increases in percent organ to body weight, decreases in several biochemical analytes and enzymes, and increases in white blood cell and differential white blood cell count. However, no changes in the level of red blood cells, hemoglobin and the related indices were observed except for C. spinarum extract-treated mice where red blood cells, hemoglobin and packed cell volume were decreased. Phytochemical screening of the five aqueous plants extracts demonstrated the presence of phenols, alkaloids, flavonoids, flavones, steroids, terpenoids, triterpenoids, tannins, saponins and cardiac glycosides. Of the seventeen mineral elements levels estimated in the five aqueous plants extracts, twelve were below the recommended daily allowances and five were above the recommended daily allowances. In conclusion, the aqueous extracts of A. spinosus, C. articulatus, C. spinarum, C. molle and R. usambarensis, neutralized snake venom activity of Naja subfulva and demonstrated toxicity in the subacute toxicity studies. The observed antivenom activity and subacute toxicity could be explained by the phytochemicals and mineral elements present in these five aqueous plants extracts from Turkana and Uasin-Gishu counties. The five studied plants could therefore be used at the tested extract efficacy doses.

SAFETY AND EFFICACY OF Prosopis juliflora LEAF EXTRACT AS A POTENTIAL TREATMENT AGAINST VISCERAL LEISHMANIASIS

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Department: Zoological Sciences

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Leishmaniasis is a major health problem in the tropics and sub-tropic regions where it is endemic. The treatment of leishmaniasis is faced with several drawbacks. Up to date there is no vaccine against leishmaniasis. The current antileishmanial drugs are associated with high resistance and relapse rate. The drugs are highly costly, toxic and have to be administered in hospitals hence not freely accessible to Leishmania infected populations. Prosopis juliflora (PJ) is a locally available plant and has been tested and shown to be effective against helminthes, bacterial diseases and fungal diseases. However, no study has been done to evaluate the antileishmanial effect of PJ methanolic leaf extract. This research was therefore, aimed at testing the leishmanicidal activity and toxicity of PJ leaf extract in BALB/c mice and in in vitro test systems respectively. BALB/c mice of mixed sexes aged between 6 and 8 weeks were used for this study in groups of 8 mice each. For determination of effects of test compounds in a murine model of visceral leishmaniasis, mice were infected intraperitoneally with 2x 106 virulent Leishmania donovani parasites and observed for five weeks for disease establishment. Treatment with the plant extract was done from week 6 and involved daily oral administering by use of gavage needle while Sodium stibogluconate (SSG) for reference drug group and normal saline for infected non-treated mice group were injected intraperitoneally for 21 consecutive days. Weight changes were observed and recorded once weekly during the treatment period. Parasite load was determined by counting parasites in splenic impression smears
while antileishmanial IgG antibodies were quantified from serum samples. Parasite burden data was expressed as the mean per 1000 cell nuclei of spleen cells ± standard deviation. The data were subjected to One-Way Analysis of Variance (ANOVA) and Tukey post hoc test was used where applicable. A value (p<0.05) was considered significant. The in vitro test of the antileishmanial activity of the methanolic leaf extract of PJ exhibited significant (p<0.05) inhibition of L. donovani promastigotes. There was significant inhibitory effect exhibited by PJ leaf extract on promastigote growth during the in vitro test whereby up to 98 percent parasites were killed at the highest concentrations of the extract as compared to SSG which showed less inhibitory effect on the promastigotes. Both test compounds had significant (p≤ 0.05) effect on the promastigote parasite burden. The splenic amastigote counts after 21 days of administration of both PJ leaf extract and SSG showed significant reduction in the number of amastigotes in the spleen in mice treated with PJ as compared to the SSG treated group hence PJ leaf extract is a suitable candidate in development of a safe antileishmanial compound owing to its safety and efficacy. Prosopis juliflora methanolic leaf extract induced a higher total IgG level as compared to the reference drug which could be attributed to higher titre in IgG2a subtype in mice treated with the extract which was not induced in mice treated with SSG. The findings of this study conclude that PJ exhibited higher inhibitory effects against L. donovani promastigotes as well as amastigotes and induced significantly higher IgG antibody levels as compared to SSG (p<0.05). Furthermore, PJ was safer than SSG on Vero E6 cells. This study therefore, recommends that PJ leaf extract has a high potential for use as an antileishmanial agent and can be evaluated further in non-human primate models before application in the treatment of clinical visceral leishmaniasis.

ASSESSMENT OF THE LEVELS OF SELECTED SKIN LIGHTENING AGENTS IN COSMETICS MARKETED IN MOMBASA COUNTY, KENYA

Muanje Abdulwakil Daudi - M.SC

Department: Chemistry

Supervisors: Prof. Ruth Wanjau

   Dr. Mildred P. Nawiri

The practice of skin-lightening has reached epidemic levels in many nations around the globe, and especially in many African countries. In Kenya, the practice is common in major urban centres like Nairobi, Kisumu, Eldoret and Mombasa. The skin lightening cosmetics occur in various forms including topical creams, soaps and bleaching powders. Ingredients such as hydroquinone (HQ), mercury (Hg), arbutin (ART), kojic acid (KA), ascorbic acid (AA), magnesium ascorbyl phosphate (MAP) are used in skin lightening cosmetics. The use of skin lightening cosmetics containing harmful ingredients which pose great risk to severe health problems has been on the rise in Kenya. The objective of this study was to quantify the levels of Hg, HQ, ART, KA, AA and MAP in creams, soaps and some powdered skin lightening cosmetics sold in Mombasa County. Purposive non probability sampling design was used to collect skin lightening cosmetics and a reversed phase high performance liquid chromatography and cold vapour atomic absorption spectroscopy were used as analytical techniques. The data was analysed by SPSS system and the mean values were compared using analysis of variance and t-test. The levels of Hg ranged between 0.001±0.0001 to 0.01±0.0004 μg/g in creams, 0.0100±0.0005 to 0.0200±0.0012 μg/g in soaps and 0.0010±0.0001 to 0.0028±0.0001 μg/g in powdered samples. The level of HQ ranged between 0.0027±0.01 to 0.0120±0.04 % in creams, between 0.0030±0.02 to 0.0059±0.11 % in soaps and between 0.0029.75±0.01 to 0.0226±3.88 % in powders. The level of ART ranged between 0.0051.45±0.35 to 1.1068.44±3.74 % in creams, between 0.00035±0.0023 to 1.77±0.01 % in soaps and between 0.0241±0.21 to 0.0253±1.22 % in powders. The level of KA

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ranged between 0.003403±0.02 to 0.01033 ±0.11 % in creams, between 0.00339 ±0.01 to 0.00713±0.30 % in soaps and between 0.00339±0.01 to 0.00713±0.30 % in powders. The level of AA ranged between 0.0867±0.03 to 0.3806±3.31 % in creams, between 0.0915±2.99 to 0.332±0.58 % in soaps and between 0.1177±3.87 to 0.7203±55.22 % in powders. In MAP, the levels ranged between 0.0837±0.01 to 0.08745±0.01 % in creams, between 0.0289 ±12.79 to 0.112±19.49 % in powders samples and it was below detectable limits in soaps. Levels of Hg did not differ significantly in creams and soaps, while AA did not differ significantly only in soaps. The other parameters differed significantly. The mean levels of all the skin lightening agents were below the maximum permissible limits. However, persistent use of these cosmetics may result to accumulation and long term manifestation of their effects.

HIV TRANSMISSION TO INFANTS IN RELATION TO MODE OF FEEDING AND MOTHER'S IMMUNOLOGICAL STATUS IN KIRINYAGA COUNTY, KENYA

Njoka Catherine T. Njagi-M.SC

Department: Biochemistry, Microbiology & Biotechnology

Supervisors: Prof. Michael Gicheru

Dr. Joseph Mwatha

Ailments such as malaria, measles, pneumonia, common cold and HIV/AIDS are the major cause of death in infants and children. worldwide, it was estimated that 1.8 million children below 15 years were HIV infected by 2017. Over 90% were infected through mother to child transmission (MTCT) during pregnancy, at birth and during breast-feeding. During that period, Kenya had about 12,940 children who had the infection and 1,480 of these were from Kirinyaga County. The Kenyan government has put intervention measures to reduce these infections by ensuring availability of highly active anti-retroviral therapy (HAART) and promoting delivery by elective caesarean section. These measures are intended to decrease HIV transmission rate to below 2% and reduce new pediatric HIV infections by 90% by 2030. The current study was aimed at investigating HIV transmission to infants in relation to mode of infant feeding, use of anti-retroviral therapy (ART) during pregnancy and mothers“ immunity in Kirinyaga County. This was a cross-sectional study involving data collection from 303 HIV-positive pregnant women offered prenatal services in Kerugoya County Referral Hospital. These women gave birth to live infants and accessed local program on prevention of Mother to child transmission (PMTCT) of HIV for 18 months. Use of anti-retroviral drugs and mode of feeding the infant during the first six months of life were considered as the main possible determinants of HIV transmission. CD4-count and viral load test were performed on all women after delivery to evaluate ART treatment and monitor the mothers“ immunity. HIV testing on infants was performed 6 weeks after birth using polymerase chain reaction (PCR). Antibody tests were done at 9th and 18th months using rapid test with either Unigold or Determine strips. In cases where antibody tests were positive while the first PCR was negative, confirmatory PCR test was performed. Categorical data was analysed using Chi-square test with 95% confidence interval as the set confidence limit. Out of 303 infants, 2 died before 9 months of age, 14 were HIV-positive by end of study period. All the 14 infants who got the infection were exclusively breast-fed. Results showed that exclusive breast-feeding (EBF) had a significant effect in HIV transmission (χ²=4.167; df=1; p= 0.045) compared to exclusive replacement feeding (ERF), which had no transmission. Low CD4 cell count was not significantly associated with HIV transmission (χ²=2.966; df=1; p=0.085) although MTCT was higher in babies born of mothers with low CD4 count. Anti-retro viral regimen being taken by mothers did not influence risk of transmission (χ²=1.944; df=1; p = 0.132) although there were more MTCT from mothers who were on Zidovudine+ Lamivudine+ Nevirapine (AZT+3TC+NVP) combination
compared to other regimes. In conclusion, vertical transmission of HIV did not occur to infants who were replacement fed nor to those delivered through cesarean section. The study recommends use of exclusive-replacement feeding. This should however be made Affordable, Feasible, Accessible, Safe and Sustainable (AFASS) to HIV positive mothers. Expectant HIV-positive women should be monitored closely for ARV adherence and adverse drug reactions (ADR's) during antenatal and breast-feeding period. More studies need to be done regarding the ARV combination used by the mothers during Breast-feeding period.

EFFECTS OF LAND USE ON SPRING AND STREAMFLOW WATER QUALITY IN RIVER MALAGET SUB-CATCHMENT, KERICHO COUNTY, KENYA

Mercy Kirui-M.SC

Department: Geography

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Various studies have shown that land use impacts on water quality are attributable to about 80 % of diseases in the developing world. The main objective of the study was to evaluate the effects of land use on water quality in River Malaget sub-catchment. The specific objectives were to: i) establish spring and streamflow water quality; ii) determine the water quality index of the selected sampling points and iii) evaluate the relationship between spring and streamflow water quality in River Malaget sub-catchment. Stratified and purposive sampling techniques were used to select 33 sampling points, i.e., 10 springs and 1 river point from each of the 3 agro-ecological zones. Maps of spatial distribution of the water quality parameters tested were developed. Additionally, MANOVA was used to compare the means from the three agro-ecological zones. Water samples from each sampling point were tested for 15 parameters. WQI for each sampling point and for the entire study area was determined. Parametric results revealed that all samples tested for temperature, electrical conductivity, DO, nitrates and total hardness were within the recommended levels. However, some of the samples tested for nitrates, ammonia, pH, turbidity, total dissolved and suspended solids, BOD, E.coli, fluorides, and phosphates were found to exceed the recommended levels. Pillai’s trace in MANOVA, revealed a significant variability in the distribution of the water quality parameters in relation to land use as the means of the three agro-ecological zones were significantly different, V =1.535, F(20, 44) =7.262, p <.05. Univariate ANOVAs on each of the variables revealed significant effect on temperature, F (2, 30) = 4.833, p > .05; electrical conductivity, F (2, 30) = 14.730, p > .05; turbidity, F (2, 30) = 3.600, p > .05; and nitrates, F (2, 30) = 5.879, p > .05. WQI values ranged from 12.22 to 237.86, i.e., from excellent to very poor water quality. Most of the samples had WQI values which were less than the threshold value of 100. More than half (57.58 %) of the samples were of excellent water quality, while 24.24 % were of good water quality, 9.09 % were of poor water quality and the remaining 9.09 % of the samples were of very poor water quality. The high levels of turbidity in the sub-catchment in all the samples, which exceeded the NEMA and WHO guideline values is largely responsible for the very high WQI values. Student’s independent T-test analysis showed a significant difference (p < 0.05) between streamflow and springs for TSS, total hardness and nitrates. In conclusion, indeed, land use has had an impact on streamflow and spring water quality in the study area, considering the spatial distribution of temperature, nitrates, electrical conductivity and turbidity. It is recommended that farming activities and waste disposal is done far from water sources, at least about 30 m away. Additionally, water should be boiled before drinking and all springs should be protected against contamination.
Beans play a significant role in food security owing to its nutritional value and generation of income. However, output of beans in Western Kenya is hindered by diseases, pests, soil infertility and unfavorable weather resulting to low productivity. Of the many diseases of beans, common bacterial blight (CBB) caused by Xanthomonas axonopodis pv. Phaseoli (Xap) is a disease of economic importance in common beans (Phaseolus vulgaris L.). Due to the fact that chemicals have not been effective against CBB, the use of resistant genotypes is a central management strategy. The current study was carried out in the field and in the green house of KALRO-Kakamega in 2013 and 2014 to screen nine bean genotypes for resistance to common bacterial blight disease. Experiments were conducted in randomized complete block design with three replications in a 9×2×2 factorial factor during the greenhouse and field screening and 4×2×2×2 field experiment when assessing the role of soil amendments and method of cropping on disease incidence and severity. During growth, data on plant height, number of pods/plant, length of pods and size and number of CBB spots was taken. Yield parameters were also assessed. During the study, the isolates that were recovered from leaf samples were categorized as Xanthomonas like, with regard to their yellow pigment and convex mucoid morphology. Reaction to Xap was assessed as the number of spots on the leaves and diseased leaf area (DLA). The findings from the experiment revealed a significant variation (P<0.05) on the entire traits studied among the nine bean genotypes. The experiment revealed that the mean CBB disease severity was significantly lower in bean plants that were not inoculated compared to those that were inoculated. Disease incidence, distribution and severity differed significantly (P<0.05) among the different bean genotypes. The CBB was significant (P<0.05) in the bean genotypes and was influenced by the soil amendments applied and the method of cropping used either monocropping or intercropping. Data from the field and greenhouse experiments were in conformity. None of the evaluated genotype was immune to CBB. CAL77 and Cal156A genotypes exhibited high level of resistance to CBB, thus a better variety to use. Seven genotypes namely Cal 285, Cal 256, CAL271A, Cal274, KK 8 and Cal 87 showed moderate resistance. In the green house, it was observed that disease symptoms were severe in beans planted in non-sterile soil and inoculated with Xap compared to those planted in sterile soil and non-inoculated respectively. In the field trials, it was noted that bean plants grown with DAP were significantly (P<0.05) taller, had more number of pods per plant and significantly (P<0.05) higher yield per plot than those grown on soils with chicken manure. Monocropped beans had significantly (P<0.05) higher growth and yield parameters that were studied. This study therefore recommends that further evaluation and screening be done, susceptible genotypes be tried in other locations; establish the factors that confer high levels of tolerance in Cal 77 and Cal 156A and advice farmers on the correct farming methods.
The rapidly increasing global population, climate change and dwindling resources have made it very difficult to meet global food demand. To address the issue of food insecurity, sustainable intensification of agriculture (SIA) has been proposed. However, the consequences of poorly managed agricultural intensification can negatively affect the ecosystem. Biochar and compost application has been widely recommended as a highly promising soil fertility replenishment option to promote sustainable agriculture. In Kenya, only relatively recent few studies have been done to assess the effect of biochar applications on the quality of poor soils. This research is therefore, intended to investigate how biochar, applied alone or with compost could improve soil quality and increase maize yield in an acidic Ferralsol in Kamiti sub-catchment, Kiambu County of Kenya. Specifically, the study sort to 1) assess the effect of biochar, compost and their combined application on soil physical properties, 2) assess the effect of biochar, compost and their combined application on soil chemical properties and 3) determine the effect of biochar, compost and their combined application on maize growth and yield. To achieve the objectives, 6-month field trial was carried out on an acidic Ferralsol with high Al and Fe contents at the Kenyatta University Research Farm using the Randomized Complete Block Design (RCBD) comprising six treatments which included; control with no amendment (C), 20 t ha\(^{-1}\) Biochar (20B), 40 t ha\(^{-1}\) Biochar (40B), 20 t ha\(^{-1}\) Compost (20C), 40 t ha\(^{-1}\) Compost (40C) and 20 ha\(^{-1}\) Biochar + 20 ha\(^{-1}\) Compost (BC). During the study, data on plant height, stem diameter and leaf area were taken after every 2 weeks. Plant samples taken at the tasseling stage and soil samples taken at physical maturity stage of the maize, respectively, were dried, ground and sieves (< 2 mm) before being sent to the Soil Science laboratory of the Department of Soil Science / Soil Ecology, Ruhr University Bochum for analysis. Statistical analysis of data was done using SPSS (version 25) statistical software. The study showed that single or combined application of biochar and compost reduced soil bulk density. The reduction in bulk density followed the decreasing order BC<40B<40C<20B<20C and C. The incorporation of biochar and compost singly or in combination increased soil water holding capacity as well as aggregate stability by 56.7% (in 40B) and 71.5% (in 40C) respectively. Soil chemical properties including available phosphorus (P), electrical conductivity (EC), exchangeable K and Mg, and cation exchange capacity (CEC) were significantly increased in the amended soils than the unamended control. Plant growth parameters such as plant height, stem diameter and leaf area were increased by the application of the organic amendments with BC treatments recording the highest increases. Grain yield (GY) and hundred grain weight (HGW) were significantly improved relative to the control treatment for all organic amendment, with increases in grain yield between 12.2% (in 40B and 40C) and 22.8% (in BC). The results suggest that the application of biochar and compost can reduce soil bulk density, increase aggregate stability, water holding capacity, soil nutrient status and maize yield. The study concludes that biochar-compost-base soil management approach offer the potential for soil fertility improvement, and recommend it for adoption by farmers in Kamiti sub-catchment.

**REDUCTION OF ERRORS CAUSED BY CROSS-POLARIZATION IN A MICROSTRIP ANTENNA**

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Supervisors: Dr. Mathew K. Munji
Microstrip antennas are used for transmitting and receiving electromagnetic signals. The transmitted signals can be reflected back within the building. This affects the strength of signal transmission. Polarization of the electric field determines the signal strength of the electromagnetic wave. If cross polarization occurs then it results in multiple signals which interfere with each other causing some signal loss during transmission. The main focus of the study was to reduce cross polarization in a microstrip antenna. The study involved designing a circular patch antenna (CPA) and Concentric microstrip patch antenna (CMPA) with an annular patch enclosing the circular patch. Simulation and optimization was also done using Ansoft high frequency structure simulator (HFSS). The antenna was then fabricated using photolithography method using the optimized radii. The results obtained during simulation and fabrication process were then analysed and evaluated. During optimization, the initial radius of the circular patch and the width of the annular patch were varied to match the required frequency of 2.4GHz. The antennas were fed using a single coaxial probe towards the centre of the circular patch. The antenna characteristics like the radiation efficiency, directivity, gain, return loss (RL) and the radiation patterns were studied using HFSS software and the patch size optimized to obtain the best results. The analysis and testing of the fabricated antenna was done using a Scalar Network Analyzer (SNA). The RL in decibels (dB) was studied to show the effect of cross polarization on a CPA and the Concentric Microstrip Patch Antenna (CMPA). In Ansoft HFSS, the circular patch had a gain of 1.8147 and directivity of 4.1753 while the circular patch with annular had a gain of 2.3354 and directivity of 5.3212. The simulated data showed a performance improvement of 29% for the gain, 27% for the directivity and 11% for RL. A study of the radiation patterns of the two designs showed reduced cross-polarization in the performance of the antenna with an annular patch around it. The RL of the fabricated antenna; CPA and CMPA were studied using the SNA. The experimental circular patch had a Return loss of -9.697dB and the CMPA had a Return Loss of -13.170 dB. The experimental CMPA reduced cross polarization by 35.8% as compared to the fabricated CPA. The research has therefore proved that an annual ring can be used as a polarization filter to reduce cross polarization errors of signals transmitted by a circular patch antenna. The experimental CMPA gave the best performance in error reduction as compared to the CPA. The results obtained show that cross polarisation can be reduced by removing some metal on the surface of a circular patch antenna and the size of the antenna should be reduced as much as possible to enable it fit in handheld devices.

**COGNITIVE ENHANCING, ANTIOXIDANT ACTIVITIES AND PHYTOCHEMICAL PROFILE OF AQUEOUS AND METHANOLIC EXTRACTS OF Piliostigma thonningii (Schum.) AND Lonchocarpus eriocalyx (Harms)**

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Dr. Antony Nuriithi Irero
ABSTRACT
Cognitive impairment is the commonest manifestation of neurologic disorders. The degeneration of cholinergic activity has been associated with advancing age, oxidative stress, brain injury and other associated complications. Conventional medicines used for cognitive deficits are only palliative, ineffective, inaccessible and are associated with adverse events. This necessitates the search for alternative and complementary approaches like herbas to ameliorate this condition. Various plants including Ptilostigma thomsonii and Lonchocarpus eriocalyx are used in traditional medicine for treating cognitive deficits among other neurologic disorders. Surprisingly, despite the rich history of herbal therapy, accessibility, affordability, and fewer side effects, scientific data validating these therapeutic effects is lacking, hence the present study. The cognitive enhancing effects of the studied plant extracts on scopolamine induced cognitive-impaired mice models, their effects on \textit{ex vivo} MDA profiles, their antioxidant properties as well as their phytochemical profiles were determined as per the standard protocols. The results revealed remarkable cognitive enhancing, \textit{ex vivo} MDA profile lowering and \textit{in vitro} antioxidant activities. Cognitive enhancing effects were reflected in significantly shorter transfer latency times and navigation distances during acquisition training, longer latency time in the target quadrant during the probe trial and low MDA profiles in mice that were orally administered with the studied plant extracts (p<.05). Generally, the aqueous stem bark extract of \textit{P. thomsonii} showed significantly higher cognitive enhancing effects and antioxidant activities (P<0.05). \textit{In vitro} antioxidant activities of the studied plant extracts were reflected in significantly low IC50 and EC50 values compared with the controls (p<.05). Upon qualitative phytochemical screening, presence of various antioxidant including phenols and flavonoids was recorded. The bioactivities of the studied plant extracts reported herein were attributed to the presence of these bioactive phytoconstituents which, either solely or synergistically, modulated various body mechanisms to counter/evade oxidative stress-induced cell damage, thereby ameliorating cognitive impairment in mice. Based on the findings, these plant extracts can be used to manage cognitive impairment and associated conditions. In addition, they can be used as antioxidant sources and supplements to counter oxidative stress. Further research to isolate and characterize bioactive molecules from these plants for cognitive impairment are recommended. Furthermore, the specific mode(s) through which the studied plant extracts exert their bioactivity other than through the restoration of redox homeostasis should be elucidated.
Antioxidants are chemical substances that inhibit oxidation (oxidation is a chemical reaction that can produce free radicals, leading to a chain reaction that may damage cells or other molecules) Free radicals are reactive oxygen species and reactive nitrogen species generated by our bodies naturally during normal metabolic functions. If free radicals overwhelm the body ability to regulate them, a condition known as oxidative stress ensues. Oxidative stress leads to the destruction of biomolecules such as lipid membranes leading to lipid peroxidation which is responsible for the pathogenesis of various disease conditions such as cancer, hypertension, and cardiovascular diseases. Hence the application of an external source of antioxidant can assist in coping with the treatment of this oxidative stress. Research on natural antioxidant has gained interest in the recent past as demand for safer and readily available antioxidant by food industries and preventive medicine has gained momentum. This study was carried out to determine the in vitro antioxidant potential of Methanolic extracts of Caesalpinia volkensii, Acacia hockii and Vernonia lasiopus. The plant samples were collected with the help of local herbalists in Embu County, Kenya and transported to Kenyatta University Biochemistry and Biotechnology laboratories for cleaning, air drying, milling, and extraction using methanol as a solvent. The antioxidant activities of the extract were evaluated through the scavenging effect of 2, 2-diphenyl-1-picrylhydrazyl (DPPH), hydrogen peroxide (H2O2) and total ferric reducing power. The antioxidant data obtained was assayed against that of the standard (Ascorbic acid). All the extracts demonstrated significant DPPH scavenging activities with the highest percentage of 87.22% for ascorbic acid and 82.73%, 76.86%, 67.36% for A. hockii, V. lasiopus and C. volkensii respectively. Ascorbic acid which was used as a standard demonstrated lowest IC50 of 0.198. The IC50 for the plant extracts were 0.601, 0.40 and 0.47 for C. volkensii, A. hockii and V. lasiopus respectively. They also demonstrated reducing the power that increased with increase in extracts concentration. In hydrogen peroxide assay increase in extracts, the concentration decreased the scavenging activity for all the extracts. There was a significant difference between the extracts and the standard. The methanolic extracts of Caesalpinia volkensii, Acacia hockii and Vernonia lasiopus demonstrated significant antioxidant activity. Qualitative phytochemical screening indicated the presence of secondary metabolites associated with antioxidant activities. The present study therefore validates and supports the traditional use of Caesalpinia volkensii, Acacia hockii and Vernonia lasiopus in management of oxidative stress and recommends further research for the development of phytomedicine with antioxidant properties.
Demand for and access to clean water has greatly risen due to population growth. Pollution of water because of discharge of chemicals from industries has led to the scarcity of this resource. The main components of these pollutants consist of dyes, pesticides, heavy metals, volatile organics and chlorophenols. Photocatalytic degradation with semi-conductors has been found to be efficient for the destruction of the above pollutants. Titanium dioxide is a better semi-conductor photocatalyst because of its availability and non-toxicity. In this research, Titanium dioxide (TiO2) thin films were prepared on titanium plate substrates using a simple and inexpensive anodization technique. Titanium foil was used as the working electrode (anode) and aluminium (Al) was the counter electrode (cathode). The titanium specimens were anodized in an electrolyte which consisted of 0.5mol/L sulphuric acid (0.5M H2SO4) and 0.075% wt HF. The anodization parameters for the titanium dioxide thin films like anodization time, applied voltage, concentration of electrolyte solution and current density were monitored and optimized. The anodic thin films were then pigmented with copper in form of a sulphate and annealed at 4500C for three hours to enhance their photocatalytic activity. Thin film models based on Fresnel formula in optical transmittance and reflection were utilised to estimate thickness of TiO2 films and determine the optical properties of TiO2 films. Optical characterization was done through UV-VIS Lambda 19 spectrophotometer. Near-normal total reflectance was measured on as anodized and copper pigmented samples in the solar (300-2500nm) wavelength range. Spectrophotometric reflectance data was analyzed to obtain the absorption coefficient and using the same to determine the band gap of the films. It was noted that the films exhibited reduced solar integrated reflectance for TiO2 samples prepared at lower anodic voltages of 50, 60 and 70V. The copper pigmented, and annealed, TiO2 samples exhibited both direct and indirect energy band gaps in the ranges, 3.38-3.86 and 2.50-2.74, respectively. Further, annealing and copper doping of the films lead to increased absorption. The photocatalytic activity of the films was assessed by measuring the rate of degradation of 10ppm methylene blue in UV light source. Copper doped TiO2 exhibited enhanced photocatalytic performance in compared to pure TiO2. An increase in the anodization voltage caused subsequent increase in photocatalytic activity of films with 70V as the optimum voltage above which photo degradation of methylene blue decreased. The study recommends for structural analysis of the copper pigmented TiO2 films be done to give an in-depth of the different phases of titanium dioxide which is critical in optical and photocatalytic properties of TiO2.

**HUMAN USE OF FOREST TREES AND ITS IMPACT ON TREE DIVERSITY AND ABUNDANCE IN CHEMUSUSU FOREST, BARINGO COUNTY, KENYA**

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Dr. Grace W Gatheri

Trees provide both direct and indirect benefits to humans, who depend on them for their livelihoods. Forest ecosystems are vulnerable to over-utilization and exploitation due to the sensitivity of its complex and highly diverse ecosystem. The aim of the study was to determine the human impact on tree species diversity, abundance, plant population structure and uses of forest trees by local communities adjacent to Chemususu forest Reserve in Koibatek Sub-County, Baringo County. Questionnaires and interview schedules were used to collect data on uses of trees; the target group were households...
within 3km stretch from the forest edge. The data on trees species, diversity, abundance and plant population structure was collected by systematic sampling using six parallel belt transects each starting from the forest edge. Sampling was conducted in quadrats of 20m x 20m (for trees) located along the transects at 500m intervals. In each of the quadrats, all the trees species were identified, counted and diameter at breast height (DBH), measured at 1.36m outside the bark to the nearest cm. Indicators of human disturbance were assessed to determine the extent of human impact. The Statistical Package for Social Sciences (SPSS) was the main tool for quantitative data analysis from both questionnaires and interview schedules. Analysis of Variance (ANOVA) was used to test whether the mean number of cut stems and debarked trees varied with distance from forest edge. ANOVA was also used to test for variation in the mean diversity indices, tree species abundance and DBH with distance from forest edge. In both cases, tukey test was used to separate the means. Shannon-Wiener Diversity index (Magurran, 1988) was computed. Pearson’s correlation was carried out to determine the relationship between abundance of cut stems and debarked trees with distance from human settlement in each study plot and to investigate the relationship between mean species abundance, diversity, and DBH with distance from human settlement. Majority of the local residents had stayed in the region for more than 15 years and perceive the forest as important for various uses, 98.4% for spiritual and cultural purposes, timber (97.52%), tourism and recreation (96.3%) and hunting (97.1%). Three trees species, Olea europaeae, Dombeya torrida and Olea capensis were used for firewood as well as charcoal and formed a large proportion of used trees. Trees used for timber Juniperus procera, Podocarpus falcatus and the exotic cupressus lusitanica had been heavily extracted. There was no significant relationship between the number of charcoal kilns and distance from the forest edge (r = -0.849; P=0.069). This also applied to the number of plots with evidence of pit sawings with distance from the forest edge (r = 0.555; P=0.333) but the number of plots with split stems decreased significantly with distance from the forest edge (r = -0.892; P =0.043). There was no significant variation in the mean number of cut stems and mean number of debarked trees with distance from human settlement (F(4, 25) = 0.82; P=0.546) and (F (4, 25) =1.795; P=0.162), respectively. Tree diversity did not vary with distance from human settlement (F (4, 25) = 0.189). There was a significant difference in the mean number of trees in different DBH classes (F (4, 25) = 5.181; P =0.002). The number of trees on the lower DBH classes was more than those on the higher classes at various distance intervals, but this difference was not statistically significant. The study showed that the community role in forest degradation was significant and they highly depended on it for their livelihood. Thus, it was important to understand the relationship between the community and the forest. Alternative sources of trees used for timber and charcoal should be encouraged to reduce pressure on forest trees.

**ASSESSMENT OF SELECTED ESSENTIAL MICRONUTRIENTS IN SOME INDIGENOUS FRUITS IN KAKAMEGA COUNTY, KENYA**

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Supervisors: Prof. Ruth Wanjau
Prof. Hudson Nyambaka

Fruits are a good source of micronutrients, yet they are less consumed. Kakamega County has various types of fruits either planted or growing wildly. Most of the fruits consumed are exotic such as avocados, mangoes, pawpaw, oranges, passion fruits and pineapples while the wild and indigenous fruits are usually neglected, seen as weeds and food for children and very poor rural people. In Kakamega County the indigenous fruits are well distributed among the rural areas and members of the community lack awareness of the nutritional importance of such fruits as Physalis peruviana L, Rhus vulgaris M, and Psidium guajava L and therefore they do not consume well. This has caused some members especially the poor to be
nutritionally affected. These indigenous fruits are rich in essential micronutrients such as vitamins and essential trace elements that help in immune boosting, destruction of free radicals and general physical growth. The need to promote such fruits requires that the levels of micronutrients present be known. Thus this study assessed levels of some micronutrients such as trace elements (Zn, Fe, Mn, Cu, and Cr) and vitamins (L-ascorbic acid (vitamin C), α-tocopherol (vitamin E), and β-carotene (vitamin A)) in selected indigenous fruits in Kakamega County, Kenya. The vitamin content was determined using HPLC and the elements analyzed using AAS. Data was analyzed by one way ANOVA followed by SNK test where there was no significant difference at p<0.05. The mean levels of Zn, Fe, and Cu were significantly high in P. peruviana (4.54±1.41, 1.48±0.10 and 11.86±1.43 mg/100g respectively) compared with other fruits. Rhus vulgaris was significantly high in Mn (14.81±1.69 mg/100g) and Cr (0.73±0.04 mg/100g) while guava varieties were significantly high in vitamins A, E and C compared with other fruits. Among the guava varieties studied the red sweet guavas were significantly high in ascorbic acid (231.64±8.40 mg/100g), followed by red bitter guavas (205.16±4.53 mg/100g). White sweet guavas had significantly high mean level of β-carotene (3.40±0.05 mg/100g) while red bitter guavas showed significant high levels of α-tocopherol (0.54±0.00 mg/100g). The study showed that the levels of micronutrients in the fruits studied were significantly different between sub-counties and between the fruit varieties. Many of the fruits studied met and some even exceeded the RDA requirements. A fresh piece of guava of mass 200 g is sufficient to provide twice the RDA for β-carotene and greater than six times of vitamin C. A fresh piece of 200 g of white sweet and red bitter guavas can provide more than half the RDA for Mn (69.96% and 86.96% respectively) and Cr (58.02% and 63.00% respectively). The same piece of red sweet guava can provide 64.27% RDA for Cu and 50.0% for Cr. Consuming 200g of wet fresh Physalis peruviana can provide 78.77% of Cu whereas the same amount of fresh Rhus vulgaris provides 145.99% of RDA of Cr and 118.48% of Mn. 200 g of wet fresh Physalis peruviana and 200 g of wet fresh Rhus vulgaris is sufficient to provide the adult daily requirement of beta-carotene and ascorbic acid. Promotion of these indigenous fruits will provide cheap sources of essential micronutrients that can help in reducing micronutrient deficiency. The result of the study is useful to food policy makers and also used to sensitize the public on nutritional matters.

PREVALENCE AND GENETIC DIVERSITY OF HEPATITIS B AND C VIRUSES AMONG HUMAN IMMUNODEFICIENCY VIRUS INFECTED INDIVIDUALS IN SIAYA COUNTY, KENYA

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Supervisors: Dr. Anthony Kebira N, Dr. James O. Nonoh

Viral hepatitis B and C co-infections among Human immunodeficiency virus infected patients is significantly becoming a worrying public health problem worldwide. The three infectious viruses’ shares common routes of transmission including, blood transfusion, sexual intercourse, and injecting drug users among others, which could be the reason for the co-infections observed in the previous studies in sub-Sahara Africa. In Kenya, the documented data from the studies conducted indicate that Nyanza recorded the highest HIV prevalence at 15.1% with Siaya County at 17.8% of the total national population. The invention of Highly Active Antiretroviral Therapy was thought to reduce morbidity and mortality rate of HIV patients, however, HIV patients continue to suffer from liver related illness due to the co-infections with hepatitis B and C viruses, in addition to the emergence of drug resistant strains. Despite this there is scarcity of information on hepatitis B and C co-infections, circulating virus genotypes and drug resistant strains in Kenya. This study evaluated the co-infections of viral hepatitis B/C and genetic diversity and drug resistance of HBV among HIV infected individuals in Siaya County. Approval to conduct this study was sought from Kenyatta University Research and Ethical Review Committee and SCRH Institutional review Committee. This was a hospital based cross-sectional study in which a total of 225 blood samples were aseptically collected from consenting participants. The blood samples were separated and plasma used for serological assays. Serological detection of HBsAg and anti-HCV IgM was performed using On Site Rapid...
Test Kits as prescribed by the manufacture (CTK Biotech, Inc, San Diego, USA). Viral DNA was extracted from positive HBsAg plasma samples using QiampTMDNA Mini kit as per the manufactures’ instructions. HBV-pol gene was amplified by nested PCR using specific primers and the amplicons directly sequenced by automated ABI 377 DNA sequencer (Applied Biosystem, Foster City, USA) using BigDye Terminator Kit (Applied Biosystem®). Generated sequences were phylogenetically analyzed together with references sequences using Molecular Evolutionary Genetics Analysis (MEGA X version 10.0.4) software. Of (225) individuals who participated in this study, 157(69.8%) were female and 68(30.2%) were males. Their ages were ranged between 3 and 76 years with mean of 38.26 years. Majority of the participants were married (146/225) with most of them having secondary education level (116/225). Gender, age and level of education were not significantly associated with HBV infection. However, place of residence was associated with HBV infection. In addition, only gender and marital status were significantly associated with HCV infections. Overall prevalence for HBV/HIV was 6.2% (14/225); HCV/HIV was 4.0% (9/225) while that of HIV mono-infection was 89.8% (202/225). Nevertheless, none of the study participants was infected with all the three viruses. HBV drug resistance mutation rt169F was detected in one participant. However, the rest of the 10 individuals were infected with HBV drug susceptible strains. Of the 11 samples that were successfully sequenced, the phylogenetic analysis revealed the sequences belonged to HBV genotype A1. The study findings reveal that the levels of HBV/HIV and HIV/HCV co-infections could be higher than reported here with circulating strains remaining susceptible to treatment. There is therefore a need for continuous surveillance of HBV, HCV infections and monitoring circulating trends of these viral genotypes and drug resistance in this region in order to guide vaccine design and optimize treatment.

**ANALYSIS OF LYCOPENE, VITAMIN A AND BETA CAROTENE IN RED CACTUS (Opuntia ficus-indica) FRUIT IN NYERI COUNTY, KENYA**

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Dr. Jane Murungi

Vitamin A deficiency (VAD) has been a serious public health problem in the developing countries especially in Africa, mostly in pre-school age children and in pregnant and lactating mothers. It contributes to 7 million pregnant women and approximately 127 million of preschool-aged children and about 1-2 million deaths every year. It has been reported that about half a million new cases of blindness emerge yearly. This has for a long time been solved in addition to modern medicines by using locally available dark green leafy vegetables (DGLVs), which are believed to also contain high levels of beta-carotene (BC). Unfortunately, they are seasonal. BC is an important source of vitamin A (retinol) and its deficiency causes morbidity and mortality in children and adults. A diet rich in lycopene is related to a decreased risk of cancer of digestive track, prostate and pancreas. Vitamin A, beta-carotene and lycopene have been found in tomatoes and carrots which require a lot of water for their growth. Red cactus (Opuntia ficus indica) fruit grows wildly along the road and in the forest in the dry areas and it is consumed by herders. This fruit has not yet entered the market, yet it could contain substantial amounts of phytochemicals (antioxidants) such as lycopene, vitamin A and beta-carotene. It grows throughout the year in arid and a semi-arid area (ASAL) hence it can supplement DGLVs, tomatoes and carrots. The objective of this study was to determine the levels of beta-carotene, lycopene and vitamin A in Red cactus at unripe, ripe and overripe stages using high-performance liquid chromatography (HPLC). The area of study was Chaka, Thegu area of Nyeri County. The unripe (the breaker stage), the ripe (completely red) and overripe (the ripe kept for 5 days to overripe) red cactus fruits were picked with the help of a taxonomist who helped in identifying the fruit and its botanical name. The phytochemicals were extracted from the fruits and analyzed using HPLC and the data was analyzed using ANOVA. The mean of beta-carotene levels in unripened cactus was 0.04 ± 0.002 mg/100 g and increased to 0.07 ± 0.001 mg/100 g at the ripe stage and 0.09 ± 0.003 mg/100 g when overripe. The mean lycopene levels in red cactus was 3.26 ± 0.12 mg/100 g.
when unripe and increased to 7.06 ± 0.11mg/100g when ripe and finally to 13.56 ± 0.50 mg/100 g when overripe. The mean vitamin A levels in (μg/100 g) in red cactus was 1.27 ± 0.05 μg/100 g when unripe and increased to 2.14 ± 0.03 μg/100 g when ripe and then decreased to 1.47 ± 0.06 μg/100 g when overripe. The results from this analysis showed that the amounts of beta-carotene, lycopene and vitamin A increased significantly (P<0.001) during ripening. From the results it’s important that people living in the dry regions and where this fruit grow should be encouraged to eat the red cactus fruits at the ripe and overripe stage of ripening to get the maximum benefit of VA and both lycopene and beta-carotene respectively. The fruits should not be consumed at the unripe stage since their levels are low and they cannot be of much benefit. This fruit can be a supplement to other sources. The information obtained on the levels should be availed to the industries set up to produce red cactus products to improve on the utilization.

**PHENOTYPIC AND GENETIC CHARACTERIZATION OF SELECTED KENYAN GROUNDNUT (Arachis hypogaea.l) VARIETIES**

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Groundnuts also known as peanut (Arachis hypogaea L.) and ‘njugu karanga ’locally is one of the principle economic oilseed and is largely cultivated in warm regions of Kenya. Groundnut contributes significantly to domestic food security and cash revenue through the sale of the seeds. The study aimed at evaluating genetic diversity and phenotypic characterization of groundnut varieties grown in some parts of Kenya. Thirty genotypes each from six varieties (ICG83708, ICGV99568, CG7, ICGV12991, RV and Chalimbana) were obtained from KALRO (Kakamega) based on quality traits. Digital Vernier calipers was used to measure seed length and breadth while an electronic weighing balance measured seed weight in each variety with five replicates. Seeds were planted in cylindrical cans with 0.2m3 of soil and allowed to germinate for two weeks. Leaf trait measurement was done using 15cm ruler and the data was recorded in excel spreadsheet and exported to MINITAB v17 software. Extraction of genomic DNA from each genotype variety was done using a modified CTAB method. DNA amplification was carried out using11 SSR primers and the products resolved in 2% agarose gel with manual scoring of bands. GenALEx 6.502 software was used to calculate AMOVA and heterozygosis, PowerMarker version 3.25 was used to calculate genetic distance, PIC, Allele number, gene diversity while phylogeny reconstruction was done using DARWIN version 6 with Bootstrap values at 1000 permutations. A dendrogram of cluster analysis was constructed using UPGMA based on simple matching coefficient of 11 microsatellite markers. Clustering of genotypes based on Euclidian distance of the 7 seed and leaf traits were grouped into 2 major clusters .in terms of the principle components generated the first two showed more Eigen values with 67.2% variability of all the traits studied. On genetic diversity a total of 35 alleles were detected across the loci of 11 primers used. Major allele frequency ranged from 0.9333 in IPAHM 165 to the least frequency of 0.6333 in IPAHM 176 with an average of 0.7610 across all the markers. The expected heterozygosity had a mean of 0.3178 with highest value of 0.4511 in IPAHM 176. The lowest dissimilarity index was observed between replicates of icg83708 and icgv99568 while Chalimbana-4 had the highest dissimilarity index of 0.7826. Phylogenetic tree had three major clusters and with high bootstrap values in genotype icgv99568 replicates.cg7 replicates clustered together with high confidence limits of 70%.AMOVA on the genotypes studied had observed within population variations of 69% while 31% was attributed to among population variations. From the study results phenotypic diversity indicated variations based on seed and leaf traits. Primer IPAHM176 was the most informative marker and should be utilized in selection of parent plants with good quality traits. Breeding programs on groundnuts could utilize grain and seed traits since they are informative and discriminatory.

**EFFECT OF INDOMETHACIN ON SELECTED PROTEIN DIGESTING ENZYMES IN THE NORWAY RAT, RATTUS NORVEGICUS**

Onyingo Joseph Opondo-M.SC
Rats are rodents of the genus Rattus and are commensals. They are rapid breeders and tend to breed all year round. Rats are responsible for the transmission of many diseases, are sources of allergens and harbour fleas and ticks which are parasites that carry diseases. Rats destroy agricultural produce, household items and documents leading to huge financial losses. Biological and physical methods of rat control have proved inefficient, while rodenticides use is associated with high cost, risks and dangerous side effects. Indomethacin has been shown to lead to 100% mortality in the Norway rat experimentally, with accumulation of undigested food in their stomach. This research therefore determined the effects of indomethacin on selected protein digesting enzymes pepsin, trypsin and amino peptidase in rats. One hundred and fifty female rats were randomly divided into six groups of twenty five rats each. Group A was used as control while B, C, D, E and F served as experimental groups and were given 12.5mg/Kg, 25mg/Kg, 50mg/Kg, 100mg/Kg and 150mg/Kg of indomethacin respectively. Five rats in each group were euthanized at intervals of one hour, two, four, eight and twelve hours from the time of indomethacin administration. The rats were dissected and the gut contents removed. The digesta from the stomach, duodenum and ileum were collected, centrifuged, and the supernatants gently pipetted into sterile vials and then frozen in liquid nitrogen. The activity of digestive enzymes in the specimens were determined by continuous spectroscopic enzyme bioassays. Analysis of data was done by one way analysis of variance (ANOVA) while significant difference in the means of experimental groups was determined using post hoc ANOVA test (L.S.D). Regression analysis showed a linear relationship between indomethacin dose and enzyme activity. The results were expressed as mean ± standard error. The results showed that increase in dose of indomethacin administered leads to a decrease in the enzyme activity. Pepsin activity at 12.5mg/Kg dose was 214.2±0.6μg/mol while at a dose of 150mg/Kg the activity was 51.4±0.5μg/mol. Trypsin activity at a dose of 12.5mg/Kg, was 113.5±0.03 μg/mol while at 150mg/Kg dose the activity was 29.0±0.1μg/mol. Amino peptidase activity at 12.5mg/Kg dose was 126.5±0.04μg/mol while at 150mg/Kg dose, the activity was 33.5±0.09μg/mol. The enzyme activity is inversely proportional to the length of time taken after indomethacin administration. Pepsin activity after one hour was 214.2±0.6μg/mol while at twelve hours the activity was 108.8±0.4μg/mol. Trypsin activity after one hour was 113.2±0.03μg/mol while after twelve hours the activity was 55.5±0.05μg/mol. Amino peptidase activity after one hour was 126.5±0.04μg/mol while after twelve hours the activity was 67.8±0.03μg/mol. The mean enzyme activities in all groups were significantly different from each other at p<0.05. The results of this study have provided better understanding of the physiological basis of functioning of indomethacin as a rodenticide and its effects in digestion of rats. The findings of this study should be used by government officers to educate the masses on control of rats using indomethacin. The mechanism by which indomethacin decreases protein digestive enzyme activity should be investigated.

EVALUATION OF ANTIOXIDANT AND ANTI-INFLAMMATORY ACTIVITIES, TOTAL PHENOLIC AND FLAVONOID CONTENT IN SELECTED MEDICINAL PLANTS, NON-EDIBLE MEDICINAL MUSHROOMS AND SEAWEED

Nasike Siangu Belinda-M.SC
Medicinal plants play a major role for sources of lead compounds in drug discovery. Studies done have shown that plants, fungi such as mushrooms and seaweeds are a good source of bioactive compounds with anti-inflammatory, antioxidant, anti-cancer and antimicrobial activities. Antioxidants play main role by hindering oxidation by protecting cells from damage by free radicals. This protects the body from cancer and other chronic ailments like heart diseases. Anti-inflammatory effect is also important as it diminishes swelling and pain due to inflammation. A lot of studies have been done on medicinal values of higher plants but less on marine sources and wild non-edible medicinal mushrooms. Phenolics and flavonoids have a wide range of biochemical activities including antioxidant as well as anticarcinogenic. In this study, the anti-inflammatory and antioxidant activities, phenolic content and total flavonoid was evaluated from wild non-edible medicinal mushrooms: Ganoderma applanatum, Ganoderma lucidum and Trametes elegan; medicinal plants; Urtica dioica, Prunus africana, Bridelia micrantha and brown algae; Eucheuma denticulatum. The antioxidant activity was assessed using 2, 2-diphenylpicryl-1-hydrazyl (DPPH) free radical scavenging method with ascorbic acid as reference standard while anti-inflammatory activity was achieved in vivo using mice as test animals. The total phenolic analysis was done using Folin-Ciocalteu reagent and expressed as Gallic acid equivalent (GAE/g) while the total flavonoid content was determined by use of aluminium chloride colorimetric method and expressed as Quercetin equivalent (QE/g). Antioxidant activity of all extracts increased with concentration. Ganoderma applanatum showed the highest scavenging activity of (95.56%, IC50< 0.025) while Urtica dioica leaves had the lowest (11.99%, IC50> 0.03) activity at 0.3mg/ml of the extract. Ganoderma lucidum showed the highest total phenolic (156 ± 3.45 GAE/g) and flavonoid (31.16 ± 0.04 QE/g) content. Anti-inflammatory activity was done using formalin induced edema. The plant extracts showed a significant effect (p<0.05) in reducing the edema. The results of the study showed that the plants are source of lead compounds with promising antioxidant and anti-inflammatory activity. There is need to separate and identify actual phytochemicals responsible for antioxidant and anti-inflammatory activities. The findings of this study will provide information on potential sources of phytochemicals with anti-inflammatory and antioxidant activity from selected medicinal plants, mushrooms and marine algae.

MANAGEMENT OF CROWN GALL DISEASE IN SELECTED Rosa hybrida FARMS IN KENYA USING Artemisia annua LEAVES AND Zingiber officinale RHIZOME EXTRACTS

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Supervisors: Dr. Jonah Birgen
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Rose flower is the world’s most traded cut-flower with 74% of it coming from Kenya. Kenya has potential for higher rose production if challenges of pests and diseases are dealt with. Pests like spidermites, false codling moth, caterpillars, aphids, thrips, nematodes and diseases such as crown gall, downy mildew, powdery mildew and botrytis highly compromise production. Crown gall disease, caused by Agrobacterium tumefaciens is the most problematic disease of roses in Kenya and causes a production loss of up to 60% depending on age and variety. This study evaluated the prevalence of crown gall disease and management of the disease using Zingiber officinal rhizome and Artemisia annua leaves extracts, in an effort to replace conventional chemicals due to their environmental and economic cost. Survey of selected flower farms in Kenyan showed a crown gall prevalence ranging from 0.1% to 65%. Zingiber officinale and Artemisia annua phytochemical screening indicated presence of terpenoids, flavonoids, alkaloids, saponins, glycosides, phenols and tannins. Agrobacterium tumefaciens colonies used in testing antibacterial effect of the extracts were isolated from crushed crown galls and purified through their growth in Congo red YEMA medium and yeast peptone glucose agar. The colonies were authenticated biochemically by Gram staining, motility test, citrate utilization, catalase production, urease production and ketolactose test. Antibacterial effect of the extracts were determined by measuring the diameter of the inhibitory zone around the filter discs soaked in extracts on Agrobacterium tumefaciens inoculated media. Micro-
dilution technique on microtiter plate was used to determine the minimum inhibitory concentrations of the plant extracts used in soaking the filter discs. Artemisia annua, Zingiber officinale, mixture of Zingiber officinale and Artemisia annua had Minimum inhibitory concentration of 125mg/ml, 62.5mg/ml and 31.25mg/ml respectively. The recommended rate (6.25 ml/l) of copper hydroxide was used. Copper hydroxide and Artemisia annua had antibacterial inhibitory zone of 12.8mm. This zone was significantly different from that of Zingiber officinale and mixture of Zingiber officinale and Artemisia annua which was 10.6 and 10.2 mm respectively (P ≤0.05). The research therefore revealed that Artemisia annua and copper hydroxide inhibited bacterial growth better than Zingiber officinale and mixture of Zingiber officinale and Artemisia annua.

Results of treatments done on inoculated rose plants in the greenhouse in terms number of plants with galls, gall weight and stem length showed similar trend to in vitro bacterial growth inhibition. The ultimate stem length of Artemisia annua and copper hydroxide treatment were 69.4cm and 65.8cm respectively. These lengths were better and significantly different from that of Zingiber officinale and mixture of Artemisia annua and Zingiber officinale which were 48.8cm and 54.4cm respectively (P ≤0.05). From the results of this research, Artemisia annua and Zingiber officinale extracts are promising biocontrols for crown gall in roses. Farmers are recommended to continue with integrated crown gall control methods and pursue plant extracts as an alternative. The performance of Artemisia annua extracts compared well with that of conventional copper hydroxide and is therefore the better option.

THERAPEUTIC, PHYTOCHEMICAL ANALYSIS AND SAFETY OF SOLANUM SCABRUM AND CLEOME GYNANDRA IN MANAGEMENT OF HAEMOLYTIC ANAEMIA IN WISTAR ALBINO RATS

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Anaemia is a disease, according to the World Health Organization, in which the haemoglobin concentration is below 12 g/dl of blood. The prevalence of anaemia in school going children in Africa is 64.6% while in Asia it is 47.7%. Anaemia is also prevalent among women and infants and threatens the life of millions of people every year. Modern therapies in management of anaemia are either too expensive or unavailable to many communities. Use of plants in the management of anaemia is not uncommon in some communities in Africa. Solanum scabrum and Cleome gynandra are some of the plants that have been reported to be used in the management of anaemia in some African communities. Despite this, there is no report on the scientific evaluation of the two plants in terms of management of anaemia and their toxicity. The World Health Organization suggested that the scientific evaluation of the safety of herbal medicines should be undertaken. The aim of the current study was to determine the efficacy, safety and phytochemical composition of Cleome gynandra and Solanum scabrum as applied in the treatment of haemolytic anaemia in wistar albino rats. The haematinic effect of the two plants was done by treatment of albino wistar rats with 40 mg/kg body weight of 2,4-dinitrophenylhydrazine intraperitoneally for 5 days and only rats with haemoglobin concentration lower than 11 g/dl were considered to be anaemic. The anaemic rats were given daily oral doses of the freeze dried aqueous extract of Solanum scabrum and Cleome gynandra at 250 mg/kg body weight and 500 mg/kg body weight respectively and separately for a period of three weeks. In the toxicity test, the sub-acute toxicity was done by treatment of non-anaemic rats with 3000 mg/kg body weight dose given once to different groups for each plant. The animals were observed for a period of 48 hours and the mortality rate was zero so the LD50 dose for the plants extract was above 3000 mg/kg. The chronic toxicity test was done by treatment of non anaemic rats with a daily aqueous oral dose of 1000 mg/kg body weight of each plant for 28 days. The haemoglobin concentration of the anaemic control and the 250 mg/kg body weight dose of Cleome gynandra were still below 11 g/dl showing moderate anaemia after one weeks of treatment. The test animals given the plant extract had their haemoglobin concentration increased to above 11 g/dl within two weeks for both the 500 mg/kg body weight dose groups and the 250 mg/kg body weight dose groups of both plant extracts as compared to the normal control which
the haemoglobin concentration was still below 11 g/dl and still anaemic. After three weeks of treatment with the plant extract all groups including the anaemic control had a haemoglobin concentration above 11 g/dl. The chronic toxicity test after 4 weeks of treatment of non anaemic rats with 1000 mg/kg body weight of both plants aqueous extracts separately showed significantly higher levels of the blood enzymes alanine transaminase, aspartate transaminase and alkaline phosphatase as compared to the normal control. The direct and total bilirubin levels were also significantly elevated as compared to the normal control. This indicated some level of liver toxicity. The 500 mg/kg doses showed an increased haemoglobin concentration of the anaemic rats to above 12 g/dl within 2 weeks of treatment with the plant extracts while for the anaemic control and the 250 mg/kg body weight dose of Solanum scabrum it required at least 3 weeks for the haemoglobin concentration to be above 12 g/dl. The 250 mg/kg body weight dose of Cleome gynandra was the only one with a haemoglobin concentration below 12 g/dl after 3 weeks of treatment. The freeze dried aqueous plant extracts of Solanum scabrum and Cleome gynandra have some haematinic activity against 2,4-dinitrophenylhydrazine induced haemolytic anaemia in wistar albino rats. The chemical phytochemicals analysis showed that the two plant extracts contained tannins, alkaloids, flavonoids, saponins, terpenoids, polyphenols and cardiac glycosides. The two plant extracts also contain important trace metals like selenium, iron, copper, zinc, cobalt and manganese which are important in synthesis of haemoglobin and erythrocytes therefore reverse anaemia.

REFERENCE INTERVALS FOR COMMONLY REQUESTED HEMATOLOGICAL PARAMETERS IN ADOLESCENTS LIVING IN KILIFI COUNTY, KENYA

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Clinicians require hematological reference measure that they can use to compare with the results presented to them by laboratories in order to make medically correct decisions because Peoples’ laboratory sample analysis results are not the same. These reference measures are derived from a healthy group of people for each hematological parameter and can be affected by age, sex, previous exposure to environmental pathogens, genetic makeup, and nutritional status of individual, pregnancy, ethnicity, and altitude, the choice of various techniques, machines, and reference samples. Clinical Laboratory and Standards Institute approved guideline-third edition recommends that medical laboratories develop their own individual reference intervals from their local population they serve or carry out validation before effectively using the ones found from different regions. The objective of this study was to develop the hematological reference intervals for healthy adolescents living in Kilifi County, Kenya. 600 volunteers aged between 13 and 17 were recruited for this cross-sectional study. However, only 314 volunteers (52.3%) were enrolled, furthermore only 242 volunteers (40.3%) got inclusion space in the final analysis to develop the hematological reference limits. Reference sample population was divided into two groups of 121 each based on gender to permit 95% confidence intervals to be non-parametrically enumerated in the establishment of lower and upper limit of the confidence intervals. The methods used for the electronic auto hematology analyzer were: Flow cytometry, colorimetric and electrical impedance. A medical statistical software was used to calculate, lowest and highest values, Median, Standard deviation, Arithmetic mean, Coefficient of kurtosis and Coefficient of Skewness. Mann-Whitney tests for independent samples, was used to find out if there were significant differences between the developed male and female hematological values in adolescents living in Kilifi. Statistically significant differences between females and males was accepted where ρ<0.05. This study determined Kilifi adolescents hematological reference values for twenty three commonly requested parameters in Hemoglobin concentration, Red blood cells count, Hematocrit levels, Red blood cells indices, White blood cells count and Platelet count, based on the blood analysis. Test for normal distribution indicated that: in males; out of the 23 parameters
measured in 121 samples, 4.35% parameters were normally distributed whereas 95.65 (%) parameters were not normally distributed. In females, out of the 23 parameters measured in 121 samples: only 39.13 (%) parameters were normally distributed whereas 60.87 (%) parameters were not normally distributed. Based on gender, out of the 23 parameters analysed 39.13 (%) showed significant differences among males and females whereas 60.87 (%) showed comparable results. From the study findings, there were both comparable and significant differences between the developed hematological values in adolescents living in Kilifi County and the commonly used published data developed from Africa and other parts of the world. The established age and sex specific reference intervals for adolescents’ haematological parameters and their indices for Kilifi County, Kenya should be adapted for use in the Health Institutions within the county. In future, studies should also focus on paediatric and geriatric populations in Kilifi County, and other regions of Kenyan.

SPATIAL DISTRIBUTION OF Opuntia stricta (Haworth) IN TSAVO EAST NATIONAL PARK, KENYA

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Kenya has experienced biological invasions some of which are considered to have significant consequences on the socio-economic status of affected communities. At the ecosystem level, they change community structure and composition. Available data on invasive species in the East African region shows that 34 different species of invasive plants have invaded Kenya. Notable examples of invasive species include Opuntia stricta (Haw) and water hyacinth (Eichhornia crassipes). This research was aimed at assessing the impact of the invasive O. stricta on other plant species and wildlife in the Tsavo East National Park, Kenya (TENP). The study area was divided into twelve transects which was 2km long and ten quadrats each 5m by 5m established systematically along each transect. Data on Opuntia stricta coverage, woody plants, dung of elephant to denote their presence and soil samples was collected in each quadrat. ANOVA was conducted on Opuntia stricta coverage and confirmed that it's distribution differed significantly per the sampled transects. Correlation between Opuntia stricta and soil chemical composition, elephant distribution and presence of woody plants was carried out. Among the soil chemical composition investigated, phosphates negatively correlated with O. stricta cover at a significance level of $p=0.002$ for $\alpha=5\%$. Sodium amount and O. stricta cover were found to have a positive correlation at a significance level of $P=0.039$ for $\alpha=5\%$. A positive correlation between the presence of elephants and O. stricta percentage cover was significant with $r=0.37$ and $P=0.000$ at $\alpha=5\%$. O. stricta cover and woody plant species had an insignificant positive correlation with $P=0.177$ at $\alpha=5\%$. Findings of this study are crucial in any strategies adopted to guide in the control of rapid spread of O. stricta in Tsavo East National Park and other similar ecosystems.

ISOTHERM DERIVATION OF OPTIMUM POTASSIUM FERTILIZER DOSAGES FOR MAIZE FARMING: MATUNGULU SUB-COUNTY, MACHAKOS, KENYA

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Population increase in Matungulu Sub-County in Kenya has led to pressure on arable land where agriculture is the main economic activity. This has caused a gradual shift in land use practices over the years from extensive to intensive agriculture. There has been a decrease in maize yields over the years despite the use of phosphate (P) and nitrogenous (N)
fertilizers, which may suggest that the levels of potassium (K) in the soil may be low. Fertilizer application for maize farming in Kenya has been reported to be 12 bags per hectare compared to the recommended 50 bags per hectare. This study sought to determine concentration levels of potassium, organic carbon, phosphorus, nitrogen and soil pH of composite soil samples from five farms. Five composite soil samples were collected at depths of between 0-30 cm from five selected farms that have been consistently under intensive cultivation. Fractionation of potassium was done by sequential extraction of soil samples with distilled water, ammonium acetate and nitric acid. Concentration levels of potassium in the extract were determined using a flame photometer. From potassium concentration levels, thermodynamic parameters were determined. pH meter, colorimeter, nitrogen analyzer, flame photometer, and Bray-1 extractable were used to determine the levels of soil pH, organic carbon, nitrogen, potassium and phosphorus respectively. The relationship between the adsorbed and equilibrated potassium concentration, quantity/intensity were determined by plotting suitable adsorption isotherms. The isotherms were in turn used in determining the buffering capacity of potassium and the concentration levels of potassium adsorbed on non-specific sites in the soil. The basic soil fertility indices were found to be below their critical values except phosphorus. It was also established that the optimum potassium dosage for growing maize in Matungulu sub County is 4.25 mg/L which was achieved by adding 95mg per kilogram of soil. Potassium concentrations in roots straw and grain were found to be 114.26, 450.28 and 3.034 mg/kg respectively. The soils were found to be acidic despite having sufficient calcium and magnesium above critical levels they were also found to lack basic soil fertility indices. In view of these findings that soil in Matungulu is highly deficient of potassium, farmers should be advised to incorporate potassium rich fertilizers in their farming. They should also be encouraged to prepare composite manure using maize straws grown in potassium rich soils in order increase high crop yields.

**POST-HARVEST FUNGI OF STORED COMMON BEAN CULTIVARS IN MENOUA DIVISION, WEST REGION, CAMEROON**

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Dr. Jonah Birgen

Prof. Afui Mathias Mih

In Cameroon, common bean (Phaseolus vulgaris L.) is amongst the legumes which are greatly consumed. Farmers in Cameroon especially the Menoua Division grow different common bean cultivars which after harvest, are stored to be used as food over the storage period or for sale. Storage of agricultural products become prone to fungal infection over time. Studies on the microbiology of stored common bean has identified fungi as a major contaminant. However it is possible that the incidence and severity of fungal infection vary with different common bean cultivars over the storage period. This research aimed at assessing the population of fungi on common bean cultivars both at harvest and storage grown in the Menoua Division of Cameroon and also to characterize the fungal species obtained from these cultivars. Six different common bean cultivars both at harvest and storage were evaluated for fungal contaminants using PDA media. Initial characterization of fungal isolate was done morphologically. A One-way ANOVA was performed on the fungal population on the different common bean cultivars to determine whether their mean values were significantly different (P ≤0.05). Results showed that a total of 31 fungal colonies resulted from the plated common bean cultivars at harvest, while 80 fungal colonies were obtained from the stored cultivars. Analysis of variance showed no significant difference (P > 0.05) between the populations of common bean cultivars containing fungi at harvest. The population of fungi on stored cultivars differed significantly from each other (p ≤ 0.05). Highest fungal levels was observed on stored common bean cultivars. Four storage fungi genera were isolated from the different plated bean cultivars. Three could be identified as the genera Aspergillus, Fusarium, and Penicillium due to their morphological and microscopic characteristics. The fourth couldn’t be identified and was named Morphospecie or ‘Mycelia sterilia’. There was also a significant difference (P < 0.0001) between
the mean population of each of the fungal type isolated from the stored bean cultivars. Molecular analysis detected by the
sequencing of their ITS region confirmed the presence of different fungal species. The Morphospecie was identified as
Xylaria hypoxylon a member of the Ascomycetes. Other species identified included; Fusarium oxysporium, Aspergillus
flavus and Penicillium aethiopicum. Phylogenetic analysis and multiple sequence alignment using mutalin revealed the
relationship among the species. The species of fungi recovered from the stored cultivars signified poor preservation
methods carried out after harvest. From the study it was established that Aspergillus flavus, Penicillium aethiopicum,
Fusarium oxysporium and Xylaria hypoxylon were responsible for the spoilage of the common bean grains in store. There
also exist differences among common bean cultivars in susceptibility to damage by fungi under storage environment by
farmers in this region. The most susceptible common bean cultivar to fungal infection was the large seeded bean cultivar
and the least were pinto bean, navy bean and Pea bean cultivar. It is therefore recommended that Pinto, Navy and Pea
bean cultivar should be used for long term storage while the Large seeded, Black and kidney bean be used for short term
storage duration by farmers.

DETERMINATION OF ARSENIC LEVELS IN WATER AND SOILS FROM AHERO RICE IRRIGATION SCHEME AND IN AHERO,
MWEA AND IMPORTED RICE

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Supervisors: Prof. Wilson Njue

Dr. Henry Mwangi

Arsenic contamination in irrigation water and soils is a major environmental health hazard in the world. There is a major
potential risk to human health through consumption of agricultural produce grown in fields irrigated with arsenic
contaminated water and soils. Arsenic Levels have been analyzed in different crops such as rice, wheat, maize and
vegetables in different countries. Rice (Oryza sativa L.) is a crop cultivated mainly in irrigated water hence its bioavailability
to arsenic is much more than in other crops. This study investigated the levels of arsenic in water and soils in Ahero rice
irrigation scheme and in locally produced and imported rice. Hydride Generation Atomic Absorption Spectrometer was
used in the analysis. Locally produced rice (Sindano and Pishori) was sampled from Ahero and Mwea irrigation schemes
while imported rice from India, Thailand, and Pakistan was obtained from various market outlets Githurai, Eastleigh, Ngara
and Kenyatta. The level of arsenic in irrigation water and paddy soils was found to be 0.0230 ±0.010 mg/L and 0.1504 ±
(0.08) mg/kg respectively. There was a strong positive correlation in arsenic levels in rice and soils from Ahero irrigation
scheme (r2=0.97, P<0.0001). A weak correlation was found between irrigation water and rice (r2=0.16). The mean arsenic
concentration in rice from Ahero and Mwea irrigation scheme was 0.059±0.040 and 0.0371 ±0.03 mg/kg respectively.
There was no significant difference in the arsenic levels in Sindano rice from Ahero and Basmati (Pishori) rice from Mwea
Irrigation scheme. Basmati rice from Thailand had mean arsenic content of 0.126±0.001 mg/kg. The arsenic concentration
was significantly higher than in Basmati rice from Pakistan and India, with a mean of 0.075 ±0.001 and 0.062 ±0.01 mg/kg
respectively. The levels in the imported Basmati rice were significantly higher than locally produced Pishori rice, a Basmati
variety. Indian Sindano rice recorded significantly lower levels (0.088±0.02 mg/kg) than those from Thailand (0.153 ±0.02)
and Pakistan (0.175 ±0.02 mg/kg). Arsenic levels was significantly higher in imported Sindano rice from Pakistan and
Thailand compared to locally grown Sindano rice (p<0.0001). However, there was no significant difference in the levels in
Indian Sindano rice and the locally produced sindano rice (p>0.05). The levels of arsenic in rice from this study were within
the WHO recommended levels in rice grain of 1.0 mg/kg dry weight. Though the levels are safe as per this study, chronic
exposure from rice consumption could be a human health risk. The information from the study will form a basis of setting
limits of arsenic levels in rice sold in the Kenyan markets.
The demand for silicon in microelectronics has put a lot of strain on the availability and eventually high prices for silicon type of solar cells. In this work, nickel doped cadmium sulphide (CdXNi1−xS) was investigated. This material was used as a window layer, combined with antimony sulphide (Sb2S3) as an absorber layer in fabricating glass/SnO2:F/CdXNi1−xS/Sb2S3/C-Ag p-n junction solar cell. Thin films of CdXNi1−xS (CdS: Ni) and Sb2S3 were prepared by CBD method on ordinary glass substrates and the cell fabricated on SnO2:F glass. Characterization was done using the following techniques: EDX-Spectrometer applied in the determination of the elements present in the samples. Carrier concentration and mobility measurements were obtained using Hall Effect measurement while transmittance and reflectance data was measured using UV-VIS-NIR Spectrophotometer in the 300-1100 nm spectral range. The thickness for Sb2S3 thin films increased with deposition time and varied from 199-294 nm. The carrier density for Sb2S3 thin films was found to be between 9.7 x 10^15 and 1.07 x 10^17 cm^-3 while their carrier mobility was between 5.11 x 10^-4 and 9.60 x 10^-3 cm^2 V^-1 s^-1. The carrier mobility was observed to decrease with the deposition time. Transmittance below 21% and absorbance above 66% was observed for these films across UV-VIS region. Their Optical conductivity was within the range 4.09 x 10^7 - 8.36 x 10^12 Ω^-1 cm^-1. Band gap for these samples varied with deposition time and annealing. The band gap for as-grown and annealed samples ranged between 1.56 to 2.24 eV. The resistivity for these thin films decreased with the rise in the deposition duration causing an increment in the electrical conductivity. Samples sheet resistivity was within the range 5.09 x 10^2 and 1.50 x 10^5 Ω cm while the electrical conductivity was between 6.66 x 10^-6 and 1.96 x 10^-5 (Ω cm)^-1. In the elemental composition analysis for Sb2S3 samples, S ions was at 51.23%, Sb ions at 48.740% with the other impurities being less than 0.01%. The hall voltages hence ratio of hall voltage to current and hall coefficients for Sb2S3 thin films were positive proving that these thin films were p-type semiconductor materials. On the other hand the film thickness for CdS: Ni samples decreased with the increase in the volume of NiCl2 solution and the concentration of the reaction bath and ranged between 101 and 234 nm. In the elemental composition analysis for CdS sample; Cd ions was at 44.64% and S ions at 55.22% with other impurities contributing percentages below 0.1%. For CdS: Ni samples, Ni ions was at 4.006%, Cd ions at 74.35% and S ions at 21.64% with other impurities being less than 0.01%. The hall voltages hence ratio of hall voltage to current and hall coefficients for CdS: Ni thin films were negative proving that they were n-type semiconductor materials. Their carrier density ranged between 7.23 x 10^15 and 2.35 x 10^16 cm^-3 and the carrier mobility ranged between 6.16 x 10^-2 and 7.51 x 10^-1 cm^2 V^-1 s^-1. The carrier mobility reduced as the volume of NiCl2 solution in the reaction bath increased. Carrier mobility for CdS: Ni thin films was higher compared to that of Sb2S3 thin films. Spectral transmittance above 68% and absorbance below 20% in the VIS-NIR region was observed for CdX Ni1−xS thin films. Their optical conductivity was within the range 3.78 x 10^7 - 2.40 x 10^11 cm^-1. Band gap for as-grown and annealed samples varied with doping and ranged between 2.55 to 3.50 eV. The resistivity increased with the increase in the volume of NiCl2 causing a decrease in the electrical conductivity. The resistivity ranged between 4.53 x 10^2 and 6.98 x 10^3 Ω cm while the electrical conductivity was between 1.43 x 10^-4 and 2.21 x 10^-3 (Ω cm)^-1. After optimizing the properties for n-type and p-type materials for the operation of a solar cell, a glass/SnO2:F/CdX Ni1−xS/Sb2S3/C-Ag p-n junction solar cell was fabricated on SnO2:F glass. I-V characteristics graph gave the following solar cell parameters; value of Voc was 0.384 V, value of Isc was 0.0323 A, value of FF was 0.62 and the solar cell conversion efficiency was 0.63 %. The maximum voltage of 0.280 V and maximum current of 0.0273 A were found leading to a maximum power output of 0.00764 W. Research involving varying the concentration of the complexing agents used in the preparation of Sb2S3 and CdX Ni1−xS thin films is hereby recommended to study its effect on optical and electrical properties.
ELECTROCHEMICAL TREATMENT OF TEXTILE DYE WASTEWATER BY ALUMINIUM AND STAINLESS-STEEL ELECTRODES

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Department: Chemistry

Supervisors: Dr. Eric Masika
Dr. Margaret Ng’ang’a
Dr. Justin Maghanga

Pollution of water resources due to the increasing growth in industrialization continues to pose a great challenge to the rapidly growing population. Textile industries are among the principal polluters of surface water. The development of these textile industries has resulted in severe water pollution due to discharge of dye wastewaters to natural water courses. This laboratory scale study was aimed at establishing an eco-friendly wastewater treatment method dubbed electro-coagulation (EC) method. The main objective of the study was to establish an electrochemical and efficient method that would effectively remove COD and colour from azo dye wastewater using aluminium (Al) and stainless steel (SS) electrodes. Increasing current density and contact time significantly increased the removal of colour and COD. Increase in current density increased both COD and colour removal. When current density was increased from 15 to 47 A/m2 the colour removal increased from 71 to 99 % for the case of disperse blue with SS electrode. Increase in contact time 5- 20min. caused increase in colour and COD removal from below 50 to 98 and 78 % respectively for disperse blue with SS. When inter-electrode distance (IED) and dye concentration was increased the colour and COD removal decreased significantly. As the IED increased from 1-3cm the percentage removal of colour decreased from 99 to 45 % for the case of disperse blue with SS. Addition of sodium chloride enhanced the electrocoagulation process. Addition of NaCl from 0 - 0.4g enhanced colour removal from 15 to 80% for disperses black with SS. Under optimum operating conditions (current density 47.2 A/m2, Inter-electrode distance 1cm, SE 0.2 g/L, 0.1 g/L dye concentration and 25 minutes contact time) the performance of stainless steel on removal of colour recorded the highest removal at 97% compared to that of aluminium of 90%. the physio-chemical parameters where reduced to NEMA disposable levels making it possible for treated water fit for re-use. COD reduced by 81%, conductivity by 89% and turbidity by 88%. Operating cost was evaluated by adding cost of electrode per Kg at the market price and the cost of electricity per (kWh/m3) for SS= 50.56 KES/m3 and Al =50.55 KES/m3. This confirms the viability and a cost-effectiveness of the process.

DESIGN AND CONSTRUCTION OF A MICROCONTROLLER-BASED HUMAN AUDIO NOISE MONITORING AND CONTROL SYSTEM

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Department: Physics

Supervisors: Dr. Mathew Munji
Dr. Anthony Kiroe

Audio noise monitoring and control has been a subject of research for several decades. Researchers have developed audio noise monitoring systems which rely on computers, internet and mobile telephone services which are costly and bulky and whose output is not easy to associate with any medical or psychological effects of noise. Active noise control has been explored using digital signal processors and field programmable gate arrays which are more costly than microcontrollers. Complex algorithm has been used to develop most of the existing active noise control systems. This research involved design and construction of a prototype audio-visual noise monitor and controller based on AT91SAM3X8E microcontroller. The target noise was in the human audio frequency range and the environment was selected using a keypad. Four micro-
electro-mechanical system microphones were used as the primary transducers to convert the sound waves to analogue electric signals. The signals were multiplexed, fed to an A-weighting filter and demultiplexed. They were then transferred to the input of the microcontroller, which was programmed to compare the average noise levels to certain set points based on known national and international health standards. Once sound pressure level surpassed the thresholds, the microcontroller triggered the fetching of a pre-recorded audio file which was then fed to an audio amplifier and to a loudspeaker to give audio feedback to the audience about the noise level. Numerical value of the noise level, the environment, the set points and the warning message were displayed using a liquid crystal display unit. At the same time, automatic audio noise control was initiated. A hybrid active/passive noise cancellation headset was designed and implemented involving analog audio noise cancelling circuitry with digital monitoring. Timely, World Health Organisation based audio and visual feedback messages about the noise levels were achieved. A 17.10% average sound pressure level reduction index was attained from the noise control headset. The AT91SAM3X8E microcontroller was found to be a good candidate for human audio noise monitoring and control. This work recommends further exploration into possible use of better electronic components and test equipment’s towards improvement of results obtained from the procedures used.
SCHOOL OF AGRICULTURE

EFFECTS OF ORGANIC AND INORGANIC MULCHING ON WEEDS, DISEASES, GROWTH AND YIELD OF TOMATO (Solanum lycopersicum L) IN BUNGOMA COUNTY, KENYA.

Musito James Wafula-M.SC

Department: Agricultural Science and Technology

Supervisors: Dr. Joseph Onyango Gweyi
Dr. Everlyne Samita Namikoye

Tomato (Solanum lycopersicon) is a major commercial vegetable for small holder farmers in Kenya. Optimizing tomato production provides an opportunity to increase household incomes, improve standards of living and creating employment opportunities for small holder farmers in the tomato growing counties. Despite the favorable climatic conditions, tomato yields in tomato producing Counties remain far below the potential yields range in open field production of 40 to 100 tons per hectare. Low tomato yield is caused by poor soil moisture and fertility management and prevalence of pests and diseases. This study was carried out to evaluate the effects of organic and inorganic mulching on weeds infestations, disease incidences, physiological disorders, growth and yield of tomato varieties. The field experiment was laid out in a Randomized Complete Block Design (RCBD) in split-plot arrangement replicated three times. Two tomato varieties i.e. Cal J (Determinate) and Tylka F1 (Semi indeterminate) were the main plot treatment while the sub plot treatments were composed of black polyethylene film mulch (standard management practice), white polyethylene film mulch (standard management practice), sugarcane Trash at 3kg per meter square and No mulch. Data was collected on plant height, shoot weight, stem thickness, number of branches, number of trusses, number of open flowers, fruit sizes (small, medium and large), Fruit weight (marketable and non-marketable), Soil moisture content, Bacterial wilt and blossom end rot incidence and severity levels and weeds dry weight. The data was subjected to the analysis of variance using SAS software at P≤0.05 and mean separation where significant differences were observed was done using Fischer’s Protected LSD. The mulching treatments showed significant influence on the soil moisture content for both seasons with the highest recorded under the black polythene mulch with a maximum of 22.1% recorded at 8 weeks after transplanting and 18.9% at 6 weeks after transplanting during the first and second seasons respectively. The lowest moisture content was recorded in plots that were not mulched. Mulching with organic and inorganic materials significantly influenced the growth and yield parameters for both seasons in the two tomato varieties. White polyethylene mulch contributed to the highest number of branches per plant (10) and number of flower clusters (30) in Cal-J variety. The tallest plants were recorded in the same treatment on Tylka variety at 143.7 cm while the shortest plants were recorded in the control treatment of Cal J variety. The highest number of large fruits (27) was observed on the white polyethylene mulch of Cal-J variety which was not significantly different from Tylka F1 with the same mulching treatment with (25) fruits per plant during the first season. Tylka F1 under the white polyethylene mulch had the highest yield with 76.8 tonnes per hectare and Cal-J had 71.6 tonnes per hectare under the same mulch treatment recorded during the first season. The lowest tomato yield was observed where no mulch was applied in both seasons under both tomato varieties. The mulching treatments did not have significant influence on the incidences of bacterial wilt and blossom end rot in the two varieties for both seasons. The black polyethylene mulch had the highest weed suppression rate with the control showing the highest fresh and dry weed weight for both seasons.
Results from this study shows that inorganic and organic mulch has the potential to increase growth and yield of tomato and suppress weeds growth.

**RESPONSE OF HYBRID RICE (Oryza sativa L.) VARIETIES TO FERTILIZER APPLICATION UNDER SYSTEM OF RICE INTENSIFICATION IN KIRINYAGA AND KISUMU COUNTIES, KENYA**

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Department: Agricultural Science and Technology

Supervisors: Dr. Nicholas Korir

Dr. Joseph Onyango Gweyi

Kenyan rice farmers have continuously obtained low yields, this has been credited to poor agronomic practices and use of low quality inbred rice varieties. To alleviate the potential catastrophes and challenges of changing climate and improving rice production, there is need to evaluate productivity of improved rice seeds under alternative production systems such as the system of rice intensification (SRI) using a combination of organic (Evergrow) and inorganic fertilizer (Sulphate of ammonia). To address the challenge, the study had four specific objectives; (a) To determine the growth and tillering ability of the two hybrid rice varieties under System of Rice Intensification (SRI) fertilizer practices, (b) To establish the yield components and grain yield of hybrid rice varieties under (SRI) fertilizer practices. (c) To establish the harvest index of the two hybrid rice varieties under SRI fertilizer practices. (d) To determine the quality of the hybrid rice varieties under SRI fertilizer practices. The field experiment was conducted in Mwea and Ahero study sites. The experimental layout was Randomized Complete Block Design (RCBD) in split plot arrangement with the main plots being organic fertilizer at a rate of 2.5 t/ha Evergrow, 200 kg/ha of Sulphate of ammonia, 2.5 t/ha Evergrow + 200 kg/ha Sulphate of ammonia (SA), 2.5 t/ha Evergrow + 100 kg/ha Sulphate of Ammonia and the control where no basal fertilizer was applied while the sub-plots were the two hybrid varieties - Arize Tej Gold, Arize 6444 Gold and a local check (IR2793-80-1). Each of the treatments were then replicated three times. Data collected included plant height, number of tillers, days to 50% and 100% flowering, unproductive tillers, number of grains per plant, harvest index and grained yield per hectare were recorded during the experimental period. Amylose and crude protein content of the grain was determined after final harvest. The collected data was subjected to ANOVA using SAS software version 9.2 and significance differences between means were separated using LSD at 5% level of probability. The results revealed significance differences (P ≤ 0.05) on the parameters evaluated as an influence of the fertilizer combinations and used varieties. The control without fertilizer treatment in the variety Arize Tej Gold took the shortest time to 50% flowering recording 78 days and 92 days in Mwea and Ahero respectively. The IR2793-80-1 variety without fertilizer had the least stand count with 16 and 17 counts in Mwea and Ahero respectively. Significance differences were also observed in grain yield in the two study sites with Arize Tej Gold at Evergrow + 100kg/ha SA having the yield of 6.37 t/ha in Mwea and 4.37 t/ha in Ahero. The grain quality of the rice varieties under the SRI treatments differed significantly on the amylose and protein contents where 2.5 t/ha of organic fertilizer plus 100 kg/ha SA had the highest with 28.77% amylose and 10.58% protein. The application of 100 kg/ha of SA and organic fertilizer leads to higher yields which are not significantly different from that of the doubled rate of the inorganic fertilizer. The 2.5 t/ha Evergrow+100 Kg/ha SA fertilizer SRI practice will lead to the highest growth and tillering of the rice varieties. The study highly recommends the 2.5 t/ha Evergrow+100 Kg/ha SA fertilizer SRI practice under the improved variety which will lead to realization of the potential grain yield.
EFFECTIVENESS OF ANTAGONISTIC BACTERIAL ISOLATES AGAINST CROWN GALL DISEASE ON ROSES IN KIAMBU COUNTY, KENYA

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Crown gall is one of the major constraint in rose flower production in Kenya. The study aimed at developing a bacterial based biopesticide to manage crown gall disease on roses. A baseline survey on status of crown gall disease was conducted from July to October, 2017 using a questionnaire administered to the production managers in randomly selected flower farms in Kiambu, Nakuru and Laikipia Counties. Pathogen and the biocontrol isolates were isolated from galls and soil samples, respectively at Kenyatta University. The isolates were screened to determine their effectiveness against Agrobacterium tumefaciens. The most effective four isolates were identified using biochemical, physiological and molecular tests and evaluated in planta. At KU, rose stems were inoculated with A. tumefaciens and the effective isolates at the same time before planting. In another set up, plants were inoculated with A. tumefaciens and the test isolates applied after galls formed. For experiments conducted at the flower farms, test isolates were smeared on galls and bruised stems of naturally infected plants. The test isolates included Lactobacillus brevis 2.28.11, Micrococcus luteus 2, Micrococcus luteus 1 and Arthrobacter sp 1; other treatments included funguran®, infected plants (with galls treated only with distilled water) and uninfected control (without galls). Treatments were replicated 7 times and arranged in a Complete Randomized Design. The number of galls, change of gall size and number of shoots were recorded at 7 days interval for 10 weeks. Heights of shoots were recorded for 6 weeks. Survey and field (In vitro and in vivo) data were analyzed using Statistical Package for the Social Sciences and Statistical Analysis Software (SAS), respectively. Field data was subjected to analysis of variance and the difference between the treatments means separated using the Fisher's least significant difference test at 5% probability level. Majority of the farms in the surveyed Counties recorded a disease incidence and severity above 50%. The largest inhibition zone in vitro resulted from Arthrobacter sp 1 with a mean of 7.8mm. Lactobacillus brevis 2.28.11 and M. luteus 2 reduced gall size by 25.5% and 26.1% on Tropical Amazon® variety, respectively. On Upper class® variety, Lactobacillus brevis 2.28.11 and M. luteus 2 reduced gall size by 21.0% and 20.3%, respectively. Plants treated with L. brevis 2.28.11 and M. luteus 2 had all galls completely dry by week 10 in all the sites. When isolates tested for preventive use, galls did not form on plants treated with L. brevis 2.28.11 and M. luteus 2. On number of shoots, L. brevis 2.28.11 and M. luteus 2 produced significantly more and taller shoots in all the sites. The study revealed that crown gall remains a threat in production of roses and local environments hold promising antagonistic bacteria against A. tumefaciens. Lactobacillus brevis 2.28.11 and M. luteus were effective against crown gall. The study recommends that awareness on greenhouse hygiene and its impact on crown gall spread be increased to rose flower growers. Further exploitation and screening of bacterial antagonists from the local environment against diseases should be encouraged. Lactobacillus brevis 2.28.11 and M. luteus can be advanced to commercialisation and promoted for use in managing crown gall disease.

QUANTIFICATION AND SIMULATION OF ORGANIC CARBON STOCKS AND FRACTIONS UNDER DIFFERENT TILLAGE SYSTEMS AND SUGARCANE PLANTATION IN SOILS OF WESTERN KENYA
Sugarcane farming systems can adversely affect soil properties especially total soil organic carbon stocks (TSOCst) and fractions. This study was carried out in Western Kenya sugar zones to assess impacts of tillage systems (Tractor and Oxen ploughing), and plantation ages (continuous mono-cropping system, more than 20 years, 11–20 years, 0–10 years) on TSOCst and fractions (particulate soil organic carbon, POC, and the mineral associated soil organic carbon, MOC) in three different Agro-ecological zones (AEZs). Consequently, their effects on soil organic carbon quantities were simulated using Rothamsted organic carbon turnover model (Roth C Model). Undisturbed and disturbed soil samples were sampled from the sugarcane plantations in the three identified Western Kenya sugar zones (Mumias, South Nyanza (SONY) and Chemelil sugar zones) at top 0.6m. Soil Organic Matter was fractionated into labile (>250 μm) and stable (<53 μm) fractions. Cumulative crop residue was greater with tractor tillage systems (TTS) than with the oxen tillage systems (OTS) in all the zones expect in Mumias tractor tillage system where residues were burnt. Regarding plantation age, high SOCst were recorded in the older farms (more than 20 years) with SONY sugar tractor tillage system registering the highest average SOCst (80.20 t C/ha). Mean SOCst and fractions differed significantly between the tillage systems and responded to plantation ages, depth and AEZs (P <0.05). The MOC increased with increasing plantation age both in TTS and OTS, which was in contrast to POC which generally decreased with increasing plantation age. In the simulation of Organic carbon, after verifying the genesis soil organic carbon (SOC) content a fifty (50) years prediction was run for three management practices: A- TTS with residue retention, B- OTS with residue retention and C- TTS with residue burning. The predicted results showed that the rate of SOC stock (t/ha) change was positively higher under tractor tillage system in comparison to oxen tillage system except where burning occurred in TTS, for the modelling period of 2017-2067. Yearly estimate of carbon storage varied from 0.1 to 0.14 t ha-1 yr-1 (0–10 years), 0.1 to 0.2 t ha-1 yr-1 (11–20 years) and 0.16 to 0.21 t ha-1 yr-1 (more than 20 years) for OTS. TTS with residue retention recorded 0.14 to 0.16 t ha-1 yr-1 (0–10 years), 0.15 to 0.18 t ha-1 yr-1 (11–20 years), 0.16 to 0.24 t ha-1 yr-1 (more than 20 years) whereas TTS with residue burning recorded annual carbon loss between 0.7 - 0.2 t ha-1 yr-1over the period 2017-2067. These results assert the potential role of sugar-cane residue management on enhanced SOM sequestration in sugar cane growing belts, besides, linking Roth C model with the measured soil details, will be important for predicting the capacity of sugarcane soils to sequester organic carbon as affected by the current land-management practices in Western Kenya sugar belt.

**EFFECTS OF ORGANIC AND ORGANOMICERAL FERTILIZERS ON SOIL PHYSICAL PROPERTIES, GROWTH AND YIELD OF TEA IN KERICHO COUNTY, KENYA**

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Supervisors: Dr. Joseph Onyango Gweyi

Dr. Nicholas Kibet Korir
Tea production in Kenya provides a livelihood to over six million people and its productivity is influenced by soil fertility. Maximum tea yields are obtained when correct soil nutrients are available in the soil. Long term use of inorganic fertilizer in tea as a mono-crop often results in moribund of tea fields. This study was conducted to evaluate the yields, growth rate and physiological responses of tea clone TRFK 31/8 to three sources of fertilizer sheep manure, enriched sheep manure and inorganic fertilizer NPK (26.5.5). The organic fertilizer and enriched organic fertilizer was applied at four rates of 60, 120, 180 and 240 Kg/ha while NPK 26:5:5 was applied at the rate of 180 Kg /ha and the effects of these applications on the soil physical properties. The trial was done at the Tea Research Institute, Kericho where trials were laid out in Randomized Complete Block Design (RCBD) and replicated three times. The parameters measured included: photosynthetic rate, stomatal conductance, transpiration rate, shoot growth, soil pH, soil hydraulic conductivity, porosity and soil aggregate stability. Collected data was subjected to analysis of variance (P≤0.05) using SAS statistical package version 9.1 and treatments means separated using Fisher’s Least Significant Difference (LSD). The apical shoot growth was significantly highest at a ratio of 4 organic: 1 DAP at a rate of 120 Kg/ha with a peak of 2.93 cm in the wet season at week 4. The highest soil pH was recorded under sheep manure (5.94) at a rate of 240kg/ha while the lowest recorded (3.81) was under the NPK alone at a rate of 180 kg/ha. The hydraulic conductivity increased linearly under the sheep manure, enriched sheep manure at both ratios of 4:1 and 8:1 as the NPK rate increased while the lowest (0.20 m s⁻¹) was recorded at the NPK treatment for the wet and dry seasons. The highest yield was recorded in the enriched sheep manure at a ratio of 8 sheep manure to 1 DAP at 180 Kg/ha with 1019.3 and 917.3 kg/ha for the wet and dry seasons, respectively. The use of enriched sheep manure and DAP at a ratio of 8:1 is recommended and will ensure increased yields and reduced soil degradation in tea production.

EFFECTS OF CALCIUM, POTASSIUM AND WATER STRESS ON GROWTH, YIELD AND QUALITY OF DIFFERENT TOMATO VARIETIES IN MANDERA COUNTY, KENYA

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Tomato (Solanum lycopersicum) is well known regarding its quality and nutritional value all over the world but imbalances of fertilizer nutrients severely affect its quality. If exposed to stress exposure, either biotic (organisms) or abiotic (arising from imbalances of environmental factors) e.g water; growth and productivity is affected. The objective of this study was to determine the effects of calcium and potassium on yield and quality responses in two different tomato varieties under different moisture regimes. The effects of three watering regimes (daily, thrice and twice a week), fertilizer application rates as treatments at Ca 0 Kg·ha⁻¹, 25 Kg·ha⁻¹, 50 Kg·ha⁻¹, K, 0 Kg·ha⁻¹, 25 Kg·ha⁻¹ and 50 Kg·ha⁻¹ applied independently were used on two tomato varieties (Riogrande and Rionex) in randomized complete block design (RCBD) with split-split plot arrangement; with watering regimes as main plot, tomato varieties as sub plot, while fertilizer rates were within the sub-sub plot. The treatments were replicated three times. Tissue analysis was done after completion of the growing cycle on leaves and fruits to determine the calcium and potassium concentration levels at National Agricultural Laboratories in Nairobi in these organs. Two-way analysis of variance (ANOVA) using GenStat 15.1 Version was used to test levels of
significance due to treatments and their interactions. Where there were significant differences, Fischer’s Protected LSD test was performed to separate the treatment means at 5% probability level. Riogrande variety had both longest internode length and fresh fruit weight of 4.89 cm and 416.9 g respectively. Watering regimes had no significant effects (P≤0.05) on internode length with 5.04 cm (optimal regime) being the longest and 4.31 cm the shortest (twice a week), while plant height of 60.18 cm was the longest and 51.41 cm the shortest (optimal and minimal watering regimes respectively). The heaviest fruit was 446.5 g and 328.5 g the lightest under moderate and minimal watering regimes. Water stress led to the highest percentage of floral abortion as well as blossom end rot score on the two varieties in both sites of 56.42% and 3.19% respectively. Application of fertilizers at 50 kg ha⁻¹, Ca and 50 kg ha⁻¹, K elicited the highest growth and yield with interactions between varieties and watering regimes observed on plant height, fruit set and fruit weight. These treatments also exhibited the lowest percentages of floral abortion. Fertilizer treatments did not significantly increase both the number of flower and fruit set in both sites but there were differences which could be attributed to positive response for both Ca and K. Fertilizer application rate at 25 Kg ha⁻¹ K and 50 Kg ha⁻¹Ca had the least incidences of blossom end rot score in both sites on the two tomato varieties with the highest score observed on control treatments. Both tomato varieties had an increasing trend on flower abortion as fruiting season advanced which was contrary to trend on blossom end rot. Both Ca and K were more partitioned in shoot than in fruits. Furthermore, both tomato varieties demonstrated resistance to fruit cracking. From the results, the common physiological incidences affecting tomatoes can be reduced by manipulating the watering regimes, Ca and K levels. It would be interesting to find out the optimal ratio of these elements in control of this physiological/disease incidence.

**UPTAKE OF MICROFINANCE CREDIT AND ITS IMPACT ON COFFEE YIELDS AMONG SMALLHOLDER FARMERS IN THARAKA-NITHI COUNTY, KENYA**

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Dr. Newton Nyairo

The past two decades has witnessed high promotion of microfinance institutions by both the government of Kenya and non-governmental organizations which are targeting smallholder farmers. Despite increase in these microfinance institutions, coffee yield among smallholder farmers has remained low. This has negatively affected smallholder coffee farmers’ earnings from the coffee enterprise and also their economic wellbeing due to loss of income. Information on the impact of microfinance credit among smallholder coffee farmers in Tharaka Nithi County remains scanty and inconclusive. Therefore, the main objective of this study was to determine the impact of microfinance credit on coffee production among smallholder farmers in Tharaka Nithi County. Multi-stage sampling design was used to select the respondents. A total sample of 390 smallholder coffee farmers was used for this study. Structured questionnaires were used to collect data which was analyzed using descriptive statistics to characterize smallholder coffee farmers in the study area. Results showed that. The results on descriptive statistics show that coffee farming among small holder farmers is practiced by the old. Majority of the households were headed by men who had at least primary level. Majority of the farmers had at least primary level education with only 3.58 percent who had gone beyond secondary level. Majority of famers had well organized families with both husbands and wives present to help each other in farming. Coffee production in the area was practiced in small scale and out of the total farm size only a portion of it is used for coffee production. The results show
that there are still a large number of farmers at 45 percent who are yet to embrace agricultural extension services in their coffee production. The findings revealed that 79% of coffee farmers require credit while 21% coffee farmers do not require it. Farmers who didn’t require credit revealed that high interest rates, lack of information on how to access credit, lack of collateral to secure the loan and the process of getting a loan being complicated as the main impediments that deter them from going for credit. Probit regression model was used to determine factors that influenced access to credit among smallholder coffee farmers. The results show that gender of the household head, coffee farming experience, number of coffee trees and access to microfinance credit had significant influence in making the decision on whether to take microfinance credit or not. Propensity score matching was used to determine the impact of microfinance credit on coffee production. Results showed an increase in coffee yields by 358.44 kilograms for caliper matching, 343.31 for nearest neighbour matching and 344.83 for kernel matching for farmers that used microfinance credit as compared to the non-users. This therefore implied that use of microfinance credit in coffee production among smallholder farmers had a positive significant impact on coffee yields. The study recommended concerted efforts by county and the national governments to come up with strategies that will focus on farmers training and ensure easy access to adequate credit to enhance coffee production among smallholder farmers.

ASSESSING THE STATUS OF CROP FARMING AND STRATEGIES USED TO SCALE-UP YIELDS FOR ENHANCED FOOD SECURITY IN TURKANA COUNTY, KENYA

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Dr Purity Nguhiu

Despite being a culture-centred livelihood activity, pastoralism alone has not guaranteed food and nutrition security for households in Turkana, Kenya. The frequency of droughts and their negative impact on livestock production in the County translate into reduced purchasing power of the pastoral households; causing perennial food insecurity and consequent human indignity. As a growing response to this perennial situation, rain-fed crop production has been introduced in the County at subsistence level. Most pastoralists however still tend to shy away from crop farming largely due to cultural factors and not their technical feasibility. This study assessed the current status of crop farming and analyzed factors limiting diversification to crop farming. Further it appraised measures towards increased adoption of viable crop production systems within households in five locations purposively selected from two Sub-counties of Turkana Central and Loima. A cross-sectional descriptive survey design targeting 357 respondents was used in this study. In addition data was collected from a few key respondents from sub-County Agricultural Extension Offices. Primary data was collected using questionnaires and interview schedules. On farm experimentation on crop performance under different treatments (drip & bucket irrigation methods) was done in order to demonstrate the potential inherent in crop farming under appropriate crop and land husbandry practices. Data was analyzed using descriptive statistics. Experimental data was subjected to analysis of variance. Results showed that an increasing number of pastoralists are now venturing into crop farming for survival purposes; of which seventy three percent (73%) of the respondents were agro-pastoralists. With a change in attitude away from cultural pastoralism, this percentage can increase with more deliberate and targeted extension service at the County level. Annual average yield of maize in Turkana County was twelve 90kg-bags per acre, while its annual cost of production was Ksh 12,600/acre and the annual revenue was Ksh 32,400/acre. The annual average yield of sorghum in
the County was relatively the same as that of maize, and its annual cost of production was Ksh 6,800/acre, while the annual revenue was Ksh 43,200/acre. The study concluded that there is potential and opportunity to improve crop farming under proper land and crop husbandry practices including water use efficiency in Turkana County. Currently, there is a shift from pastoralism to agro-pastoralism. However, this shift is still slow and adoption levels low leading to poor crop yields. The main challenges that constrain crop farming include general lack of knowledge in crop farming and low adoption levels of modern agricultural practices such as use of manure and fertilizer. The study established that drip irrigation had good crop yields, though not used due to high initial costs. Where irrigation is being used, increasing salinity problem was noted. On farm trials with spinach (Spinacia oleracea) as the test crop demonstrated the superiority of water use efficiency under drip irrigation than under bucket method of irrigation. The use of inorganic fertilizers is not common in Turkana County because of the combined reasons of costs and knowledge on fertilizer use under water scarcity conditions. Some farmers use farmyard manure, which readily available from the large herds and flocks kept, but the level of use is low. The study recommended a more deliberate and targeted extension service to introduce improved crop agriculture which can be integrated with the cultural way of life of pastoralists which would ensure improved livelihoods and food security.

EVALUATION OF FERTILIZER FORMULATIONS ON SOIL CHEMICAL PROPERTIES, GROWTH, YIELD AND QUALITY OF SUGARCANE VARIETY (KEN 83-737) IN KAKAMEGA COUNTY, KENYA.

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Low sugarcane productivity has persisted in Western Kenya where most of the crop is grown. A study conducted by Kenya Sugar Research Institute in January 2011 at, Nyando Sugar Zone indicated that sugarcane yields were varied based on fertilizer type applied to the crop. Average sugarcane yield was 64 tones/ha as opposed to a potential yield of more than 100 tones/ha under rain-fed conditions. Declining soil fertility and lack of critical nutrients in fertilizer formulations applied to the crop were key reasons for the declining yields. The provision of well formulated fertilizers to sugarcane growing areas has been a challenge, yet sugarcane has extremely high demand for elements particularly NPK. There is therefore need to formulate fertilizers with an aim to provide the required nutrients in appropriate quantities. The aim of the present study was to provide formulations of sugarcane fertilizers targeting critical nutrient requirements to improve on the crop response in terms of nutrient uptake, growth, yield and cane quality. The study was conducted in 2013 in Mumias Sugarcane growing zone at Mumias Sugar Nucleus estate situated 0021’N and 34030E at 1314 meters above sea level. The treatments under experiment were as follows; T1 (DAP + Urea), T2 (DAP + MOP + Urea), T3 (NPKCaMg) and T4 (No fertilizer – Control). A randomized complete block design (RCBD) was used with 4 treatments each replicated 4 times to give 16 experimental plots, each measuring 10x6 meters (60 m2). Data was collected on tiller count, growth rate and yield. TCH, P01% cane, foliar potassium, nitrogen and phosphorus were also determined. The soil chemical analyses were carried out before and after cane growth. Data collected was subjected to analysis of variance (ANOVA) using R software version 3.4.0 and treatment means separated using the Tukey’s HSD post hoc test at 5% level of significance. Where there was significant difference, the mean separation was done using LSD. The NPKCaMg (T3) formulation elicited the highest plant height of 4.2 cm at the time of sampling compared to control which was 1.5cm, the differences were statistically
significant. The NPKCaMg (T3) formulation was superior in Po1% cane (14.1), followed by DAP + Mop (T2) (13.3) followed by DAP (T1) (12.0) and control (10.5). The difference between control and DAP were not statistically different. The cane yield followed the % Pol values, only that in this case there were significant differences amongst all treatments. The NPKCaMg (T3) and DAP + Mop (T2) treatments led to higher soil pH values ranging between 5.0 to 5.5 while the control and DAP had values less than 5.0. In correlation and regression analysis different fertilizer formulations were observed to affect development and sugarcane yields. Therefore, from these findings farmers at Mumias Sugarcane growing zone should be encouraged to adopt blended fertilizer formulations to improve cane sucrose content, soil chemical properties and overallly improve sugarcane yields in the long run.

EFFECT OF GIBBERELLIC ACID 4 AND 7 AND 6-BENZYL ADENINE ON GROWTH, YIELD AND QUALITY OF SUGARCANE IN KAKAMEGA COUNTY, KENYA

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Declining sugarcane productivity in Kenya has attracted a plethora of interventions such as optimal fertilizer regimes, improved seedcane quality and use of plant growth regulators (PGRs). Although application of PGRs in leading sugarcane producing countries like China and India has registered success, sugarcane farmers in Kenya are yet to exploit this technology. Globalization and liberation of world sugar industry now subjects the local millers and farmers to stiff competition. The local sugar millers have responded by seeking to adopt payment model based on yield and sucrose content. To address this problem, a study was conducted to determine the effect of different levels of gibberellic acid 4 and 7 and 6-benzyl adenine on growth, yield and sucrose content of five selected sugar cane varieties (CO 421, KEN 83-737, D8484, CO 945 and EAK 73-335). The study was carried out at the Butali Sugar Company Research and Demonstration farm in Chegulo, Kakamega County-Kenya. The trial was laid out in a Randomized Complete Block Design in 5 by 5 factorial arrangement. The treatments consisted of gibberellic acid 4 and 7 and 6-benzyl adenine at 0, 1, 2, 3 and 4 litres per hectare and the five sugarcane varieties. All treatments were replicated three times. Data on germination, tillering, height, girth, length of internodes and leaf number was collected monthly for six months for two seasons. Data on yield was collected by harvesting all the sugarcane from each plot at the 12th month after planting and recording the stalk biomass. Pol% was gene rated by extracting juice from 10 randomly selected stalks per plot to obtain a homogenized, composite sample before adding lead sub-acetate clarifier and measuring the filtrate using a polarimeter before multiplying the recorded value by the corresponding pol factor. All the data was subjected to ANOVA using SAS 9.1 software; and means separated using Tukey’s test (P≤0.05). Finally, cost-benefit analysis was computed for all varieties under study. It was observed that use of gibberellic acid 4 and 7 and 6-benzyl adenine led to significant and or linear increasing growth, yield and quality (sucrose content) of sugarcane. It was also observed that the varieties differed in their response to application of the gibberellic acid 4 and 7 and 6-benzyl adenine. In yield, D8484 grown with GA4+7 and 6-BA at 4 litres per hectare recorded the best performance at 75.35 and 75.23 tons/ha in Seasons 1 and 2 respectively. EAK 73-335 recorded superiority in sucrose accumulation with pol% of 14.70% and 14.69 % in seasons 1 and 2 respectively when treated with GA 4+7 and 6-BA at 4 litres per hectare. There was no significant difference at 4 litres per hectare in all parameters under study. Application of gibberellic acid 4 and 7 and 6-benzyl adenine increased growth, yield and quality of the sugarcane varieties...
with D8484 recording the best overall performance and the highest net positive benefit-cost ratio at 3.7. Gibberellic acid 4 and 7 and 6-benzyl adenine increased yield by 11-22% and sucrose content by 3-6%. Therefore, it is recommended that variety D8484 and EAK 73-335 be grown and gibberellic acid 4 and 7 and 6-benzyl adenine at 3 litres per hectare be incorporated in the production of sugarcane in Kakamega County and areas with similar agro ecological conditions. In addition, there is need for evaluation of response of more cane varieties and in other agro ecologies. Further study is recommended on performance of ratoon crop previously applied with gibberellic acid 4 and 7 and 6-benzyl adenine.

ULTRAVIOLET RADIATION AND SELENIUM NUTRITION ON YIELD, BIOCHEMICAL COMPOSITION AND SENSORY QUALITY OF SELECTED TEA VARIETIES IN KERICHO COUNTY, KENYA

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Ultraviolet (UVB) radiation (280–315 nm) and interaction with Selenium (Se) have potential promoting plant tolerance to UVB stress in plants and modify metabolites that influence taste and functional properties of tea. The objectives of this study were to assess sensitivity of two tea varieties to ambient solar UVB radiation and Selenium nutrition on 1) yield components, 2) secondary metabolites, antioxidant activity, theanine and mineral composition of tea and 3) non-aerated (green) tea quality. The field experiment was undertaken in Chepgoiben, Kericho County 0’, 24’16” S and 2160 masl. The experiment was conducted in RCBD laid out in split-split plot with three replications and 3 factors under evaluation (Variety as main plot, Selenium in subplots and UVB radiation as experimental unit plots). Three levels of UVB radiation; UV ambient (+UVB amb), UVB blocked (-UVB) and +UVB transparent filter control (+UVB-FC), without (-Se) or with (+Se) foliar Se application (10 g L−1 chelated Se) were tested for two seasons S1 (Jan-Mar) and S2 (April to July) 2019. Upon harvest of shoots ad processing, tea brew was prepared and evaluated based on color, flavour, bitterness and astringency with reference to commercial standards of Japanese green tea and Kenyan non-aerated purple tea. Results showed that -UVB caused average accumulation of ~11%, ~15% and 28% more fresh leaf weight, dry weight and shoot density respectively compared to UVB-FC plants irrespective of Selenium nutrition in both varieties. In SMK 30/52, highest levels of chlorophyll SPAD values were found in –UVB (353) followed by +UVB ambient (341) and lowest in +UVB-FC (293). The results revealed that TRFK 306 has distinct catechin, caffeine and theanine profiles compared to regular green tea while Catechins (EGC, GC, GCg and ECg) were influenced by UVB radiation regardless of Se nutrition. It was observed that TRFK 306 (purple tea) is less sensitive to UVB radiation perharps due presence of additional UV absorbing anthocyanins. However, both varieties had similar range of antioxidant capacity (p<0.05). Selenium nutrition did not significantly change N, P, K, S and Se content in tissues in both varieties. Sensory evaluation based on hedonic scale showed quality differences were affected by varieties and UVB radiation with least astringent and bitter being in the order –UVB (5.8) > +UVB FC (5.5) > +UVB ambient (5.3). Tasters preferred flavour in -UVB blocked (5.9) and UVB-FC (5.9) teas, the latter having unique bakey and fruity note in SMK 30/52. Teas from +UVB and UVB-FC treatments had appealing colour (6.3) and least in UVB ambient (5.8) tea samples. Correlation analyses showed that astringency, bitterness and flavour were most influenced by GC, EGC, EGCg, EC, Cg and Caffeine. It was determined that bitterness and astringency of teas is a central attribute in determining taster’s perception of sensory quality. The overall metabolic fluxes of some key secondary metabolites by solar UV exclusion in green tea variety SMK 30/52 demonstrated that ambient UVB exclusion can potentially improve
quality and yield of non-aerated tea. UVB exclusion is therefore proposed as an alternative agronomic management method to improve tea yield while minimizing undesirable bitterness and astringency and overall marketing quality characteristics of non-aerated (green) tea.

FARMERS’ PERCEPTIONS AND ADOPTION OF MICRO CATCHMENTS FOR IMPROVED ESTABLISHMENT OF AGROFORESTRY TREES IN EAST SHEWA ZONE, ETHIOPIA

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Tree planting on farms has both environmental and socioeconomic benefits. The practice of establishing trees and tree plantations is common among rural population in the dry regions of Ethiopia, who depend on livestock, trees and tree products for subsistence. Despite the importance of trees, their survival in these dry areas is low and often challenged by drought and water shortage. To address the water scarcity problem, two micro catchments specifically, micro basins and trenches were established in East Shewa zone of Ethiopia. This study sought to assess their suitability in enhancing the survival of three tree species namely Cordia Africana Lam, Grevillea robusta A.Cunn. ex R.Br, and Mangifera indica L. Survival of the trees grown in the micro catchments was compared to trees grown in the ordinary planting pits (control).

The specific objectives of the study include 1. To assess farmers’ perception of the effectiveness of micro catchments in establishment of agroforestry trees. 2. To determine factors influencing adoption of micro catchments for tree survival. 3. To determine the effectiveness of micro catchments in enhancing survival of agroforestry trees. Data to assess farmers’ perceptions and factors influencing adoption of the micro catchments were collected through a household survey involving 142 farmers and key informant interviews. Tree survival data was collected at intervals of 6 months from planting time up to 36 months. Using the statistical package for social sciences (SPSS) and STATA descriptive statistics and regression models were used to analyze the data while the Kaplan Meier method using SPSS was used for tree survival analyses. Results showed that over 50% of the respondents perceived the micro catchments to be effective for survival of trees and conservation of soil moisture with a higher preference for micro basins. Variables such as land size, perception of water scarcity as a problem, labor availability had a significant influence on farmers’ perception of micro catchments. Further results showed that access to extension information, fencing of trees for protection, number of land parcels, previous use of soil and water conservation methods significantly influenced adoption of the micro catchments. A low survival rate was observed for all the three tree species (<30%) after 36 months in the three treatments. The highest tree mortality rate occurred between the sixth and twelfth months, this was mainly attributed to soil moisture deficit. Trees that had survived beyond 18 months survived up to 36 months. Farmers, perceptions further revealed that the high rate of tree mortality was not only as a result of water scarcity but also due to damage from free-grazing livestock and insect attack. The study concluded that in spite of the positive perception towards micro catchments, these structures may fail to adequately address the problem of low tree survival rate and this may limit their adoption. Therefore, efforts to enhance tree survival should be responsive to all constraints of tree survival and holistic approaches implemented to address the challenges. The study recommends further research into both biophysical and social-ecological factors that affect tree
Tomato Solanum lycopersicum L. is an important crop in Kenya. Arthropod pests are major constraints to its production. The pests make farmers to rely heavily on synthetic chemicals for control and this increases costs and pollution of the environment. The objective of this study was to assess the occurrence of arthropod pests of tomato and evaluate the effectiveness of native Kenyan fungi in managing thrips as an alternative to synthetic pesticides. A survey was carried out in Bungoma County and data collected from ninety farmers on tomato production practices, pests present, diseases and their management practices. In vitro studies were conducted to evaluate the effectiveness of native fungi against Frankliniella occidentalis collected from the tomato fields and maintained in the laboratory. The fungi were isolated from ninety soil samples from tomato fields and identified based on their vegetative and reproductive structures. Treatments included fungal isolates and a control; replicated four times arranged in a completely randomized design. The effect of the fungal isolates on F. occidentalis was evaluated by treating thrips with concentrations of 1.0 x 10^7 conidia ml^-1. Data on mortality of F. occidentalis was recorded daily for 10 days after treatment. Field trials were conducted at Bukonoi and Cheptais in 2018 to determine the most virulent fungal antagonists. The fungi were Trichoderma virens 1, Trichoderma virens 2, Trichoderma afrorharzianium, Fusarium solani and Fusarium oxysporum. Their efficacy was compared to Beauveria bassiana, synthetic pesticide Imidacloprid and a control (water). All treatments were applied weekly as foliar sprays commencing three weeks after transplanting of tomatoes until harvesting. Fungal antagonists were applied at a rate of 1.0 x 10^8 cfu g^-1. Treatments were replicated four times in a randomized complete block design. Data were collected on population of F. occidentalis and the yield. Survey data was analyzed using SPSS version 18.0 while data on in vitro and field trials were subjected to Analysis of Variance using SAS version 9.4. Means were separated using Student Newman-Keuls test at P≤0.05. Results revealed F. occidentalis (58.6%) as major pests of tomato and Ralstonia solanacearum disease (75%). The most frequently used chemicals were Imidacloprid (24.4%) and Mancozeb (17.2%). Only 2.4% of the growers used bio-pesticides. In vitro studies showed that T. virens, F. solani, F. oxysporum and T. afrorharzianum were more virulent against F. occidentalis causing mortalities above 50%. The least mean number of F. occidentalis per flower at Bukonoi was observed on T. afrorharzianum and F. oxysporum treated plots with 2.2 and 1.0 during long and short rainy season, respectively. At Cheptais, the lowest mean of F. occidentalis (2.4) was recorded on F. oxysporum and T. afrorharzianum (1.0), respectively. Tomato plots treated with T. afrorharzianum gave the highest yield of 3.8 t/ha and 27.2 t/ha during the long and short rainy season at Bukonoi with a corresponding 0.3 t/ha and 12.3 t/ha at Cheptais, respectively. The findings showed that T. afrorharzianum and F. oxysporum have potential for development as fungal-based bio-pesticides against F. occidentalis on tomato. Further studies should be done to determine the optimal conditions for effectiveness of F. oxysporum and T. afrorharzianum.
ASSESSMENT OF VERTICAL PRICE TRANSMISSION IN RICE MARKETS IN NAIROBI CITY COUNTY, KENYA

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Sub-Saharan Africa (SSA) agricultural commodity markets have been liberalised since the 1980s through Structural Adjustment Programs (SAPs). The aim was to foster market integration and efficiency. Liberalisation of markets allows free flow of goods and services from areas with excesses to those with a deficit. But most Sub-Saharan countries, Kenya included, has associated liberalisation with failure and unsustainable food markets though agriculture is the mainstay of the economy. Price information is a conduit connecting and integrating different market locations and levels. Thus, this study assessed the degree of market integration and direction of price influence between the wholesale and retail rice market levels in Nairobi City County. Besides, the research examined the role of market structure and conduct in vertical market integration and Granger causality. The Eastern African Grain Council (EAGC) provided the weekly wholesale and retail price data from January to December of the year 2016. Data analysis was done in E-views 9. Primary data were randomly gathered from 80 rice traders in Nyamakima and Toi markets through questionnaires. The data consisted of socioeconomic aspects, market structure, and market conduct of rice wholesalers and retailers. This data was analysed using SPSS 20. Johansen cointegration method revealed the absence of cointegration between the wholesale and retail rice markets. Further, wholesale and retail prices exhibited independent Granger causality. The assessment of socioeconomic characteristics showed the dominance of female retailers. Further, most retailers were in their productive ages while most wholesalers were old. Also, wholesalers were more educated than retailers, and retailers possessed more experience than wholesalers. The assessment of market structure showed a high concentration in the wholesale market (HHI of 0.33) while the retail market had a moderate concentration (HHI 0.21). The examination of market conduct showed a majority of both wholesalers and retailers shared a similar source of rice supplies (brokers). Besides, the word of mouth provided most of the market information. The study concluded the rice market in Nairobi City County were not integrated and inefficient. It links this to the presence of market power at wholesale and retail market levels, minimal price interaction, and unreliable market information. Policies that favour a formal centralised information system can improve market integration. Adoption of Information and Communication Technologies (ICTs) can also enhance reliability of information and access to formal financial services.

GROWTH PERFORMANCE AND CARCASS CHARACTERISTICS OF THE AFRICAN CATFISH (CLARIAS GARIEPINUS) REARED ON DIETS CONTAINING BLACK SOLDIER FLY (HERMETIA ILLUCENS) LARVAE MEAL

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Fish feed protein ingredients are the most expensive and often unavailable in sub-Saharan Africa especially in commercial aquaculture systems. The major fish feed protein ingredient in fish farming in Kenya is fishmeal (FM) that is often times expensive and adulterated leading to low productivity of fish farming. This problem has necessitated a need for exploring alternative less expensive and easily available protein sources such as black soldier fly larvae (BSFL). This study aimed at evaluating the growth rate, feed utilization, survivability and carcass characteristics of the African catfish (Clarias gariepinus) reared on diets containing BSFL meal as a replacement for FM. Treatment diets were formulated for BSFL meal to replace FM at the rate of 0% (C), 25% (D1), 50% (D2), 75% (D3), 100% (D4) and D5 (49% BSFLM, 49% FM and 2% Baker’s yeast). All diets were formulated to meet the nutritional requirements of catfish. The catfish were housed in harper nets each measuring 2 by 2 by 2 meters and the net had one millimeter perforations to allow proper circulation of water and also prevent escape of the catfish. Each harper net held 20 pieces of catfish. The experiment was laid out in a completely randomized design with each treatment being replicated three times. The performance of the catfish was determined by recording the weights, lengths and mortality biweekly for six months. Analysis of variance was carried to determine the effects of the treatment diets on the weight gain, length gain and carcasses characteristics. Water quality parameters including dissolved oxygen, temperature, salinity and conductivity measured were within the optimum levels recommended for rearing the African catfish. Catfish consuming diets with 50% and 75% BSF larvae meal had the highest growth rates of 1.01g/day and 0.98g/day respectively. However, the growth rates of the catfish consuming the diets with 0% and 100 % BSFL meal as well as the diet containing 2 % baker’s yeast were not significantly different (P>0.05). Mortality of 1.10% was noted in the catfish consuming the control diet and diet containing 25 % BSFL but there was no mortality for the other treatment groups. Carcasses of African catfish fed treatment diets with BSFL meal had significantly (P<0.05) higher amounts of crude protein (CP) especially for D2 and D3. Ether extracts from the carcasses showed that an increase in BSFL meal led to an increase in the lipid content of the carcasses. The inclusion of BSFL meal did not negatively affect the nutritive composition and carcass quality (especially essential amino acids) of the African catfish. The study noted that the concentration of essential amino acids increased as the amount of BSFL meal in the diets increased. Substitution of BSFL meal for FM in the treatment diets didn’t negatively affect the survival rates of the catfish. The study recommends the use of BSFL meal at substitution rates of 50% and 75% for better survival and enhanced growth performance of African catfish as well enhanced quality of its carcass.

EFFECT OF CONSERVATION AGRICULTURE ON WATER RETENTION, SOIL PROPERTIES AND MAIZE YIELDS IN SEMI-ARID KAJIADO COUNTY, KENYA

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Food insecurity and hunger are global challenges attributed to poor crop harvests, land degradation, low soil moisture and declining soil fertility. Low maize yields and household food insecurity in Kajiado, Kenya could be alleviated by use of sustainable agricultural practices such as conservation agriculture (CA), integrated soil fertility management (ISFM) and increased water use efficiency. This study was carried out in Kajiado during the long rainy season of March-July, 2016 to (i)
determine the effects of conservation tillage on maize growth and yields (ii) determine the effects of conservation tillage on soil physical properties (soil moisture retention and soil structure) and (iii) determine the effect of conservation tillage on soil chemical properties (Soil Carbon, soil pH, soil N, P, and K). The treatments were laid out in a RCBD with three replications. The treatments included: 1. Conventional tillage with residue removal (Control). 2. Conventional tillage with residue retention (3 ton/ha). 3. Conventional tillage with residue retention (5 ton/ha incorporation). 4. Reduced tillage – (one plough with 3 ton/ha stover incorporation). 5. Reduced tillage – (one plough with 5 ton/ha stover incorporation). 6. No-tillage practice – (no prior tillage, 3 ton/ha stover residue chopped, surface applied). 7. No-tillage practice – (no prior tillage, 5 ton/ha stover residue chopped, surface applied). Analysis was done using SAS version 8. Results from the study show significant effects (p<0.05 and p<0.01) of CA on dry matter maize yields and water retention. The volumetric moisture content at 0-60 cm soil depth was highest in NT5 treatment, followed by NT-3 > RT-5 > CT-5>CT-3 > RT-3 and CTC (Control). At 0-20 cm depth, NT-5 had the highest volumetric soil moisture content of 0.299m3m-3 which was significantly higher than the other treatments. NT-5 increased soil moisture by 9.7%, NT3 by 9%, RT5 by 5.4%, while RT-3 by only 3.8%. After wet sieving, treatments, RT-5, NT-3 and NT-5 significantly increased the 2-1 mm soil aggregate size, thus indicating improvement in aggregate stability of the soils. Up to RT-3 does not degrade the soil structure because there was no significant reduction of the fraction less than 0.5mm. NT-5 significantly gave the highest stover yields of 5334kg/Ha and grain yields of 3228.2kg/ha which was 37.3% increase from the control. CT3 had the highest plant height at (12.5cm) 2 weeks after planting (2WAP). However, NT5 had the highest significant effect (P=0.01) on plant height 4WAP, 6WAP and 8WAP at 58.2 cm, 122.8 cm and 140.2 cm respectively. No significant effects (P<0.01 and P<0.05) were recorded in pH before and after the experiment. However, soil organic carbon (SOC) recorded significant improvements across all the treatments with NT-5 being the highest followed by RT-5 > RT-3 > NT- 3> CT-5 > CT-3 respectively in that order. The treatments had significant effects on soil mineral N (NH4+ and NO3-) and total N. On the other hand, the treatments also had significant effects on available P, Na+, and K+. Therefore, the results confirm that CA is very effective in enhancing crop yields and improving soil physical and chemical properties.
Financial leverage decisions are critical since they significantly explain firm financial performance. There is lack of consensus (from empirical literature) in respect to the nature and strength of relationship between firm financial leverage and financial performance. Moreover, the impact of financial leverage on different measures of financial performance is varied. Most agricultural co-operative societies in Kenya have not achieved their potential due to poor financial performance. In Kiambu County, the poor performance has in some instances led to farmers abandoning their trade altogether and instead converting their land into real estate projects. Hence, this study assessed the effect of financial leverage on financial performance of agricultural co-operative societies in Kiambu County, Kenya. Specific objectives of the study were: to determine the effect of capitalization mix, degree of interest coverage and degree of asset coverage on financial performance. Additionally, the study evaluated the moderating effect of corporate governance on the relationship between financial leverage and financial performance. The study is anchored on agency, pecking order and trade off theories. Positivism research philosophy and explanatory research design were adopted. The study adopted a census of 25 active registered agricultural co-operative societies in Kiambu County. Secondary data was extracted from the annual reports and audited financial statements; Data was obtained from the Directorate of Co-operatives office in Kiambu for the period 2013-2017. Data was analyzed using panel regression analysis, Pearson simple correlation and Descriptive statistics; data was presented in tables and figures. Diagnostic tests performed include: Normality, Multicollinearity, Autocorrelation, Heteroscedasticity, Stationarity and Test for fixed or random effects. The study found that degree of interest coverage has a significant positive effect on financial performance; ($\beta = 2.01937; \ P = 0.015$). Degree of asset coverage also had a positive but insignificant effect on financial performance ($\beta = 1.174203; \ P = 0.063$). The relationship between capitalization mix and financial performance was negative and significant; ($\beta = -0.2589299; \ P = 0.040$). Additionally, the study found that the relationship between financial leverage and financial performance was significantly moderated by corporate governance factors; ($\beta = 0.9821695; \ P = 0.000$). Hence, the study recommends that managers of Agricultural Co-operative Societies in Kiambu County, Kenya should formulate optimum debt-equity mix strategies as well as avoid over-reliance on debt since increase in the proportion of debt may increase financial risk leading to poor financial performance. Further, the study recommends that co-operative societies should consider cheaper sources of finance that do not deplete the firms’ earnings. Finally, the study recommends the consideration of corporate governance factors (Annual General Meetings and Internal Audit Committees) by Agricultural Co-operative societies to oversight financial reporting processes, internal controls and conformity with stipulated regulations in order to enhance financial performance.
Revenue efficiency is recognized as a major ingredient in sustainable growth in insurance business. The growing complexity in the insurance business characterized by the constant change in the operating environment has increased the significance of the effect of revenue efficiency in resource utilization in the sector. The continuous decline in revenue efficiency in the Kenyan insurance has affected profitability and sustainability of insurance companies. The main objective of this study was to determine the effect of firm characteristics on revenue efficiency of selected insurance companies in Kenya. The specific objectives of the study included: to determine the effect of firm size on revenue efficiency, to establish the effect of capital adequacy on revenue efficiency, to determine the effect of claims experience on revenue efficiency of insurance companies, to establish the effect of asset quality on revenue efficiency, to assess the effect of risk on revenue efficiency, to determine the moderating effect of competition on the relationship between firm characteristics and revenue efficiency. The research was based on the information asymmetry theory, the agency theory, passive learning theory and the structural conduct theory. The study used a causal research design and was underpinned on positivism research philosophy. The target population was the 27 insurance companies that have consistently been in operation during the study period, 2008-2017 and registered by the Insurance Regulatory Authority. A census of all the 27 insurance companies was taken. The study relied on secondary data from audited financial statements as submitted to the Insurance Regulatory Authority. The panel secondary data was quantitative in nature and was analyzed using descriptive statistics and inferential statistics. Descriptive statistics included mean, mode, median and standard deviations. Inferential statistics included correlation analysis and multivariate analysis using the two stage Data Envelopment Analysis by obtaining efficiency scores in the first stage thereafter Dynamic panel regression model in stage two. Data was analyzed by STATA (14). The research findings showed that capital adequacy had a positive statistically significant effect on revenue efficiency of insurance companies in Kenya, firm size and asset quality had a statistically significant negative effect on revenue efficiency; claims experience and risk did not have a significant effect on revenue efficiency. The moderating effect of competition on the relationship between: capital adequacy and revenue efficiency; claims experience and revenue efficiency was negative and statistically significant; the moderating effect of competition on the relationship between: Asset Quality and Revenue Efficiency, Firm Size and Revenue Efficiency, risk and Revenue Efficiency was not significant. The study recommends that insurance companies should put in place robust measures to ensure remittance of policy premiums especially from insurance agents, to reduce exposure to large sizes of debtors consequently poor asset quality. The study also recommends that insurance companies should be encouraged to form strategic business units through spin-offs, which will encourage specialization for the different units reducing the too-big-to-fail phenomenon.
I-Tax is the new system that has been developed by the Kenya Revenue Authority (KRA) to ensure online submission of tax returns and other taxation related transactions. Despite the increasing need to raise the level of revenue collection and enforcement so as to provide public services, developing countries still face the challenges of low tax compliance. This leads to frequent tax reforms aimed primarily at closing short-term revenue gaps. The Kenya Revenue Authority presented the i-tax framework in the year 2013 to additionally build up the utilization of innovation to make a cutting edge impose gathering for Kenya. This prompted an expansion in income accumulation, for instance in the fiscal year 2016/2017, KRA gathered Sh.1.365 trillion compared to the target set of KSh. 1,415 trillion. The Authority increased its revenue collection by 13.8 percent compared to the previous financial year 2015/2016 where it collected Sh1.210 trillion. The increase was attributable to growth in the various taxes, for example the Value Added Tax (VAT) that had a 21.2 percent growth attributed to enhanced compliance measures. Despite these efforts, the Kenyan government is still experiencing a lot of problems as far as effective and efficient tax administration is concerned hence affecting revenue collection. This research looked at the effect of itax adoption determinants on VAT compliance among large corporate taxpayers in Kenya. The study was guided by the following hypothesis:

H01: Large taxpayers’ perception towards the utilization of itax framework does not have significant effect on VAT tax compliance among large corporate taxpayers in Kenya.
H02: Large taxpayers’ level of IT literacy does not have significant effect on VAT tax compliance among large corporate taxpayers in Kenya.
H03: Large taxpayers’ knowledge of tax laws does not have significant effect on VAT tax compliance among large corporate taxpayers in Kenya.
H04: Costs of compliance does not have significant effect on VAT tax compliance among large corporate taxpayers in Kenya.

This study was based on these theories; Fischer tax compliance model, the economic theory of tax compliance, Diffusion of Innovation (DOI) and Theory of Technology Acceptance Model. The study followed a positivism research philosophy. The study employed a descriptive research design. The target population was the large corporate taxpayers in Kenya. The study targeted all the 1278 large corporate taxpayers in Kenya registered for VAT. Stratified random sampling technique was used to select 192 respondents for the study. A five-point likert scale structured questionnaire was used to collect primary data. A pilot test was conducted to assess validity of the research instruments whereas Cronbach’s coefficient alpha was used to determine reliability of the research instruments. Both descriptive and inferential statistics were used to analyze the data. Statistical significance of relationships among selected variables was determined using multiple regression analysis. Results obtained were presented using tables. The study established that online taxpayer registration, online tax return processing, online compliance and monitoring activities; and electronic tax payments have a significant contribution on revenue collection at KRA. The study concluded that when all these iTax components were embraced, revenue collection, accounting for taxes paid, monitoring of taxpayers, service delivery to taxpayers and compliance improved. This study recommended that KRA management should focus on taxpayer facilitation through a robust system of customer relationships management, efficient complaints resolution and ensuring that more resources are invested in user friendly online tax systems in order to realize long term benefits.

FINANCIAL INNOVATIONS AND PERFORMANCE OF DEPOSIT TAKING SAVING AND CREDIT COOPERATIVES IN NAIROBI CITY COUNTY, KENYA

Ouma A. Amabel-M.SC
With increasing varying business environment that is categorized by uneven markets, scientific advances, strategy changes, and increasing reliance on non-price rivalry has lured service sectors to be inventive to meet ever changing customers’ demand, and equally ensure sustainability and growth of their firms. The enormous performance characterized by vast investment in financial innovations and training of workforce to handle the novel technologies by Deposit Taking Savings and Credit Cooperatives has raised a concern for an investigation on the relationship between financial innovations and performance to ascertain if performance of Savings and Credit Cooperatives Societies is manipulated by their financial innovations. The main objective of this study sought to determine the effect of financial innovations on performance of Deposit Taking Savings and Credit Cooperatives in Nairobi City County, Kenya. The specific objectives were: to assess effect of new products, new service process and new organizational form on financial performance, and to determine the moderating effect of firm characteristics on the relationship between financial innovations and performance of Deposit Taking Savings and Credit Cooperatives in Nairobi City County, Kenya. In view of the study specific objectives, four hypotheses were formulated and tested. The study was anchored on regulatory dialectic theory, regulation and taxation theory, pecking order theory and agency theory. The study adopted positivism research philosophy and employed use of both descriptive and explanatory research designs. The target population was licensed Deposit Taking Savings and Credit Cooperatives in Nairobi City County, Kenya while the accessible population was 19 Deposit Taking Saccos that had been operating and licensed by Sacco Societies Regulatory Authority between the years 2010 to 2014. Purposive sampling technique was employed and the sample size was 76 respondents of senior employees though only 68 responded. A structured questionnaire was self-administered to gather primary data while secondary data was derived from the financial statement of the Savings and Credit Cooperatives Societies. SPSS version 21 was used to analyze data using regression analysis. The study found that new products has a statistical significant relationship with liquidity (p=0.000) and capital adequacy (p=0.006). New service processes has a statistical significant relationship with liquidity (p=0.011) and capital adequacy (p=0.001) while new organizational form has a statistical insignificant relationship with profitability (p=0.737) and capital adequacy (p=0.344). The results from the study further indicate that firm characteristics have moderating effect on the relationship between financial innovations and performance (p=0.000). The study therefore concludes that both new products and new service processes have significant influence on performance. The study recommends that Savings and Credit Cooperative Societies to adopt financial innovations strategies to enhance efficiency in all their operations boost profitability and expand their market share focusing on firm characteristics as an additional advantage; management of Savings and Credit Cooperative Societies to embrace research and development to foresee new and innovative ideas to advance their performance; Sacco Societies Regulatory Authority to develop effective regulatory and surveillance structures that will ensure adoption of financial innovation strategies by Deposit Taking Saving and Credit Cooperatives focusing on their firm characteristics to enhance their efficiency and performance.

TECHNOLOGICAL BANKING INNOVATIONS AND FINANCIAL INCLUSION BY COMMERCIAL BANKS IN NAIROBI CITY COUNTY, KENYA

Njoki Grace Wanjiku-M.SC

Department: Accounting and Finance
Financial inclusion is the provision of financial services at affordable costs to sections of underprivileged and low-income segments of society, in contrast to financial exclusion where those services are not available or affordable. Failure to constantly redesign strategies that help the commercial banks adapt to changing business environment may lead to a strategic mismatch between what they offer and what markets demand. The objective was to study Technological Banking Innovations and financial inclusion by commercial banks in Nairobi County Kenya. The study was anchored on the theory of financial intermediation, diffusion of innovation theory and Silber’s Constraint theory of Innovation. The study used a descriptive research design and a positivism philosophy because the conceptual hypotheses were drawn from existing theories and identified knowledge gaps as founded on the research design. Multiple regression model was employed in this study. For the purpose of this investigation, the target population included all the 42 registered commercial banks operating in Nairobi County, Kenya in the year 2016. Purposive sampling technique was used to determine the sample size. Thirteen (13) selected banks that had successfully implemented technological banking innovations in Nairobi County were purposively sampled for the study. Both primary and secondary data was used in this study. Primary data was collected using questionnaires. Secondary data on mobile bank transactions and mobile phone subscriptions in the banks for the period between 2011 and 2016 was obtained from Central Bank of Kenya, Kenya National Bureau of Statistics and the Banking survey manuals. Questionnaires were administered to randomly selected respondents. The confirmatory test for multicollinearity was done using the Variance Inflation Factor. Data was analyzed using descriptive statistics (mean and standard deviation) and inferential analysis (correlation, Goodness of Fit, analysis of variance, F statistic/significance of the study variables and regression of coefficients) which were used to draw inferences on the relationship between the study variables. Data was presented using tables and figures. Results of the study indicated that the predictor variables; mobile banking, agency banking, electronic banking outlets and internet banking have an influence on financial inclusion. Correlation results also indicated that mobile banking, agency banking, electronic banking outlets and internet banking were positively associated with financial inclusion. Additionally, the regression findings indicated that mobile banking, agency banking and electronic banking outlets were statistically significant predictors of financial inclusion. However, Internet banking had a significance level of 0.586 which is higher than the conventional threshold of 0.05 which rendered the variable as statistically insignificant in prediction of financial inclusion. The findings concluded that mobile banking, agency banking, electronic banking outlets and internet banking have an influence on financial inclusion with the technological innovations being well adopted by the customers in the respective banks. The study recommended that the banks’ management should make use of these research findings to come up with innovative approaches of improving financial inclusion while maintaining the existing ones in the conduct of their business so as reach more clients with their products and services.

DERIVATIVE HEDGING AND PERFORMANCE OF NON-FINANCIAL FIRMS LISTED IN THE NAIROBI SECURITIES EXCHANGE, KENYA.

Kivindu Silvah Ndallah-MSC

Department: Accounting and Finance

Supervisor: Dr. J. N. Mungai
Dr. C. W. Njoka

Derivatives have been in the use by firms for the longest period. Some firms use them for trading or speculation purposes while others use them purely for hedging purposes. Despite the usage of derivatives by non-financial firms, their performance has been varying. In Kenya, listed non-financial firms use derivatives for hedging purposes while financial firms use derivatives for both speculation and hedging purposes. Contrary to the greater growth opportunities and tighter controls that make derivatives attractive, listed non-financial firms still experience variations in their market values hence posing a threat to their growth opportunities. Exchange rate fluctuations and weather uncertainty have been found to affect firms’ operations, operating cash flows and non-financial firms’ performance. Since 2010, Kenyan listed non-financial firms have made huge losses due to derivatives hedging. For example, Kenya Airways reported a net loss of Kes. 25.7 billion in 2015, out of which Kes. 7.5 billion was attributed to derivatives usage, representing 29.18 percent of the total loss reported in that financial year. This saw the firm value as measured by Tobin’s Q ratio drop from 0.08 in 2014 to 0.04 in 2015. Also, Kenol Kobil, one of the largest Oil marketers in Kenya reported a net loss of Kes. 6.28 billion for the 2012 financial year, a drop of 292 percent compared to a profit of Kshs. 3.2 billion in 2011, out of which Kes. 4.6 billion was attributed to derivatives hedging, representing a 73.25 percent of the total loss. In 2012, the firm value was 0.63 as measured by Tobin’s Q ratio. In 2013, a Tobin’s Q ratio of 0.53 was witnessed, a drop from 0.63 in 2012 even after cancelling some derivative contracts. Therefore, this study sought to find out the effect of derivatives hedging on the performance of non-financial firms listed in the Nairobi Securities Exchange as measured by the Tobin Q’s ratio. The specific objectives of the study were, to determine the effect of currency derivatives hedging, commodity derivatives hedging and interest rate derivatives hedging on the performance of non-financial firms listed in the Nairobi Securities Exchange. The study targeted all the 34 Nairobi Securities Exchange listed non-financial firms as at 31st December 2017, out of which 10 firms were sampled purposively and studied for a period of six years, i.e., 2012 – 2017. A descriptive survey research design and a positivism study philosophy were utilised in the study. The study used both primary and secondary data. Primary data was collected through a questionnaire while secondary data, which was used to evaluate the performance of the Nairobi Stock Exchange listed non-financial firms, was obtained from the published financial statements of the firms. The collected data was analysed using estimators of Stata 15. The study applied both descriptive and inferential statistics to analyse the quantitative data that was collected. The study employed panel data (Fixed effects) based on the Hausman specification outcome, to determine the effect of derivatives hedging on the performance of non-financial firms listed in the Nairobi securities exchange. A negative relationship was found between the derivatives hedging and the performance of the non-financial firms. Currency derivatives, commodity derivatives and interest rate derivative hedging were positively related to the performance of non-financial firms listed in the Nairobi Securities exchange. Exchange rates were found not to have a moderating effect on the relationship between derivatives hedging and the performance of the non-financial firms. The study therefore recommends the usage of currency derivatives for hedging purposes and a better combination of interest rate derivatives and commodity derivatives in hedging interest rates and commodity risks.

FINANCIAL OUTREACH AND FINANCIAL SUSTAINABILITY OF LICENSED DEPOSIT TAKING MICROFINANCE INSTITUTIONS IN NAIROBI CITY COUNTY, KENYA.

Rabecca Nundu Mutua-M.SC

Department: Accounting and Finance
Deposit Taking Microfinance institutions have increased in number through issuance of license by Central Bank of Kenya. The trend of financial sustainability for deposit taking microfinance institutions overall sector over the years has been below the threshold except for 2013 when operating self-sufficiency was only achieved. In the year 2017 the sector was hit by loss making whirlwind with only Faulu staying afloat thus raising an alarm that financial sustainability needed to be checked. There are two major obstacles that Microfinance Institutions are facing such as financial sustainability and financial outreach. The economic goal of sustainability in line with vision twenty thirty makes these institutions not to be left out hence under spotlight. Therefore, there is need to examine whether they are financially sustainable to continue serving the low-income earners, heaving them out of poverty and boost the economy of Kenya. It is better not to start any institution than starting it and fail to accomplish its mission in the long run. For Deposit Taking Microfinance Institution to increase financial outreach, it must be operationally sustainable. The study objectives involved determining the existence of relationship between breadth of outreach, depth of outreach, cost of outreach, establishing the relationship between experience of institution and financial sustainability of Deposit Taking Microfinance Institution in Nairobi county, Kenya. Finally, to determine the moderating effect of credit risk management on the relationship between financial outreach and financial sustainability of Deposit Taking Microfinance Institution in Nairobi County, Kenya. The study was anchored on three relevant theories which were: Financial Intermediation theory, Life Cycle theory, Institutionalist theory. Past literature was reviewed with an aim of identifying the research gaps to be filled thus appraised the study. The study employed a positivism research philosophy to determine the relationship between financial outreach and financial sustainability. A population of 13 licensed Deposit Taking Microfinance Institution was considered for this study. Census method was preferred due to small number of target population. A static Panel linear regression model with fixed effect was developed for both operating self-sufficiency and financial self-sufficiency. Secondary data was obtained from Central Bank of Kenya from audited financial statements. Inferential analysis method was employed using Stata statistics software then descriptive statistics tool such as mean and standard deviations were used. several diagnostic tests were conducted namely: normality, multicollinearity, heteroscedasticity, serial correlation, stationarity and Hausman. The study found that number of active clients (breath of outreach) had statistically significant relationship; Average loan size (depth of outreach) had insignificant; age of firm (experience of institution) had insignificant relationship on financial sustainability of DTMFIs in Nairobi county, Kenya. The study recommended that the government through Central Bank of Kenya should formulate policies that enhance savings with DTMFIs and therefore encourage financial inclusion. Further, DTMFIs should engage in vigorous financial education to boost financial facilities’ awareness to boost the breadth of outreach and get involved in information collection and sharing to mitigate credit risk.
There has been a declining trend in the performance of companies in Nairobi Securities Exchange in the recent past with seventeen companies issuing profit warnings to investors in the year 2019, fifteen in 2018, while eighteen firms issued in 2015. Most of the firms reporting inadequate profits were listed in the Commercial and Services sector of the Nairobi Securities Exchange. It raises concern whether companies listed in this sector were more exposed to financial risks in the business environment. The declining trend of performance in Commercial and Services listed companies between the years 2013 and 2019 triggered the desire for the researcher to undertake this study. The study’s main purpose investigated how financial risk affected performance of the Commercial and Services companies. The specific objectives established effects of operational, liquidity and credit risks on Commercial Services companies’ performance on Nairobi Securities Exchange. In addition, the study determined how firm size moderated the effect on financial risk on performance of Commercial and Services companies. The study was anchored on agency theory supported by information asymmetry theory and theory of signalling. Explanatory research design was used. The target population was 14 companies under the Commercial and Services segment in the Nairobi Securities Exchange, Kenya. Census of the companies was done. Panel data in published annual reports for the period 2013-2019 was collected. Panel regression model was applied with the random effect model being used based on the Hausman specification test. Findings indicated that credit risk and operational risks had a positive insignificant effect on Return on Equity with liquidity risk having a negative significant effect on Return on Equity. On the other hand, credit risk had a positive significant effect on Return on Assets. On the other hand, liquidity risk had a negative insignificant effect on Return on Assets and operational risk had a positive insignificant effect on Return on Assets. Firm size did not have moderating effect on the relationship between financial risks and firm performance but was rather found to be an explanatory variable. The study concluded that cost to income ratio had the most impact on Return on Assets while Return on Equity was impacted by the current ratio. The study recommends that the management of Commercial and Services companies should use cost to income and current ratios to track how costs are changing and therefore impacting firm performance. Cost to income and current ratios signal an immediate indicator to firms of emerging problems in the cash flow. The study recommends that shareholders and management of companies listed in the Commercial and Services segment could take calculated credit risks to have a sound financial performance and avoid future insolvencies. In addition, the study recommended that firms should find ways of expanding their assets base since it is associated with better financial performance.

**MONETARY POLICY INSTRUMENTS AND FINANCIAL PERFORMANCE OF COMMERCIAL BANKS IN KENYA**

Abonyo Owuor Fredrick-M.SC

Department: Accounting and Finance

Supervisors: Mr. Gerald Atheru

Ms. Gladys Kimutai

The commercial banks in Kenya have witnessed a general decline in their profitability over the years occasioned by the global financial crisis of 2008 which ravaged the banking sector. Financial performance of Kenyan banks has since declined.
from 4.43% in 2010 to 2.8% in 2018. Consequently, some banks were put under receivership a few years after the crisis while others navigated through the difficult times, albeit with declining profitability. The Central Bank of Kenya responded with a myriad of monetary policy interventions to protect the banking industry from such a crisis. The main objective of this study was, therefore to investigate the influence of these monetary policy instruments and the mediating effect of capital adequacy ratio on the relationship between monetary policy instruments and financial performance of commercial banks in Kenya. The specific objectives of the study were: To examine the effect of open market operations, cash reserve, and central bank rate on the performance of commercial banks; and to establish the mediating effect of capital adequacy ratio on the relationship between monetary policy instruments and financial performance of commercial banks in Kenya. The theoretical framework of the study was guided by the Loan pricing theory of money, the neo-classical theory of interest, efficiency theory, and financial intermediation theory. The study was anchored on the positivism philosophical orientation. Both the descriptive and the explanatory research designs were used for the study. Secondary data obtained from archival data of the Central Bank of Kenya and specific data from the various banks under study were used. Data was then edited, presented, and analysed using Microsoft Excel spread sheets, and STATA. The study was a census of all the 42 commercial banks licensed and supervised by the Central Bank of Kenya. Data analysis was done using descriptive and inferential statistical techniques such as mean, standard deviation, correlation, coefficient of determinant, and tables. The analysis showed that 58.4% of the variability of financial performance was accounted for in the model. The p-value for the overall model was 0.000, which is significant at 5% level of significance, implying that monetary policy has a significant influence on commercial banks' performance. The correlation analysis showed a very weak negative correlation between OMO and ROA, a strong negative correlation between CRR and ROA, a very weak positive correlation between CBR and ROA and a very strong positive correlation between capital adequacy ratio and ROA. The study concluded that open market operations, cash reserve, and central bank rate have a statistically significant influence on the performance of commercial banks. The analysis also showed that the capital adequacy ratio partially mediates the relationship between monetary policy and financial performance of commercial banks. The study recommends that the regulator make OMO more appealing to commercial banks, increase the volume of trade in the open market, and keep CRR and CBR at manageable levels to enhance banks' profitability. Capital requirements need to be reviewed regularly to keep banks liquid. This study recommends to scholars to investigate the influence of monetary policy on the profitability of both commercial banks and non-bank financial institutions. The effects of fiscal policy on the performance of commercial banks also need to be studied.
adopted area sampling method which is a form of cluster sampling and data was collected using self-administered questionnaires based on a 1-5 Likert Scale. Reliability was achieved by the use of Cronbach alpha which had an acceptable level of 0.749. Descriptive and inferential data was analyzed using multiple regression and data was tested using SPSS (22.0). Interpretation of descriptive statistics was done using the mean scores while that of inferential statistics was done using the p-value score. Findings reveal that product strategies had an aggregate mean score of 3.71 which implies respondents considered the smartphone features like battery life and processing speed to large extent in their purchase preference. At the significance level of p<0.05, product strategies with a p-value of 0.000 was found to have a significant effect on purchase preference. Pricing strategies indicators like everyday low pricing, free data bundles and high price for high specifications were found to be the most significant strategies. With an aggregate mean score of 2.68 and a p-value of 0.012 pricing strategies was found to have a significant effect on purchase preference. With an aggregate mean score of 2.93 and a p-value of 0.001 promotion strategies influenced purchase preference significantly. Social media reviews, family and friends, TV advertisements were the most effective of all promotion strategies items. Place strategies significantly influenced purchase preference with indicators like shops stocking a wide variety of phones, online presence and availability of warranty centers being the most significant. With an aggregate mean score of 3.19 and a p-value of 0.023, place strategies had an influence on purchase preference to a moderate extent and was found to have a significant effect on purchase preference. Customer characteristics (age, education and income) had a significant moderating effect on the relationship between marketing strategies and purchase preference. Based on these findings the study concluded that marketing strategies do have a significant effect on purchase preference. Key recommendations drawn from the research indicate that manufacturers should pay more attention on technological advancements and changing consumer preferences which affect how the consumer choses product features in a smartphone. Vendors should stock a wide variety of smartphones, embrace online marketing and invest in good aftersales services like warranty which ensures that the consumer gets absolute value for money. The study further recommended that government agencies like the Communications Authority ensure that the Kenyan consumer has access to good quality smartphones that will safeguard not only their health but investment in the purchase, enabling easy access to information and government services offered online.

WORKING CAPITAL MANAGEMENT AND FINANCIAL PERFORMANCE OF MANUFACTURING AND ALLIED CATEGORY OF FIRMS LISTED AT THE NAIROBI SECURITIES EXCHANGE, KENYA

Ochieng Ruth Marenya-M.SC

Department: Accounting and Finance

Supervisors: Dr. Ambrose Jagongo

Dr. F.W. S. Ndede

Manufacturing sector is one of the key pillars to economic development in Kenya. Most of the organizations consider working capital management as an important recipe in financial management due to its effects on a firm’s profitability, risk and value. Empirical evidence has shown that well formulated and implemented working capital management policy has a positive effect on the firm performance. In the recent, listed manufacturing firms has been experiencing volatility in their returns as well as poor stock performance in the last five years. This may be due to manufacturing firms investing heavily in the various working capital components. The sector is continually facing crucial challenges being inadequate resource linked to poor working capital management that is poor liquidity levels, firms operating without credit control department and increased cases of bankruptcy making it difficult for the sector to succeed. Despite various studies done,
it is not clear how the various components of working capital affect profits, due to their varying effects on profitability hence the need for further research. The current study sought to fill this research gap. The study aimed at investigating how accounts receivables management, inventory management, accounts payables management and cash management influences the financial performance of manufacturing and allied category of firms listed at the NSE. The research utilized explanatory survey research design. The population of interest in this study constituted of all listed firms in the category of manufacturing and allied quoted at the NSE for the period of eleven years (2006 to 2016). There are 9 listed firms at the NSE on the category of manufacturing and allied sector. The study relied on secondary sources of data that was collected using a data extraction form. The collected data was analysed using SPSS.v.23.0. Descriptive statistics was used in the analysis which involved the use of frequencies, means and standard deviation. Quantitative data was presented in tables. The study used inferential statistics which involved tests for multiple regression assumptions of Multicollinearity, Normality, linearity tests, model fit and coefficients. The findings of the research indicated that there was a positive association of working capital management on the financial performance of manufacturing and allied category of firms as indicated by a R2=.923. The study further indicated that firm size had a significant and positive moderating effect on the interaction between WCM and financial performance. The research recommended that firms need to strengthen their management of accounts receivables, accounts payables, cash management and inventory management in order to foster financial profitability. Specifically, the study also proposed that, manufacturing and allied firms should stop making investments that cannot be accessed for longer periods than what the company is currently forecasting and to use a formula that best fits the industry to arrive at a reasonable maximum amount of credit to offer customers, over which a senior manager must approve the terms to ensure adherence to best limits.

COMPENSATION PRACTICES AND EMPLOYEE PERFORMANCE IN FIVE (5) SELECTED BISCUIT MANUFACTURING COMPANIES IN NAIROBI CITY COUNTY, KENYA

Nzyoka Christopher Muthusi-MSC

Department: Business Administration

Supervisors: Dr Jedidah Muli
Dr. Eliud Obere

Employee performance is of high importance in any organization as it determines productivity and future direction. In order to maintain peak performance, organizations use compensation practice as one of the ways to build a competitive strategy for attracting, retaining suitable employees as well as maintaining peak performance. Various compensation practices have been set up in the organizations in pursuit of increased performance and the general growth to ensure sustainability. However, despite the setup, the organizations are still struggling at the marketplace as they have not established the effect of these compensation practices on employee performance. The general objective of this study was to establish the effect of compensation practices and employee performance in the biscuit manufacturing companies within Nairobi city-county, Kenya. Specifically, the study determined the effect of basic pay, examined the effect of employee benefits, effect of skill development, established the effect of work-life balance and the moderating effect of organizational culture on the relationship between total compensation practices and employee performance in the biscuit manufacturing companies in Nairobi city-county, Kenya. The descriptive research design was used and stratified random sampling technique was used to select a sample size of 320 respondents from the target population of 1,600 employees within the Biscuit manufacturing companies in Nairobi City County. Primary data was collected using semi-structured questionnaires. Content, construct and criterion validity was ensured while reliability of data collection instruments was tested using cronbach’s alpha value. To avoid bias in data, diagnostic tests were done in form of normality tests by use of rule of thumb, linearity test using Pearson’s correlation where all variables showed positive correlation, multicollinearity test using variance inflation factor revealing VIF≤3 meaning no multicollinearity and finally homoscedasticity test to
measure variance between dependent independent variables using levene’s test. Descriptive statistics in form of mean, mode, percentages and standard deviations were used to present data. Inferential statistics using a multiple regression model was used to analyse the relationship between compensation practices and employee performance. Statistical Package for Social Sciences (SPSS) computer package for windows version 21.0 was used to aid in the analysis. Results were presented using tables. The findings indicate that there was a significant positive relationship between compensation practices and employee performance in the biscuit manufacturing companies in Nairobi County, Kenya with work life balance being most significant at 0.873 and employment benefits least significant at 0.663. From the findings, the study concluded that compensation practices having significant effect on employee performance need to be taken seriously, biscuit manufacturing companies need to improve on some practices like basic pay and commutate their polici es well. The study recommends a salary survey for biscuit manufacturing companies in Nairobi County and consideration of other practices with more impact like competency based pay.
SCHOOL OF CREATIVE ARTS, FILM & MEDIA

EXPLORING ALTERNATIVE STRATEGIES FOR TEACHING MUSIC THEORY AND AURALS TO THE HEARING IMPAIRED LEARNERS IN KAKAMEGA COUNTY, KENYA

Omari Lycmas-M.SC

Department: Music and Dance

Supervisoprs: Dr. Aggrey Nganyi Wetaba
Dr. Isaiah Oyugi

Education for all (EFA) is a global commitment established in the year 2000. Vision 2030 also advocates for Education as an important pillar in development. The Government of Kenya has introduced free and compulsory Education. Learners with hearing impairment (HI) however do not learn music as a subject. This study aimed at filling this gap by exploring strategies to be used to teach music to learners with HI. The objectives of the study were to: establish the challenges likely to be experienced by learners with HI while learning Music theory and aurals; analyze pedagogical challenges likely to be faced by music teachers of learners with HI in teaching music theory and aurals; and to explore strategies to be used in teaching music theory and aurals. Purposive, stratified and random sampling methods were used to select target respondents. 2 primary schools and 2 secondary schools all from Kakamega County were sampled for the study. In addition, Mumias Education Assessment Resource Centre (MEARC) was used to provide information on the selection and placement procedure of learners with HI. 80 students from each targeted institution were sampled for the study. In addition, 5 administrators from institutions of learners with HI were interviewed. The study employed descriptive and experimental research designs. Data was collected using questionnaires, observation schedules, and interview schedules and then presented using charts and tables. The questionnaires, observation and, interview schedules were administered to learners with HI, their teachers, and MEARC officers. Some learners were subjected to selected teaching strategies (experimental group) and other learners not subjected to those teaching strategies (control group). Validity was ensured by using respondents versed with special needs education. Instruments for study were tested through piloting with few respondents. The experimental design targeted relevant respondents (HI). Music equipment used was tuned well to give correct pitch. Data was coded and presented using tables, figures and graphs. Collected data was subjected to content analysis in which triangulation was employed to get views from different sources. The major findings of the study are: learners with HI have a lot of potential in music and therefore can do music as a subject; assessment of learners with HI plays a big role in their learning ability; the learners with HI can substitute their sense of hearing with their sense of sight, feel and touch to learn music theory and aurals; and, teachers of learners with HI are not trained in the subject of music. The study recommends that: The learners with HI should be provided with adequate teaching and learning materials in Music; they should be given an opportunity to study music as a subject; KISE should introduce Music as a subject; and, KICD and KNEC should incorporate concerns of the HI in their syllabi. It is hoped that findings of this study will be beneficial to Curriculum developers (KICD), teachers, EARC officers, and learners with HI in regard to teaching Strategies for learners with HI. The study concluded that the hard of hearing (HOH) and the partial hearing impaired (PHI) learners are capable of studying music as a subject.
PARTICIPATION IN CHORAL MUSIC ENSEMBLES AND ITS IMPACT ON MUSICIANSHIP AMONG MUSIC EDUCATION STUDENTS IN SELECTED PUBLIC UNIVERSITIES IN KENYA

Eric Koome Murianki-M.A

Department: Music and Dance

Supervisors: Dr. Maurice Amateshe

Dr. Isaiah Oyugi

Music, just like other arts requires time for practice. Despite clearly outlined objectives about practical music in the curriculum by the Ministry of Education, several music education trainees do not consistently exhibit the ‘musical’ part of their training. They give their practical music abilities, especially aural musicianship, little or no attention even after spending quality time with their instructors/teachers. This translates to relatively poor performance at assessment. Guided by Lev Vygotsky’s Social Constructivism theory, this study focused on establishing the extent to which music education students participate in choral music activities as well as examining the effects on participation in choral music. It also focused on assessing the effectiveness of using choral music instruction methods in acquisition of musicianship skills and determining the impact of participation in choral music on musicianship among the music education students. A quasi-experimental research design was employed where pre and post-tests were used. Through the use of purposive sampling techniques, the public universities that offer Bachelor’s degree in music education were considered. An interaction with the respondents who were the music education students at the selected public universities through the use of questionnaires, interviews, observations and focus group discussions, guided the data collection. An analysis through the use of descriptive and inferential statistics was guided by the research questions and objectives of this study. The findings were considered in general music practices that helped in finding out the impact of participation in choral music on musicianship among music education students in public universities in Kenya as they prepared to begin their careers as music teachers.

KEY COMPONENTS OF FILM SCRIPT CONSTRUCTION

Musau Mattmeachamjr Muhammad-M.SC

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This study contended that love scenes, fight scenes, chase scenes and crowd scenes were essential components in film script writing. This study employed the Hollywood classical theory of film making. Hollywood classicism theoretical foundation is based, in many respects, on Freudian theory which rests on the principle of cause and effect where human action and interaction derive from psychological catalysts. The basic concern of this thesis was to determine if the components under study play a significant part in audience appreciation for Kenyan films. Three Kenyan films were selected for this study. The researcher randomly selected three Kenyan films from YOUTUBE based on the number of YOUTUBE subscribers who watched the films. According to YOUTUBE the following Kenyan films were viewed over a hundred
thousand times by YOUTUBE subscribers: 1). The Roadside, directed by William Owusu and produced in 2015; 2). Jongo Love, produced and directed by Paul Ekuru and produced in 2015; and 3) Anasa produced in 2014, a Kenyan Riverwood Movie. These randomly selected films were used to observe the inclusion of the components and the frequencies of these components under study. The research employed both qualitative and quantitative methods. And the findings suggest that the components under study are essential variables which enhance the character of a film script. Of course, there are several components and techniques used by commercial film makers which complement and supplement the components in this study, but observational exercises utilized by the researcher indicated that the components under study were ever present in All the Hollywood blockbusters. One, two, three or all the components under study were present and persistent in every successful Hollywood film production observed.

**Impact of Curriculum Review Policies on Music Teaching and Learning: Case of Public Primary Schools in Kiambu County, Kenya 1999-2019.**

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Dr. Cleniece Owino

The place of music in the Kenyan curriculum of education has for long not been assured as a result of curriculum review and changes. In order to understand how Kenya’s Curriculum Review Policies have impacted the stakeholders in the Public Primary Schools, this study examined the influence of Kenyan education policy and commissions of inquiry into the education system on the attitude/perception on the teaching and learning of Music as a subject in public primary schools in Kenya. This study identified its statement of the problem as being the various changes in the music curriculum whose impact has not been fully analyzed in literature thus creating a gap as to the relevance of these changes to the overall learning experience in public primary schools. This study sought to achieve the following objectives: to establish how the various music curriculum reviews have influenced classroom behavior and overall learning of music in PPS in Kiambu County; To determine how the music curriculum review and changes have affected the morale, performance and state of music in PPS in Kiambu county and; to explore strategies for better teaching and learning of music as a subject in PPS in Kiambu County. The study is significant as it contributes to knowledge by filling the present gap in literature on how music curriculum changes have affected the teaching and learning of music. Policy makers and scholars can therefore have a vital resource to rely on. The study employed the Functionalist Approach to Attitude Formation and change which suggests that attitudes impel people to react to objects, situations, or propositions in ways that can be called favorable or unfavorable. The study correlated the influence of Curriculum Review Policies (independent variable) as it affects the state of music in PPS, which is the dependent variable. A descriptive Research Design was chosen because it enabled the researcher to present the various opinions and attitudes from the subjects in the most effective way. For purposes of gathering objective data, the study employed participant observation of pupils, questionnaires and interview schedules as primary data collection tools with the findings being complemented by secondary data collected from journals, books, policy documents, and online sources. The research employed purposive sampling technique to select respondents based on the characteristics of a population and their level of engagement with music education curriculum. The study chose as its area of study Kiambu County (Kenya) because it has Public primary schools that have been in existence long enough to have been affected by the Curriculum Review Policies changes. This study shed light on the influence of policy on classroom
behavior and the overall learning of music. The study therefore, provides a timely insight into this problem with a view to re-defining learning and teaching of music in the Kenyan public primary schools by proposing measures that are responsive and inclusive of the end users of any music policy. The study revealed that a majority of the respondents were in agreement as to the negative impact of the various music curriculum changes on the overall learning of music and on classroom behaviour. There has also been a marked decline in the place of music in the PPS education curriculum, a situation that has had a negative impact on the attitudes of teachers and pupils towards music.
COMPLEMENTARY FEEDING PRACTICES AND NUTRITION STATUS OF CHILDREN OF MOTHER-TO-MOTHER SUPPORT GROUPS PARTICIPANTS AND NON-PARTICIPANTS IN KAKUMA, TURKANA COUNTY, KENYA

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World Health Organization recommends the formation of Mother-to-Mother Support Groups (MtMSGs) to improve nutrition information for mothers. This strategy has been implemented in Turkana since 2008. With limited research on its contribution to improved complementary feeding practices, this study sought to ascertain if there were significant differences in complementary feeding practices and nutrition status of children 6-23 months of MtMSGs participants and MtMSGs non-participants. The study targeted mothers of children 6 to 23 months of age and their children in 3 locations in Kakuma Division. Systematic random sampling was used to select the 177 MtMSGs participants from Kakuma location and 179 MtMSGs non-participants from Pelekech and Nakalale locations. A structured questionnaire was used to collect socio-economic, demographic, and complementary feeding practices data. Anthropometric tools were used to measure the length and weight of the children 6-23 months. Focused Group Discussions (FGDs) involving fathers, grandmothers, and traditional birth attendants (TBAs) were also carried out. The data obtained from this study was analyzed using SPSS version 20. Anthropometric data was analyzed using ENA for SMART 2015. Data was presented in figures and tables. Pearson correlation (r), T-test, chi-square, and odds ratio were used to measure associations, relationships, comparisons, and risk associated with being or not being MtMSGs participants, respectively. With a response rate of 94.1% (MtMSGs participant) and 95.2% (MtMSGs non-participants), the results showed 61.0% and 51.4% of the children of MtMSGs participants and MtMSGs non-participants respectively, were still breastfeeding. The results further showed that MtMSGs participants were 1.8 times more likely to introduce complementary foods at 6 months while MtMSGs non-participants introduced foods earlier than 6 months. The odds ratio showed that MtMSGs participants were 1.3 times more likely to continue breastfeeding up to 23 months than MtMSGs non-participants who had an early stoppage (OR= 1.32; P=0.024 CI, 0.97 to 3.938). The mean dietary diversity score was 3.7±1.6 with the majority (61.6%) being in the lower tercile (<3) for the MtMSGs participants and a bigger proportion (73.2%) of the MtMSGs non-participants. Children belonging to MtMSGs participants were twice more likely to feed on a diversified diet compared to their counterparts. Global acute malnutrition was significantly higher (25.7%) in the MtMSGs non-participants as compared to the 16.9% in the MtMSGs participants. In conclusion, being in MtMSGs group led to a higher likelihood of the introduction of foods at 6 months and continued breastfeeding up to 2 years. More children in the comparison group were malnourished than in the MtMSGs group. This study, therefore, recommends more sensitization of mothers on exclusive breastfeeding, continued breastfeeding, and optimal complementary feeding.

BLOOD PRESSURE AND ITS ASSOCIATED RISK FACTORS AMONG STAFF AT UASIN GISHU LEVEL 5 HOSPITAL, UASIN GISHU COUNTY, KENYA

Sum Jepchumba Rael - M.SC
High blood pressure continues to be a global public health issue and attention needs to be given to primary preventive measures especially among health practitioners who are a channel to the entire population. Modifiable risk factors for hypertension include overweight and obesity, low consumption of fruits/vegetables, physical inactivity, occupational stress, smoking and excess alcohol consumption. The prevalence of hypertension among health workers in other countries outside and within Africa ranges between 10%-33% while Kenya is between 18.4-32.6% among various community populations but there is no specific data on the prevalence of hypertension among health workers in Uasin Gishu County. This study aimed at determining blood pressure and its associated risk factors among staff at Uasin Gishu level 5 Hospital, Uasin-Gishu County. A cross-sectional analytical study was conducted on a convenient sample of 136 respondents at Uasin Gishu hospital since it is the largest hospital in Uasin Gishu County. Pretested and validated tools were used. A structured questionnaire was used to collect data on socio-demographic characteristics and behavioural factors. 24-hour dietary recall and dietary diversity score were used to collect data on dietary practices. Data on physical activity levels of respondents was collected using the Global physical activity questionnaire. Anthropometric parameters namely weight, height and waist hip ratio were used to determine the nutritional status which was described using World Health Organization classification on Body Mass Index (BMI) and waist hip ratio (WHR). 24hr dietary recall data were analyzed using Nutri-survey. Demographic and socio-economic factors, behavioural factors, occupational stress, dietary practices, nutritional status and physical activity level were analyzed using descriptive statistics. Pearson correlation test was used to determine the relationship between variables, chi-square for the association. A p-value of <0.05 was used as a criterion for statistical significance. The mean age of the hospital staff was 36.96±9.96 years. Prevalence of high blood pressure was 22.6% with the most prevalent risk factors being central obesity (66.9%), BMI above 24.9kg/m2 (63.4%), occupational stress (23%) and physical inactivity at 14%. High dietary cholesterol intake of 219mg which is above RDI of 200mg was observed in female respondents. A Majority (80.1%) had medium dietary diversity score. Dietary intake of key micronutrients such as potassium, calcium in women and vitamin C in males were below the recommended dietary intake. Gender was associated with BMI (p-value = 0.007) and physical activity level (p-value =< 0.001). Factors related to BP were BMI (p-value= 0.011), WHR (p-value= 0.002), age (p-value =< 0.001), education (p-value= 0.016) and household size (p-value= 0.004). Socio-demographic and nutritional status of Uasin Gishu hospital staff influenced their BP levels. Based on findings from this study, respondents should be informed on their nutritional status and blood pressure levels and its associated risk factors. County health administration may find the results from this study useful to help come up with interventions to curb risk factors among their staff. Ministry of Health and other relevant stakeholders such as Kenya Cardiac Society, International Society of hypertension and MoH involved in the prevention and management of hypertension may find this information useful for guiding policy and meeting global targets and goals.
Musculoskeletal disorders refer to a broad range of degenerative and inflammatory conditions that affect the joints, muscles, ligaments, tendons, bones, nerves, and the localized blood circulation system. Despite there being significant literature about musculoskeletal disorders among teachers in other parts of the world, Kenya lags behind in research in this area. The current studies point out to high workloads and stress levels among primary school teachers following an increase in the teacher-pupil ratio. These are among the correlates of musculoskeletal disorders, suggesting an underlying problem worth exploring. The objective of this study is to determine the prevalence and person and work-related predictors of musculoskeletal disorders among Kenyan primary school teachers in Machakos County. The specific objectives of the study were: to determine the prevalence of Musculoskeletal Disorders among primary school teachers in Machakos County, to explore the person related predictors of musculoskeletal disorders and to explore the work-related predictors of musculoskeletal disorders. A cross-sectional design was used to collect data from 302 randomly selected teachers. The data was collected using a questionnaire and an observation checklist. It was analyzed using chi-square and logistic regression analysis and expressed as odds ratio. The prevalence of musculoskeletal disorders at any site of the body was 85.10% with lower back, knees, neck, and ankles being the most affected body sites at 58.60%, 57.6%, 53.3%, and 53% respectively. The least affected body part was the elbows at 25.2%. Neck musculoskeletal disorders were associated with being between 40 and 45 years (p=0.02) and over 50 years (p=0.01), and teaching while standing (p=0.01). Shoulder musculoskeletal disorders were associated with being between 45 and 49 years and being over 50 years (p<0.01 for each), teaching while standing for 2-3 hours and for over 4 hours (p=0.03 and 0.01 respectively). Elbow musculoskeletal disorders were associated with being over 50 years (p=0.01). Musculoskeletal disorders of the knees were associated with lack of back support on chairs (p<0.01). Wrists/hands musculoskeletal disorders were associated with being over 50 years and teaching while standing (p=0.01 for both). Low back musculoskeletal disorders were significantly associated with being between 30-34 years (p=0.01), 35-39 years (p=0.01), 40-44 years (p<0.01) and being over 50 years (p<0.01). Musculoskeletal disorders of the ankles were significantly associated with working on a head-down posture (p=0.01). MSDs interfered with teachers’ ability their normal activities with lower back MSDs being the most prominent at 23.8%. This study reveals that musculoskeletal disorders are very common among primary school teachers in Machakos County, Kenya. The nature of the risk factors is diverse, calling for measures to reduce the notably high prevalence of MSDs, their progression, and burden.

ADOPTION LEVEL OF A PROACTIVE SAFETY PROGRAM WITHIN THE CONSTRUCTION PHASE OF OLKARIA’S GEOTHERMAL POWER STATIONS OF NAKURU COUNTY, KENYA

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Kenya is among the leading countries globally with significant geothermal resources. Geothermal energy provides reliable, cost-competitive, base load power with a small carbon footprint, and reduces vulnerability to changes in climate by
diversifying power supply away from hydropower. Kenya has set out ambitious targets for geothermal power plants to meet an increasing power demand with significant impact to the safety and health of the workforce. This study focused mainly on this sector with a great emphasis to Olkaria’s geothermal power stations of Nakuru County that are under development. Olkaria domes has over 71% of Kenya’s potential to geothermal power capability. The overall objective of this study was to determine level of adoption of proactive safety program measures within construction phase of Olkaria’s geothermal power stations of Nakuru County. Additionally, the study sought to identify the level of importance attached to each proactive safety measure, determines the strategies employed in ensuring that proactive safety program measures are adopted at construction phase and to establish the barriers and success factors to the adoption of this proactive safety program measures. Safety performance metrics and leading indicators from Institute for Work and Health Organisational performance metrics provided measure for the safety performance. Known safety performance indicators of this study were quantitative and qualitative. A descriptive cross-sectional and evaluative study design which uses both quantitative and qualitative methods in data collection has been applied in this study, with a study population being the workers working at the two Geothermal power plants that are currently under construction, a sample was drawn from all the Departments, data was collected using a self-administered questionnaires, observations through a structured checklist, document review and key informant interviews. The data collected was computer managed and analyzed by using the Statistical Package for the Social Sciences software version 20.0. Analysis was achieved by use of descriptive statistics which includes frequencies, percentages, and the mean. The overall result shows that there is partial adoption of the proactive safety measures with dismal performance in process safety measures and thus need for contractors to have policy statement by the top management in commitment to support proactive safety program adoption and implementation. The research pointed out that, employee competency assessment is of great importance to this challenging area, and management should consider their competencies before being hired. Barriers to the adoption of this program has been noted, the management has not provided adequate budget allocation to the provision of personal protective equipment and thus workers are vulnerable to injuries as a result, there is need for management to incorporate safety budget in their core project budget. The findings of this study when adopted, will provide a body of knowledge to all players within the construction phase to enforce a positive safety culture, help to prevent accidents from occurring, and improve health and safety of workers. By incorporating these proactive safety measures as a zero-harm strategy, management shall understand that accidents are preventable and zero accident is a realizable goal.

PHYSICAL HAZARDS AND REPORTED HEALTH EFFECTS AMONG WELDERS IN THE SMALL AND MEDIUM ENTERPRISE SECTOR IN EMBAKASI, NAIROBI CITY COUNTY, KENYA.

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Worldwide, there has been an increasing concern about occupational exposures and injuries among welders in both the small scale and large scale manufacturing industries. Occupational hazards include activities, processes, or materials related to welding with the potential to cause harm or adverse health effects on people performing this task. The sprawling of small and medium-sized enterprises (SMEs) in the developing world provides several challenges to ensuring health and safety practices among workers in the urban poor. This study, therefore, investigated the prevalence of
physical hazards and their related risk factors among welders in Embakasi, Nairobi County. It was a cross-sectional study conducted among 214 welders from 72 workshops in the Embakasi region, namely in Kariobangi South Light Industries, Kayole, and Umoja. Data collection procedure entailed observation and interviews through self-administered questionnaires. A structured questionnaire was used to collect data on risk factors such as socio-demographic profile, training prior to induction, experience, job duration, and use of protective equipment, associated with occupational injuries in the past one year. Key informant interviews and focused group discussion were also conducted to gather qualitative data on welding occupational hazards and the associated injuries. Data was analysed using SPSS version 22 and both descriptive statistics and inferential statistics such as chi-square test and Fishers’ Exact Test were conducted to explain the association between the study variables. The study recorded an overall response rate of 93.9%. It was found out that those who practice arc welding accounts for 58.9% of the welding types followed by those who practice both arc welding and gas metal arc welding (GMAW or metal inert gas welding) (34.6%). Bright light (94.4%), excessive heat (61.7%), projectiles (87.9%), and sharps (78%) were the most common hazards (reported by more than 60% of the respondents). Eye related symptoms (>90%), cuts to the hand/arms and feet (98-100%) and burns to the hands and feet (99%) were the most prevalent self-reported health conditions in the present study. The study indicated that 90.2% of welders knew the activities at the workplace that pose health hazards, about 75.2% of them knew that PPE could be used to protect workers from hazards. Fire was the most reported hazard (97.7%). Welders’ knowledge of physical hazards at their workplace was significantly associated with experience (Fishers Exact Test =45.025, p=0.000), number of hours worked per day (Fishers Exact Test = 9.322, p<0.007), and PPE use ($\chi^2$= 3.884, df = 1, p = 0.049). The study results will be beneficial for the formulation of guiding principles for health and safety for welding procedures. These principles will be adopted by the welders and other artisans in the metal industry, especially those in the Jua Kali sector as well as the regulatory authorities in the country. The study results will be beneficial to welders in making informed decisions about the adoption of safety measures, identification of occupational hazards, and developing health-seeking behaviours.

NURSES’ JOB SATISFACTION IN SELECTED PUBLIC HOSPITALS IN KERICHO COUNTY, KENYA

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Eliphus Gitonga Makunyi

Job satisfaction among healthcare workers plays an important role in influencing productivity, performance efficiency, effectiveness, and the quality and safety of health care services. While there are numerous factors that influence healthcare workers’ job satisfaction, there is a need to identify the factors and address them adequately to improve the satisfaction and enhance the quality of health care services provided to the general public. As the Kenyan Government, through the Ministry of Health focuses on promoting the health and wellbeing of Kenyans by advancing health services, it must outline the challenges and inadequacies within the healthcare setting that limit quality, efficiency, and effectiveness in providing care. Identifying the main issues affecting healthcare in Kenya and their influence on nurses’ satisfaction continues to enhance quality improvement and public health. This study therefore sought to assess nurses’ job satisfaction in selected public hospitals in Kericho County, Kenya. The study sought to determine the proportion of nurses satisfied with their job, identify socio-demographic, individual and organizational factors influencing job satisfaction among nurses. The study employed a facility-based cross-sectional study design. The study reports on results obtained from selected
public hospitals in the county. Study respondents were drawn from Kericho, Kapkatet, Sigowet, Londiani and Kipkelion District Hospitals which were purposively chosen. The study targeted a sample size of 216 respondents who were randomly sampled for study using computer generated numbers. Quantitative data was collected using structured questionnaires administered to respondents. Quantitative data was analyzed using Statistical Package for Social Sciences version 22.0. The results were presented in frequency tables, charts, percentages and graphs. Inferential statistics were done using Chi Square tests to determine the association between study variables at 95% confidence interval (p<0.05). The results revealed that 59% of respondents were satisfied with their jobs in their current work stations. Age (χ²=15.803, df=3, p=0.001), marital status (χ²=19.846, df=3, p=0.001), education (χ²=7.032, df=3, p=0.041), work experience (χ²=1.640, df=2, p=0.019), income (χ²=62.579, df=3, p=0.001), intention to leave (χ²=33.856, df=2, p=0.001), interpersonal relations (χ²=0.292, df=1, p=0.037), working environment (χ²=16.287, df=3, p=0.001), training (χ²=68.598, df=3, p=0.001), tools and equipment conditions (χ²=9.922, df=3, p=0.219) and acknowledgement and recognition at work (χ²=92.863, df=3, p=0.021) were significantly associated with nurses’ job satisfaction. The study concludes that the respondents from Kericho County were satisfied with their current nursing job. Socio-demographic, individual and organizational factors are significantly influencing nurses’ job satisfaction. These results would be of use to the County government of Kericho, public hospitals and the Ministry of Health for purposes of policy formulation and implementation with regards to workable improving job satisfaction thus increased efficiency in work performance and productivity.

CAREGIVER HOME BASED PRACTICES FOR MANAGING CHILDREN AGED (0-59 MONTHS) WITH DIARRHEAL DISEASE IN BUSIA COUNTY, KENYA.

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Dr. Florence N. Okwara

Globally, diarrhea remains the second leading cause of reported mortalities among children (0-59 months) and a cause of significant morbidity, especially in developing countries. In Kenya, diarrhea accounts for 16% of deaths among children (0-59 months). It’s a major cause of mortality in children below five years after malaria and pneumonia in Busia County. Many of the children die due to poor home-based management of diarrhea. The main aim of the study was to explore the different interventions care givers use to manage diarrhea among children (0-59 months) in Busia County and factors associated with home-based management of diarrhea. This was a facility-based descriptive cross-sectional study done in Busia County. Multistage sampling was used to obtain the study sample and a sample size of 389 was used. Both inferential and descriptive statistics were used for quantitative data. Chi-square was used to test relationships between dependent and independent variables at 95% confidence interval. Logistic regression was used to examine the associations between socio-demographic and economic factors, level of knowledge and practices adopted for home-based care. A p-value of less than 0.05 was considered significant. The general knowledge of caregivers on home-based care was unsatisfactory. Out of the 389 caregivers interviewed, only 114(29.3%) had good knowledge level of knowledge on home-based management of diarrhea. Specifically, only 62(20.6%) could mention more than 1 acceptable cause of diarrhea while less than half of the caregivers (48%) thought diarrhea could be prevented. Knowledge of diarrhea management was also not sufficient. Despite all (389 caregivers) having practiced home-based management of diarrhea in the in the last 2 weeks, the study revealed that the overall home-based care practices were inappropriate 280(72%). Socio-demographic
and economic factors like education, occupation, distance to the health facility, source of information and number of household members were significantly associated with appropriate home-based management of diarrhea at <0.001*, <0.001*, 0.044*, 0.003 and 0.001 respectively. Good level of caregivers knowledge was also significant to appropriate home-based management of diarrhea (<0.001*). When other factors had been adjusted, caregivers education p=0.0111 and care givers level of knowledge p=0.0021 were found to be significantly associated with appropriate home-based care of diarrhea in children (0-59 months). The general conclusion of the study was that the caregivers’ level of knowledge about diarrhea was unsatisfactory and measures adopted by caregivers for home-based management of diarrhea were inappropriate. There is, therefore, need for extensive educational interventions such as health education and promotion activities on diarrheal diseases in the study area, together with emphasize on teaching caregivers about the “germ theory” of disease causation, effects, dangers as well as appropriate home management practices and prevention of diarrheal diseases.

MATERNAL COMPLICATIONS AMONG WOMEN MANAGED THROUGH FOCUSED ANTENATAL CARE IN PUBLIC COUNTY HOSPITALS IN NAIROBI CITY COUNTY, KENYA

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Supervisors: Prof. Margaret N. Keraka

Dr. Meshack Onyambu

Focused Antenatal Care is antenatal care that provides individualized counseling, targeted assessment and provides safe, cost effective, and evidence-based intervention. The noted public health major problem has been maternal mortality in developing countries. Majority of maternal deaths occur due to complication during pregnancy and eventual child delivery. The rate of maternal mortality was estimated at 686/100,000 live births in Sub-Saharan Africa. In Kenya maternal mortality rate is at 362/100,000 live birth. The implementation of Focused Antenatal Care was a strategy aimed at improving maternal health in developing countries. Utilization of Focused Antenatal Care has influenced pregnancy outcomes and this varies from country to country. This study therefore aimed at investigating maternal complications among women managed through Focused Antenatal Care in selected public county hospitals in Nairobi City County, Kenya. The study was conducted in postnatal wards of Mbagathi, Mama Lucy Kibaki and Pumwani Maternity Hospitals. The study adopted a cross-sectional descriptive study design. The study used quantitative and qualitative data collection methods. Quantitative data was collected using questionnaires administered to women in their postnatal period who had attended their antenatal care clinics at the selected public county hospitals. A total of 397 postnatal women were interviewed for the study. Qualitative data was collected using Key Informant Interview guides with 12 health care providers who were involved in provision of focused antenatal care services to clients. Quantitative data was analyzed using Statistical Package for Social Sciences to generate descriptive statistics and results presented as frequency tables, bar graphs, pie charts and percentages. Qualitative data from key informants was triangulated with quantitative data as direct quotes and narrations. Inferential statistics were done using Chi Square tests to determine the association between study variables at 95% confidence interval (p<0.05). Before data collection, the study sought approval from Kenyatta University Graduate School, ethical approval from Kenyatta University Ethics and Review Committee, research permit from the National Commission for Science, Technology and Innovation, research authorization from Nairobi City County, research permission from relevant hospital management and consent from study respondents. The study was conducted between 2nd January to
28th February 2019. The study results revealed that 30% of respondents reported to have encountered a maternal complication during their current delivery outcome. Socio-demographic factors such as age (p=0.002), occupation (p=0.001), income (p=0.011), number of deliveries (0.001) and mode of delivery (p=0.001) were significantly associated with maternal complications. The study results further revealed that 54.7% of respondents had high knowledge levels with 63.7% having positive attitude towards FANC utilization. Knowledge level of FANC was significantly associated (p=0.017) with maternal complications among respondents. The study concludes that the women managed through FANC from Nairobi City County had relatively low maternal complications with majority of socio-demographic characteristics playing a significant influence. The respondents further had high knowledge levels and positive attitude towards FANC utilization. These results would be of use to the Ministry of Health for purposes of health education, policy formulation and implementation concerning workable short and long-term maternal and child health interventions. This will ensure strict adherence to FANC utilization thus improved maternal outcomes during pregnancy and eventual child delivery.

ADHERENCE TO PULMONARY TUBERCULOSIS TREATMENT IN MURANG’A COUNTY, KENYA

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Department: Environmental and Occupational Health

Supervisors: Dr. Jackim Nyamari

Dr. Jackim Nyamari

Non-adherence to Tuberculosis treatment is a major barrier for TB control programs because incomplete treatment may result in prolonged infectiousness, drug resistance, relapse and death. Successful treatment of TB involves taking anti TB drugs for at least six months as per the doctors advise. Currently, Tuberculosis has become a resurgent public Health problem in developing countries and is the leading cause of death from any single infectious agent. The purpose of the study was to identify factors contributing to non-adherence to TB treatment amongst pulmonary TB patients in Maragua Sub-County of Murang’a County. The objectives included were to determine the social-economic related, healthcare related, patient-related and disease and medicine related factors associated with non-adherence of TB treatment amongst patients in Murang’a County. The study was guided by the Health Belief model as the theoretical framework. A cross-sectional survey study design was used. Census method was used and all 270 people were considered. Data was collected using a mixed method approach of interview guides, questionnaires and Focus Group Discussions. A total of 270 adult Pulmonary TB patients, amongst whom 59 (47%) were adherents and 67 (53%) non adherents with TB treatment, who received treatment in 2017 and had completed treatment, Community Health workers, and Health Personnel in the TB clinic participated in the study. Data was entered to EPI INFO version 3.5.3 and analysed using Statistical Package for Social Sciences (SPSS) version 22. Multiple logistic regressions was used to identify associations and to control potential confounding variables. Chi Square was used to test independence of categorical variables with p value of less than 0.05 at 95% confidence interval being considered significant. Data presentation was done using figures and tables. From the results of the study only the distance taken to collect drugs in the health facility was found to be associated with non-adherence to TB treatment (n=9, 13%). The study recommends that measures should be undertaken so as to reduce the non-adherence level to TB treatment by ensuring anti-Tb treatment is accessible to patients at the nearest Health facility from their residence. Additionally, the study proposes that the patients should be sensitized on the importance of adherence to TB drug medication. Interventions with Health promotion initiatives emphasizing the benefits of treatment adherence should be enhanced in the communities by further large scale multicentred studies and that an enabling
environment which is conducive for good patient interactions should be created. The study concludes that there are challenges facing adherence of TB treatment which ought to be addressed. The study, suggests that measures to improve drug adherence such as improving health conditions, increasing the availability of drugs and conducting health educations to the patients is essential in minimizing the drug non-adherence to TB drugs.

**ASSESSMENT OF REFERRAL PRACTICES AND FACILITATION ACTIVITIES OF HIV TESTING AND COUNSELING SITES IN NAIROBI CITY COUNTY, KENYA.**

Malaba Joy Serah-M.SC

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Supervisors: Dr. John P. Oyore

Dr. Christine M. Wasanga

Knowledge of one’s HIV status through HIV Testing and Counselling remains the first step towards HIV prevention, appropriate care, and support and treatment services. The knowledge needs to be coupled with means of accessing and obtaining essential posttest services including appropriate care and treatment for all individuals who test HIV positive. Through linkages with care, treatment and support programs, HTC is expected to contribute to lessening the impact of the HIV epidemic on children, adults, families and communities only if all clients who test HIV positive are offered and/or linked to all the requisite prevention, care and treatment services. Therefore the aim of the study was to identify frequency of referrals, referral practices and facilitation activities of HTC providers in Nairobi County for individuals who test HIV positive. The objectives of the study were to determine the frequency of referrals for HIV positive clients by type of HTC site, identify the referral practices by HTC type and establish referral facilitation activities for clients to test HIV positive by type of HTC type in Nairobi County. A cross-sectional comparative study design was employed. The study took a census approach and a total of 92 sites participated in the study. A structured questionnaire was administered to 92 authorized personnel at the HTC sites. The Statistical Package for Social Sciences version 22.0 was used for quantitative data analysis. Key variables of the study were cross tabulated with the main institutional variables and aggregates computed. The relationship between the HTC site type and the varied referral practices and facilitation activities was assessed using the chi square test of association. The results were presented in form of tables, bar charts, and pie charts. Findings showed that 94% the sites referred all the clients who tested HIV positive. However, there was no association between type of HTC site and referrals (X² = 0.0039, P =0.95). Majority of the sites had a documented referral system. Nevertheless, there was no relationship between the type of HTC site and a documented referral system (X² = 0.432, P =1). Only 44% of the sites had conducted referrals for HIV positive clients considered to be emergency cases, with 45% reporting accompanying clients. None of the referral facilitation activities studied had an association with the type of HTC site. The study concluded that there are gaps in the frequency of referrals, referral practices and facilitation activities of HTC providers for clients who test HIV positive in Nairobi County. The study recommends actions for both policy and practice modifications. In order to increase frequency of referrals, NASCOP should institute compliance measures to ensure HTC providers adhere to policy requirements for referral and linkage of all individuals who test HIV positive. The HTC sites should institute review of frequency of referrals and institute corrective measures to ensure linkage of all individuals who test HIV positive. In order to enhance referral practices, the National AIDS and STIs Control Program should refine and disseminate standardized guidance on referral practices for HTC sites. HTC sites should adhere to standard documentation for referrals, institute formal collaborative relationships with referral network partners and
designate staff to manage referrals and follow ups. In order to improve referral facilitation activities, NASCOP should refine and disseminate standard guidance on referral facilitation activities related to accompaniment, transportation and follow up for clients who test HIV positive. On the other hand HTC sites should establish site specific activities that will ensure accompaniment, provision of transport and/or bus fare and follow up to intensify linkage of individuals who test HIV positive and are regarded as emergency cases, into requisite HIV care and treatment services.

RELATIONSHIP BETWEEN LEISURE PARTICIPATION AND MENTAL HEALTH AMONG YOUNG PEOPLE IN MATHARE SUB-COUNTY, KENYA.

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Dr. David Muigai

Leisure participation is active or passive involvement in an activity in one’s free time and is undertaken at one's free time for personal benefits. These benefits may contribute to an individual’s mental health. This study aimed to determine the relationship between leisure participation and mental health among young people in Mathare sub-county, Kenya. The main objective of the study was to assess the participation in leisure activities (time-out, social and achievement) and assess its influence on the mental health of young people, and find out whether age, gender and level of education impact on the mental health of the young people from two settings, the structured and unstructured settings. There were 391 male and female respondents, 240 were selected using convenience sampling from unstructured leisure setting, while the 150 participants were selected using purposive and simple random sampling from the structured leisure setting. Data was collected using two standardized questionnaires; the Leisure Activity Questionnaire (LAQ) to assess the young peoples’ leisure habits and the General Health Questionnaire (GHQ-12) to assess the mental health and well-being of the young people. Data were coded using SPSS version 22 and independent T-test was used to differentiate the means between genders with the mental health status in both settings. One way ANOVA was used to test for the difference between age and level of education with mental health in both structured and unstructured settings. Tukey post-hoc test was used to test any significant differences after the significant F-Ratios. All hypotheses were tested at 0.05 level of significance where results according to age (F(2,227)=32, p=0.00) and level of education (F(3,225)=14.62, p=0.00) indicated significance, therefore having a negative impact on the mental health of participants in unstructured leisure settings unlike in the structured setting for age was (F(2,148)=1.18, p=0.31) and level of education (F(3,146)=2.08, p=0.11). Independent T test was used for gender and there was no significant statistical difference between the males and females mental health in unstructured (t=1.58, df=227, p=0.12) and structured (t=1.01, df = 143, and p = 0.32). Multiple regression analysis was used to examine the relationship between leisure participation (Achievement, Social and Time-out Leisure) and mental health in both structured and unstructured setting. For achievement leisure results indicated (Reading Unstructured setting (R2 =.23 (F [3, 52] = 5.171, p<0.003), Design structured (R2 =.89 (F [3, 3] = 8.64, p>.06)), Sports unstructured (R2 =.49 (F [3,102] =32.01, p < 0.00), Sports structured (R2 =.11 (F [3,120] =4.75, p=0.00); social leisure indicated (Watching TV Unstructured (R2 =.17, (F [3,151] =10.39, p=0.00), Watching TV structured (R2 =.08, (F [3, 69] = 2.01, p = 0.12), Playing pool unstructured (R2 =.96(F [3, 6] =41.96, p<0.00) and time out leisure with (Walking with friends unstructured (R2=.3 (F [3, 94] =14.59, p<0.00), Attending church unstructured (R2=.53 (F [3, 14] =5.17, p=0.01). In the relationship between achievement and social leisure participation and mental health in the structured and unstructured setting, there were significant
relationships an indication of positive relationship. However, with the time out leisure, there were significant relationships also, which was unexpected. In conclusion, the results of this study indicate that young people in Kenya have better mental health when they participate in activities in structured leisure settings, while participation of leisure in unstructured settings is detrimental to the mental health of young people in Kenya. There is need to transition to structured leisure settings will improve the mental health of young Kenyans. This will ultimately prepare, equip and ease their passage to adulthood and be better citizens who can contribute to the socio-economic growth of Kenya.

Recommendation for further studies might consider a rural study location or the relationship between leisure and mental health of young people in a location of a higher socioeconomic status in Kenya.

**RELATIONSHIP BETWEEN ACCESS TO REPRODUCTIVE HEALTH INFORMATION AND RISKY SEXUAL BEHAVIOURS AMONG SECONDARY SCHOOL ADOLESCENTS IN KIAMBU COUNTY, KENYA**

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Dr. Wachuka G. Njoroge

Reproductive health information is critical to adolescents in empowering them make sexual and reproductive health decisions. Studies have shown that adolescents in secondary schools lack adequate, accurate and age appropriate reproductive health information; though faced with unique sexual and reproductive health needs, making them vulnerable to risky sexual activities and behaviors. The study aimed to determine the relationship between access to reproductive health information and risky sexual behaviors among secondary school adolescents in Kiambu County, Kenya. Specifically, the study assessed the level of awareness, sources of reproductive health information, adolescent perception on reproductive health information and influence of social cultural factors on access to reproductive health information, in relation to risky sexual behaviour. This was a descriptive cross-sectional study. The study targeted 7002 adolescent students from all the 13 public secondary schools in Thika West Sub-County. The following schools were selected: Chania Girls’ Boarding School; Chania Boys’ Boarding School and Broadway mixed day school with an accessible population of 2047 students. Fisher’s formula was used to arrive at 364 respondents of which 10% was added to cater for attrition, giving a sample of 400. Stratified sampling technique was adopted in selecting participating schools; to allocate the sample in the respective strata. The study sampled 400 students, and their guidance and counselling teachers as the key informants. The Researcher administered questionnaires, interviews schedules (KII) and focus group discussion guides (FGD) were used in data collection. Descriptive statistics included mean, mode and percentages, while for inferential statistics chi square and binary logistic regression was applied. A p value ≤ 0.05 was considered statistically significant. The findings from the chi square relationship revealed that the risky sexual behaviour was low at 44.7% as indicated by the students who had had sexual relationships. The study found that there is less likelihood of risky sexual behaviour (by 0.571 times and by 0.349 times) for those students who received information from teachers, school counsellors and parents respectively. The relationship was found to be significant represented by a p value of 0.001. The findings also revealed that there is less likelihood of risky sexual behaviour (by 0.626 times, 0.648 times and by 0.629 times) for students who listened to information, on contraceptives, safe sex and STIs respectively. This relationship was found to be significant represented by a (p value of 0.020, 0.003 and 0.019) respectively. The study found that there is less likelihood of risky sexual behaviour (by 0.2012 times, by 0.591 times, by 0.6211 times and by 0.359 times) for those students who found reproductive health
information easily available, very useful, and easy to understand and apply respectively. The conclusion of the study was that access to reproductive health information among adolescents in Thika sub-county was statistically significant in relation to risky sexual behaviours. The study recommends that adolescents should be equipped with adequate age appropriate reproductive health information as early as possible, and consistently made accessible throughout their lives to enable them in make sound sexual and reproductive health decisions thus reducing risky sexual behaviour.

OCCUPATION HEALTH RISKS ASSOCIATED WITH GARBAGE RECYCLING AT DANDORA DUMPSITE, NAIROBI COUNTY, KENYA

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Dr. Eunice Kairu

Increased huge waste volumes are now a common phenomenon in many major world cities. This has resulted in management crisis due to costs and lack of disposal sites. Most have resulted to recycling which exposes the workers to diverse health risks in the process of manual sorting out, scheming and separation of wastes. Kenya has no policies or guidelines addressing health issues in recycling work yet the national burden of occupational diseases and injuries remain unknown. Cases are not documented, due to lack of an occupational health programme addressing recycling. Promotion of healthy work (environments, practices and places) in line with the second WHO Global Strategy for Occupational Health and Safety is low or lacking (UN-Habitat, 2014). In observance of World Conventions, guidelines and standards in safe waste handling and its management, Kenya needs data available only through carrying out studies addressing all critical factors and aspects affecting recycling. This study was designed as an attempt to fill that gap. A descriptive cross sectional study, which evaluated the health risks associated with recycling, was carried out in Dandora, the main dumpsite in Nairobi County, Kenya. Only about 850 tons of the 3,000 to 3,200 tons of solid waste generated daily by Nairobi’s 6.5 million people reach the dumpsite. Selected randomly and recruited in the study, were 240 recyclers from whom data was obtained using open and close-ended questionnaires. A significant association was found between sex of recyclers and marital status (χ²= 24.5, df = 3 P<0.05). Most recyclers were separated, divorced or single (χ² = 18.2, df = 1, p<0.05). The recyclers comprised 67% males and 33% females, with a mean age of 31.2 ± (SE of 0.87). Most respondents (78%) had been taken ill in the last 2 years, with 79% reporting multiple suffering, respiratory (37%), malaria (8%), eye problems (4%), muscle pains (3%), and others (7%). Of the 25% whose family members had suffered a similar disease, 97% reported fatal outcomes, 3% none, while 1% could not recall if it had occurred. There was a statistically significant association between sex and injuries with 50% of health care providers reporting more infections in males than in females (χ² = 103.3, df = 9, p < 0.05). The health problems associated with recycling were respiratory (62%), cuts (22%), typhoid (13%) and back muscle pains (2%). All the 240 respondents were aware there was need for preventive health care to elevate the status of health in their work. Over 59% were aware that glass posed the highest physical injury risk. In contrast to awareness, association between knowledge and practice was significantly low ((χ²= 157.07, df = 4, p<0.05). Recycling was perceived as risky by 85% of the recyclers, with 15% reporting it had no risks. Improvised protective equipments sorted from the wastes were used by 30% of the recyclers, 96% ate food in the dump and only 7% washed their hands. The study results suggest that the haphazard disposal of the wastes together with the inorganic and organic wastes from hospitals, discarded batteries, drugs and various other chemicals, pose biological, chemical and physical risks. The dumpsites’ hardships and
hostile lifestyle pose psychosocial health risks while the strenuous nature of the work poses muscular skeletal problems. Health problems due to bioaccumulation may also arise among the recyclers or the public who eat the recycled foods. The findings of this study will be of value to the Ministry of Health and County Governments in their efforts to address the recycling industry and related health problems especially cancer and other risks to people who reside in and around dump sites. The Kenyan government can also be able to come up with a waste management policy focusing on recycling in line with the WHO Global Strategy for Occupational Health for all.

UPTAKE OF INTERVENTIONS TO MITIGATE MOTHER TO CHILD TRANSMISSION OF THE HUMAN IMMUNODEFICIENCY VIRUS AMONG POSITIVE WOMEN IN NAROK COUNTY, KENYA

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Supervisors: Dr. Harun Kimani

Prof. B.M. Okello-Agina

Prevention of Mother-to-child Transmission (PMTCT) has been scaled up to elimination of mother-to-child transmission (eMTCT) to illustrate the global goals of eliminating all new cases of pediatric HIV. According to NACC (2015), 13.2% children were infected with HIV in Narok despite the efforts in elimination of mother to child HIV transmission in comparison to the national MTCT rate at 6.8%. This study therefore analyzed the various interventions geared towards zero transmissions of Mother to child HIV/AIDS infection in Narok County. A cross sectional design was employed in the research. The study collected data from all the HIV positive mothers attending Maternal and Child Health (MCH) clinics post-delivery. A sample of 300 respondents was studied. Pretested semi structured questionnaires were administered to the HIV positive mothers attending the postnatal clinic. Qualitative data was collected from the Community Health Volunteers, health care providers and mentor mothers using Focus Group Discussion (FGD) Guide and Key Informant Interview (KII) schedule. Quantitative data was analyzed using Statistical Package for Social Sciences (SPSS) version 22. Qualitative data was analyzed thematically and organized objectively. Quantitative data was analyzed using descriptive statistics and inferential statistics used to measure associations between variables. Data was presented using frequencies and proportions. Analyzed data revealed that 8.7% infants born to HIV positive mothers had contracted HIV. Only 14.7% mothers attended ANC during the first trimester. In regards to diagnosis of HIV status, only 16.6% mothers knew their HIV status prior to pregnancy and during the 1st trimester. At least 21.0% of HIV positive mothers delivered at home. Only 74.6% of the infants had received an initial HIV test within 6 weeks. Viral load uptake and suppression among mothers on care was 46.4% and 74.4% respectively. It was found out that 25.3% of HIV positive mothers practiced mixed feeding on infants within the first 6 months of life. Only 74.7% mothers reported to have received family planning counselling during the postnatal clinics. Factors significantly associated with uptake of PMTCT interventions were marital status ($\chi^2 = 6.866; \text{ df } = 1, \text{ O.R. } = 0.329, \text{ P value } = 0.019$), level of education ($\chi^2 = 10.209; \text{ df } = 1, \text{ O.R. } = 2.817, \text{ P value } = 0.003$), knowledge of MTCT services ($\chi^2 = 7.867; \text{ df } = 1, \text{ O.R. } = 0.430, \text{ P } = 0.006$), attitude ($\chi^2 = 4.239; \text{ df } = 1, \text{ P } < 0.041$), stigma ($\chi^2 = 25.631; \text{ df } = 1, \text{ O.R. } = 4.020, \text{ P } = 0.001$), and distance ($\chi^2 = 12.325; \text{ df } = 2, \text{ O.R. } = 0.364, \text{ P } = 0.001$) and partner support ($\chi^2 = 4.239; \text{ df } = 1, \text{ O.R. } = 2.375, \text{ P } < 0.007$) and cultural constraints ($\chi^2 = 4.332; \text{ df } = 1, \text{ O.R. } = 1.885, \text{ P } < 0.039$). On disclosure, only 43% of the respondents had disclosed their HIV status to partners and this was significantly associated with uptake of the PMTCT interventions. This study clearly highlights on the critical service delivery gaps and need to strengthen optimization of PMTCT services to help eliminate vertical transmission of HIV from infected mothers to their babies. The study
recommends need for education of mothers on MTCT and mobilization for early attendance of ANC and skilled deliveries to enhance timely interventions. Community units to be activated so as to strengthen the referral and linkage systems. The government to upgrade and integrate PMTCT services in the small facilities in hard to reach areas. Finally, cultural sensitive models of engaging the men in PMTCT programs should be explored to improve uptake of the PMTCT services. In conclusion, individual and contextual factors influence uptake of PMTCT interventions among HIV infected mothers in Narok County.

**PREDICTORS OF PRETERM BIRTH AMONG WOMEN OF PASTORALIST COMMUNITIES IN MARSBABIT COUNTY, KENYA.**

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Dr. David Galgallo

Preterm birth (PTB) is a major cause of neonatal mortality worldwide. The prevalence of PTB in Africa (about 12%) is more than twice that in developed countries (about 5%). In Kenya, the prevalence is about 17% which is way more than the average in Africa, pointing to the need for targeted interventions to reduce its burden. Sub County Medical Officer of Health (SCMOH) of Moyale Sub-County reported an increasing trend in Preterm Birth (PTB) in the region from 40% in 2012 to 60% in 2014. This study sought to establish the factors associated with PTB among mothers delivering in public hospitals in Moyale Sub-County. This was a cross-sectional study that involved 370 mothers with infants less than one year of age recruited at the post-natal clinics (PNC) from eight facilities in Moyale Sub-County. Systematic sampling method with stratum-proportional size allocation was used to select the study participants. Information on their socio-demographic characteristics, obstetric and antenatal history was collected from the participants using a structured interviewer-administered questionnaire. Data was analyzed using STATA version 15. Chi-square test of association was used to determine the associations between the mothers’ characteristics and preterm birth status. The mothers in this study were aged between 18 and 46 years with median of 29 years (IQR=25-35 years). Majority (63.0%) of the participants were from rural parts of the study area. The prevalence of PTB in this population was 38.7% (95% CI: 30.8%-40.8%). Antenatal Clinic (ANC) attendance (1-3 visits vs none, PR=53.0% [0.40-0.71] & ≥4 visits vs none, PR=55.0%[0.39-0.76]), having UTI during pregnancy (PR= 64.0% [0.45-0.91]), history of miscarriage (PR= 46.5% [0.37-0.56]), history of underlying medical conditions during pregnancy (PR=42.5% [0.27-0.58], parity (PR=37.0% [0.12-0.62]), and employment status of the mother (PR=45.0% [0.16-0.74]) were significantly associated with the risk of PTB. The study shows that the prevalence of PTB in Moyale Sub-county is high, almost 3 times higher than the National estimate. Among the factors found to have a significant effect on PTB prevalence, some like ANC attendance can be addressed through community sensitization on the importance of making such visits to improve attendance and detect potential complications that would lead to PTB in advance. Special attention should be accorded to mothers with history of underlying medical conditions and miscarriages to enhance survival of the neonates. Mothers who are self-employed were found to have a higher risk of PTB compared to the unemployed; a possible explanation for this would be exposure to extraneous physical activities during pregnancy. There is need to educate the women on the importance having sufficient rest and avoiding heavy manual work for the safety of the mother and baby.
PREDICTORS OF RETENTION IN CARE AMONG HUMAN IMMUNODEFICIENCY VIRUS INFECTED PREGNANT WOMEN IN NAROK COUNTY, KENYA

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Retention is critical to HIV-infected women for the prevention of mother to child infection, reduction of maternal morbidity and mortality. Treatment drop out is a major challenge that hinders the success of elimination of mother to child transmission (EMTCT) of HIV in Kenya and Sub Saharan Africa. Although all pregnant human immunodeficiency virus (HIV) infected women in Kenya are initiated on lifelong antiretroviral treatment (ART) irrespective of CD4 count or WHO staging, not all patients who are initiated on antiretroviral treatment are retained in care. The retention in care in Narok County is far below the national retention. Despite measures and efforts by several stakeholders in HIV prevention, care and treatment to increase retention in care among HIV infected pregnant women retention is still very low. As a result, the risk of maternal-to-child transmission in Narok County is still high. Moreover, there is limited data on predictors of retention in care among women in Kenya. The main objective of this study was to determine the predictors of retention in care among HIV infected pregnant women in Narok sub-county hospitals, Kenya. The specific objectives were; to establish demographic and socioeconomic factors that influence retention in care among HIV infected pregnant women in Narok sub-county hospitals, to determine the knowledge, attitude and perception of EMTCT among HIV infected pregnant women in Narok sub-county hospitals and to establish the health system-related factors that influence retention in care among HIV infected pregnant women in Narok sub-county hospitals. The study adopted a cross-sectional mixed method design. Purposive sampling method was used to sample the required sample size of 117 HIV infected pregnant women, the participants of the Focus Group Discussions (FGD) and Key Informant Interviews (KII). The study was conducted in all Narok sub-county hospitals. Questionnaire was used to collect quantitative data. Focus group discussion and KII guides were used to collect qualitative data. Quantitative and qualitative data was analyzed using SPSS version 21 and Nvivo version 14 respectively. Chi square test and logistic regression analysis were used to determine the predictors of retention in HIV care. Thematic content analysis was done for qualitative data. The mean age of participants was 30 years (SD=6.48). Among the demographic and socio economic factors education, marital status, religion, distance to health facility and partner knowledge were significantly associated with retention in care with a p-value of 0.031, 0.040, 0.023, 0.024 and 0.03 respectively. Eighty three percent of the women had high knowledge on cause of HIV, 43% on mode of HIV transmission and 34% on when maternal to child transmission of HIV occurs. It was also found that majority of HIV infected pregnant women had positive attitude and good perception towards EMTCT services offered in the hospitals. On medication-related factors, ARVs side effects (P<0.041) and being on combined treatment drug (P<0.035) were that were found to be associated with retention in care. This study also established that health system-related factors influenced retention in care among HIV infected pregnant women. However, only ARV availability had a significant association with retention in care (P<0.001, OR=0.19). The multiple logistic regression was used to predict the influence of grouped variables. Overall, the model was a significant predictor of retention in care. Of the grouped predictors, demographic and socio-economic (P<0.03, OR=0.71) and knowledge, attitude and perception of EMTCT (P<0.01, OR=1.77) were found to be
predictors of retention. Medication related factors (P<0.18, OR=12.84) and health system related factors (P<0.34, OR=5.14) were found not to be significant predictors of retention in care. The study recommends that the Ministry of Health and other stakeholders should hold community awareness and sensitization programmes on benefits of prevention of mother to child transmission of HIV services to increase retention in care in order to prevent vertical and horizontal transmission of HIV.

ASSESSMENT OF NEWBORN RESUSCITATION PRACTICE BY NURSES IN MACHAKOS LEVEL 5 HOSPITAL, MACHAKOS COUNTY, KENYA.

Daniel M. Muli-M.PH

Department: Population, Reproductive Health and Community Resource Management

Supervisors: Dr. Joseph Thigiti

Dr. Kenneth Rucha

The first minute after birth is usually referred to as the golden minute, and the baby should be able to initiate spontaneous breathing, failure to which birth asphyxia ensues. Globally, approximately 5% to 10 per cent of newborns require resuscitation. In sub-Saharan Africa where over one third of all intrapartum related neonatal deaths occur, the rates of skilled attendance at birth are very low. In Kenya neonatal mortality remains at 22/100,000 live births, majority associated with poor resuscitation. This study sought to assess neonatal resuscitation practice among nurses in Machakos Level 5 Hospital, in Machakos County, Kenya. The study aimed at identifying individual, knowledge and health system factors that influences practice of neonatal resuscitation among nurses. The study adopted a descriptive cross-sectional study design. The study population included nurses working in Machakos level 5 hospital in Machakos County. The study sampled 201 nurses involved in neonatal resuscitation who were interviewed. Quantitative data was collected using semi-structured questionnaires from selected nurses through systematic random sampling at a predetermined interval of 2. Every second respondent was selected for interview until the required sample was reached for interviewing. Qualitative data was collected using key informant interview schedules with 6 selected Key Informants. Key informants were purposively selected for inclusion in the study. The researcher sought all required approvals from relevant authorities and ensured study participants gave an informed consent prior to the conduct of the study. Descriptive statistics were calculated using Statistical Package for Social Sciences version 22 with the aid of Microsoft Excel program to generate frequency tables, graphs and pie-charts. Qualitative data was analyzed using thematic analysis and results triangulated with quantitative data as direct quotes or narrations. To test the association between study variables, Chi-Square tests done was at 95% confidence interval (p<0.05) were used. The study results revealed that 41 per cent of respondents fully practiced neonatal resuscitation. Individual factors such as age (p=0.001), years in current position (p=0.001), highest level of education (p=0.021), training on neonatal resuscitation and performance of neonatal resuscitation (0.001) were associated with practice of neonatal resuscitation. Health system factors such as availability of resuscitation equipment (p=0.001), place of keeping resuscitation equipment (p=0.021) and reference to guidelines (p=0.001) had a significant influence on neonatal resuscitation practice. The study results further revealed that 56 per cent of respondents had high knowledge on neonatal resuscitation. Knowledge level (p=0.001) significantly affected practice of neonatal resuscitation. The study conclude that a significant large number of respondents did not fully achieve neonatal resuscitation despite majority of them being knowledgeable on neonatal resuscitation. The study recommends on job training and seminars on newborn resuscitation towards improving the practice of neonatal resuscitation. The hospital administration should sponsor nurses
to specialize in neonatal care and ensure that each department has a team leader to offer mentorship to others in order to reduce neonatal mortality.

HERBAL MEDICINE USE AMONG PREGNANT WOMEN IN MAKUENI COUNTY, KENYA.

Philip Mbithi Muia-M.PH

Department: Population, Reproductive Health & Community Resource Management

Supervisors: Dr. Titus Kahiga
Dr. Daniel Muia

The use of herbal medicine is becoming increasingly popular worldwide with statistics showing 65% to 80% of the world’s population using herbal medicines. In Kenya, more than two thirds of the Kenyan population is using herbal medicines for their essential health care needs. A cross-sectional survey was conducted on 384 purposively selected pregnant women between July and September 2015. The main objective of the study was to establish the patterns of herbal medicines use during pregnancy in Makueni Sub County. Specifically, the study aimed to establish the extent of herbal medicines use during pregnancy in Makueni Sub County; to establish the factors that influence use of herbal medicines during pregnancy; to describe the reasons for use of herbal medicines during pregnancy in Makueni sub county and to document some of the perceived adverse effects related to herbal medicines use during pregnancy. Quantitative data was collected using a self-administered questionnaire while qualitative data was collected using key informant interviews and focus group discussions. Quantitative data was analyzed using SPSS version 21. Logistic regression and Odds Ratio (OR) were used to establish strength of the associations of variables while qualitative data was analyzed using NVivo. The study revealed that 30.5% of women had used herbal medicines during pregnancy. Level of education, socioeconomic status and age were associated with herbal medicines use during pregnancy. It was found that women used herbal medicine during pregnancy to manage nausea/vomiting, cough related ailments, prepare uterus for labour among others. Mothers in law, herbalists and traditional birth attendants were key recommenders. Diarrhea and abdominal discomforts/pains were highlighted as the main undesired effects resulting from use of herbal medicines. Approximately a third of the women use herbal medicines during pregnancy for varied reasons. From this report, it is recommended that rigorous health education against indiscriminate use of herbal medicines is needed to alleviate any danger that could be posed to the mother and the fetus by unknown chemical constituents in the herbal medications.

HEALTH INFORMATION SYSTEM FEEDBACK IN SELECTED PUBLIC HEALTH FACILITIES IN NAIROBI CITY COUNTY, KENYA

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Department: Health and Informatics Management

Supervisors: Dr. Daniel Muthee
Dr. George Otieno

Health Information System (HIS) is important in policy making and improvement of health care. Developed countries across the world continue to improve HIS as a means of promoting uptake of Universal Health Coverage (UHC). However, in developing countries especially Africa, HIS is not considered important factor in achieving UHC. In Kenya, it remains a
significant challenge to determine level of feedback from health dispensaries, county hospitals and national hospitals yet the facilities contribute data that supports health policies and performance of health programs. Thus, this study sought to assess the extent to which sources of HIS information, flow of HIS and HIS exchange platforms are associated with HIS feedback in the public health facilities in Nairobi County. This study adopted the descriptive survey research design. Independent variables include: sources of data and Information of HIS, and information exchange platforms. The intervening variables were Health Information Policy and available resources while dependent variable was the HIS feedback. Public health facilities in Nairobi County are chosen as the area of study. The researcher targeted public health record personnel in the public health facilities and the officials of the National HIS Coordinating Committee. To obtain suitable sample, the researcher used stratified, random and purposive sampling techniques. The sample size of 130 respondents was chosen in the public health facilities. The research instruments used included questionnaires and interviews schedules. Collected data was coded then entered into a secure database for analysis by use of Statistical Packages for Social Sciences (SPSS) version 23. Both descriptive (measures of central tendencies dispersion and frequency distribution) as well as inferential statistics (Pearson correlation and logistic regression) were used for analysis. Qualitative data was analyzed with an aim of establishing the themes. With response rate of 88%, the study established that with correlation coefficient of -0.753, source of information negatively influenced HIS feedback. Also, the study revealed that with a correlation coefficient of 0.440, information flow in HIS positively influenced feedback. In addition, the study established that with correlation between exchange platforms and feedback indicated that with a correlation coefficient of 0.579, exchange platform positively influenced feedback in HIS. Based on the findings, it was concluded that sources of data, information flow and exchange platforms are significant but not major factors influencing HIS feedback. The study therefore recommended the MOH to have strong, relevant, effective, efficient and versatile information flow and exchange structures and platforms. The presence of such well-defined information flow and exchange structures and platforms guarantee suitable HIS that creates impacts and sustainability in the Health sector.

FACTORS ASSOCIATED WITH UPTAKE OF HIV AND AIDS COMBINATION PREVENTION STRATEGIES AMONG FEMALE SEX WORKERS IN NAKURU COUNTY, KENYA

Ng’ethe Rachael Mumbi-M.PH

The fight against HIV and AIDS in Kenya has been intensified to reduce the prevalence of HIV and AIDS across all populations. The National adult HIV prevalence rate in Kenya is 4.4%, with prevalence higher among women (5.7%) compared to that of men (3.1%). The prevalence among female sex workers (FSWs) is highest at 29.3% compared to all other populations, This implies that there is low uptake of HIV combination prevention strategies (HACPS) which are the recommended prevention intervention for FSWs due to their risk of exposure. This study aimed to determine factors associated with uptake of HACPS among FSWs in Nakuru County. The specific objectives were to establish the level of uptake of HACPS among FSWs, to establish the level of knowledge, attitude and practice of HACPS among the FSWs, to determine the perceptions of FSWs associated with uptake of HACPS and to establish the demographic characteristics associated with uptake of HACPS among the FSWs in Nakuru County. The study adopted a descriptive cross-sectional research design. Data were collected using questionnaires from 336 FSWs reached through snowballing. Focus group discussion was done with six purposefully selected participants. Data were analyzed using SPSS version 21 to produce percentages and frequencies, presented in tables and charts. The study found out that uptake of HACPS among FSWs in Nakuru County was low at 32.4%. The level of knowledge of HIV risk and that of HACPS was 61.3% and 45.9% respectively. The perceptions associated with uptake of HACPS were low perceived barriers (p: 0.000) and low motivational drive towards uptake (p: 0.001). The demographic characteristics associated with uptake of HACPS were long duration in sex
work for more than five years (p: 0.000), level of education beyond primary school (p: 0.003). The conclusion from the study was that the level of uptake of HACPS was very low at 32.4 % which put the FSWs at risk of acquisition and transmission of HIV and AIDS. There was little knowledge on HACPS at 45.9% despite moderate knowledge on HIV risk (61.3 %). FSWs with negative beliefs, negative behavior and low motivational drive were less likely to take up HACPS. Education below secondary school and duration of sex work above five years was associated with uptake of HACPS. The recommendations from this study is that Nakuru County department of Health and implementing partners working with FSWs in the county to work on measures that will help to scale up the low uptake of HACPS among FSWs, through education and sensitization of FSWs on HACPS. The Sensitization should target all FSWs especially those with negative perceived barriers low motivational drive, education level below secondary school and duration of sex work below five years.

UTILIZATION OF THE SEXUAL AND REPRODUCTIVE HEALTH CARE SERVICES AMONG YOUTH LIVING ON THE STREETS IN NAKURU COUNTY, KENYA

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The access and utilization of sexual and reproductive health care is a crucial concern surrounding the advancement of sexual and reproductive health (SRH) and rights. Making clinical services attractive to the younger generation has remained a challenge. Sexual and reproductive health services remain underutilized by the youth living on the streets. Unfortunately, this group is exposed to a very hostile environment on the streets, has a highly mobile and unprotected lifestyle often resulting in early sexual debut, physical and drug abuse, sexually transmitted infections and unwanted pregnancies. Recent years have seen a sharp rise in these youth on the streets. Toward the Kenya government goal of attainment of Universal health for all Kenyans, there is a need to explore the unique SRH needs of this group. This study sought to investigate the utilization of SRH services among the youth living on the streets. A descriptive survey research study was done in Nakuru town in Nakuru County, Kenya. One hundred and eight study participants were recruited using cluster sampling from five sites identified. Three core research tools used to collect data were the researcher administered questionnaires, group discussion, and key informant interviews. Data were analyzed through statistical package for social sciences (SPSS) version 21.0. The qualitative data were analyzed using a content approach. The study found out that these youths knew their SRH needs and inadequate information on the various SRH services being offered in the health facilities. The utilization of SRH services is low at 25.9%. A majority (84.1%) had experienced SRH problems. Most (75.07%) did not know the types of reproductive health services offered. Demographic factors such as; whether parents are employed or not (p 0.018), and youth’s level of education (p 0.005) were associated with the utilization of the SRH services. Economic factors like the affordability of SRH services (p 0.005), costs charged by SRHF (0.000), staff’s attitude in the health facility (p 0.017) and availability of health facility (0.017) were associated with utilization of SRH services. Recommendations include the provision of information for YLOS on SRH need and the available SRH services to increase utilization, efforts should be made to establish and strengthen Youth friendly service Centre in Bondeni where a large number of the YLOS seek reproductive health services and need to increase funding for reproductive health services to these facilities so as all the
services can be offered free of charge to the YLOS. This will further increase access and utilization as most of them do not have reliable sources of income.

GLOBAL GAG RULE INFLUENCE ON DETERMINANTS OF UNMET NEED FOR FAMILY PLANNING AT FAMILY HEALTH OPTIONS KENYA IN NAIROBI CITY COUNTY

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Dr. Justus Ngatia

Introduction: This study was about the determinants of unmet need for family planning in the era of the global gag rule at Family Health Options Kenya in Nairobi City County. Problem statement: This policy creates inhibitions on family planning programs and results in loss of US funding for reproductive health NGOs that depend on donor funding for their reproductive health activities such as family planning. FHOK has had to close down the Kitengela and Mombasa clinics.

Objectives: The objective of the study was to determine the unmet need for family planning among women who visited Family Health Options Kenya in Nairobi County by examining the association between unmet need and affordability of contraceptive services, accessibility of FHOK clinics and quality of FHOK services. Methods: Data was collected from clients using questionnaires for quantitative data and key informant interviews of service providers for qualitative data. The study design was a descriptive cross sectional study design. Purposive sampling was used to select the clinics of the study and systematic random sampling was used to select the participants of the study. Data Analysis was done using Statistical Package for Social Sciences (SPSS). Chi square was used to test the significance of the association between the dependent and independent variables. Results: The most popular contraceptive selected at FHOK was implants. Unmet need was found to be 46.1%. Affordability of FHOK services was not found to have a significant association with unmet need for family planning. Accessibility and quality of FHOK services were also not found to have a significant association with unmet need. However, it was noted that the patients who used to visit the Kitengela clinic that was closed due to the global gag rule reported that the distance to the FHOK clinics in Nairobi County was too far. However, their numbers were not significant enough to show an association with unmet need for family planning. The key informant interviews revealed that the health providers had a meeting in the wake of this policy to strategize on how to mitigate it. They decided to focus on providing their clients with long term contraceptives as opposed to short term ones to reduce the frequency of the patient’s subsequent visits thus reducing the chances of stock outs of contraceptive commodities. Conclusion: Unmet need, at 46%, was higher than the national estimate of 18% (KDHS 2014) due to the fact that the study population was women who visited the clinic specifically for family planning services, not the general population of women in the community. None of the factors of affordability, accessibility nor quality of services were found to have a significant association with unmet need for family planning because the Global Gag Response project currently ongoing at FHOK has ensured replacement of the funding that was lost to the tune of USD 500,067 and this has ensured that despite the changes made by FHOK to adjust to the reduced funding, the affordability, accessibility and quality of patient care has not undergone a significantly noticeable change to the patients.
SCIENCE LABORATORIES SAFETY ASSESSMENT AMONG SECONDARY SCHOOL STUDENTS IN KITUI COUNTY, KENYA.

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Laboratories are potentially dangerous work environment, often containing a wide variety of toxic, flammable, corrosive, and reactive compounds that can cause harm or injury if safety standards are not adhered to. Although several studies show laboratory safety is a growing concern for schools, little national data exist on the current safety of facilities, equipment, and practices. There is an exponential rise in student population in secondary schools in Kenya that leads to safety concern. The study was conducted in both public and private secondary school between January and October 2016 in Kitui central sub-County, Kitui County, Kenya. The main objective of this study was to assess science laboratories safety among secondary school students in Kitui County, Kenya. The study was conducted in eighteen secondary schools and the main focus was on issues of chemicals management and student population in secondary school science laboratories. Descriptive cross sectional design was used in the study. The sub-county had 34 secondary schools, 8264 students and 108 science teachers. Stratified, proportionate, purposive and simple random sampling was used to recruit the study participants comprising of 18 school Principals, 36 Science teachers, 16 laboratory assistants and 368 students with all the subjects being given equal chances of being selected to participate in the study. Structured and unstructured questionnaires and observation check list were used to collect primary data. The collected data was analyzed, coded and sorted in appropriate form and the results were presented in charts, tables and narrations. The data was analyzed using percentages and chi square guided by research objectives and research questions. Statistical package for social sciences (SPSS) version 20 was used to analyze the data. The research results revealed the significant causes of injuries as inhalation of gases (25%), sharp objects (23.33%) and chemical spillage (20%) which increase when schools fail to comply with the laboratory safety standards and procedures. The study revealed that only 31.25% laboratory assistance trained up to diploma level and were mainly in National schools where there were few injuries, 31.25% were untrained, mainly in private schools. This shows inadequate knowledge among the laboratory assistant which compounds the exposure of the students to injuries. Significant associations were observed between type of school and frequency of injuries ($\chi^2=4.4$ df=4 and p=0.021). The result of this study may be used by school administration and policy makers to plan on systems to reduce injuries by employing trained laboratory assistant and ensuring the recommended number of students of between 40-45 per given class in secondary school. The study recommends school administration to ensure that teachers and their students are made aware against safety risk to reduce frequencies and causes of injuries. The study also recommends the government through MOE should improve coordination and follow up of all stakeholders in safety policy implementation process to ensure that laboratory safety standards are adhered to. The study recommends further research on challenges faced by students, laboratory technicians and teachers in the science laboratories which was not covered in this study.

MANAGEMENT PRACTICES OF ACUTE DIARRHOEA BY CAREGIVERS OF CHILDREN UNDER FIVE YEARS IN MATHARE INFORMAL SETTLEMENT, NAIROBI CITY COUNTY, KENYA

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Diarrhoea continues to remain one of the main and the second most significant cause of death globally in children under five years. The number of diarrhoea cases continues to increase every year and is estimated to be 1.7 billion annually. In 2018, in Kenya, 1,499,146 cases of diarrhoea were reported among children under five years and Nairobi accounted for 136,028 cases. A research in Nairobi Informal Settlements showed that 25.6% of children living in the Informal Settlement had diarrhoea. Caregivers in Mathare reported that their children contract diarrhoea at least once every two weeks. As diarrhoea is mostly managed at home by caregivers there is need to determine the management practices of acute diarrhoea by caregivers of children under five years. The main objective of the research was to determine the management practices of acute diarrhoea by caregivers of children under five years in Mathare Informal Settlement. To achieve this objective, a cross-sectional study design was used. Due to its pollution and diarrhoea frequency reported by caregivers, Mathare Informal Settlement was purposively selected. For the choice of households and respondents, simple random sampling was used. Researcher administered questionnaire and observation checklist were completed appropriately. Fisher’s and exact test, Pearson Chi-square as well as Pearson correlation were utilized in the analysis. P < 0.05 was considered as statistically significant. Age of the caregivers ranged from 18-72 years old. The main age group of caregivers was 25-31 years old with 56.17%. The household size ranged from 2 to 15. Children under five years living in the selected households of the study ranged from 1 to 7 per household. Children who were 1 per household accounted for 49.4%. Mothers accounted for 83.6%. Prevalence of diarrhoea among children was 18.7%. Sex of the caregiver (p=0.008), relationship of the caregiver (p<0.001), number of household residents (p<0.001), and number of children under five years in the household (p<0.001) were found to be statistically significant with diarrhoea prevalence among children aged zero to less than five years. Knowledge level of caregivers regarding management practices of acute diarrhoea was found to be statistically significant with prevalence of diarrhoea in children under five years (p=0.020). Majority of the respondents (63.89%) used drugs from hospitals to manage diarrhoea. In 63.89%, water was given like any other day during diarrhoea. One hundred and seventy six caregivers breastfed the child during the survey. The majority of the respondents (52.78%) had no formal education. Faeces, flies and open garbage were present near or within the household in 37.72%, 59.26%, and 80.25% respectively. All the respondents washed their hands during the study. However 27.78% of the respondents did not wash their hands after disposing the child faeces. Caregivers disposed the child stool in garbage in 38.89 %. Fifty caregivers did not take their children for immunization. Statistical significance was observed between diarrhoea prevalence and the caregiver’s educational level (p<0.001), renting (p=0.024), existence of flies near or within the household (p<0.001), existence of faeces near or within the household (p<0.001), existence of open garbage near or within the household (p<0.001), immunization of children (p<0.001), age when the children start using latrine (p<0.001). In conclusion, low knowledge level was a predictor of diarrhoea among children under five years. Many factors such as existence of open garbage near or within the household and immunization practices were found to be associated with diarrhoeal prevalence among children under five years. It is therefore recommended that there is need for public health education and promotion in the study area.
The World Health Organization (WHO, 2018) defines adolescents as individuals in the 10-19 years age group. Every year, estimated 21 million girls aged 15-19 years, and 2.5 million girls under 15 years become pregnant and approximately 3.9 million girls aged 15-19 years undergo unsafe abortion every year. Despite the high sexual activity by the Malawian adolescents which is rated at 51 percent, there is low utilization of modern contraception. Failure to utilize the modern contraception has resulted in adolescent girls getting unplanned pregnancies which have detrimental effects both to their health as well as their social life. Therefore, the aim of this study is to assess the modern contraception utilization among adolescent girls at Tsangano Turnoff community in Ntcheu District, Malawi. The objectives of the study were to determine the prevalence of modern contraception, to assess the level of knowledge among adolescent girls’, to determine socio-demographic, socio-cultural and health systems factors influencing the utilization of modern contraception among adolescent girls at Tsangano Turnoff community in Ntcheu District, Malawi. This study focused on all unmarried adolescent girls living in the study area at the period of study. The study used a cross-sectional study employing both simple random sampling technique for quantitative data and purposive random sampling technique for qualitative data. The research instruments were self-administered questionnaires and Focused Group Discussions (FGDs). Quantitative data was analyzed using Statistical Package for Social Sciences (IBM SPSS®) version 22.0. Analysis proceeded in two steps. First, univariate descriptive statistics were used to describe sample characteristics and estimate contraceptive prevalence among the adolescents. Contingency table methods were used to test associations between independent (categorical) variable and utilization of contraception and the qualitative data from the FGDs was transcribed and analyzed by thematic content analysis techniques. Overall 180 adolescent girls aged 10-19 took part in the study (mean age 15.2 ±1.5 years). The findings showed that 41% of the respondents had sexual debut at the age of 15 years but modern contraception utilization is still low (36%) with the majority using condoms. On knowledge, it revealed that with higher knowledge are ≥1.5 times more likely to use contraceptives than their counterparts (OR=1.595: 95% CI 1.3394-1.825: P (χ2) ≤0.001). The study revealed that the odds of utilizing contraception among the adolescent girls is more ≥1.5 times higher in those of 15-19 years than those of the lesser age (10-14 years) (OR = 1.561: 95% CI 1.386-1.758: P(χ2)≤ 0.001) similarly, those adolescent girls with higher education are ≥3.8 times higher than those with lower education levels (OR= 3.869:95% CI 2.381-4.972: P(χ2)< 0.05). On sociocultural, religion is significant in utilization of modern contraception as those from Zion and Catholics are less likely to utilize contraception than their counterparts from other denominations (OR= 4.421:95% CI1.874-7.692: P(χ2)<0.05). However, health-care workers attitude, commodity availability and opening hours of the facility have no significant statistically as the odds of adolescent girls utilizing contraceptives because of these factors are less than 1 (OR =0.908, 95% CI 1.596-1.384: P (χ2)>0.05; OR = 0.944: 95% CI 0.167-5.325: P(χ2)>0.05 and OR= 0.344: 95% CI 0.104-1.173: P (χ2)>0.05) respectively. These results showed a big gap between knowledge and utilization among adolescent girls as it showed that 74% knew about modern contraceptive but only 36% utilized it. There is a need to develop age specific reproductive health messages to guide schools’ education curriculum as well as parents and guardians to specifically communicate to this group of people. Secondly, develop adolescent friendly health services as another vital aspect to
improve adolescent health access to sexual and reproductive health services which will subsequently improve modern contraception utilization.

DETERMINANTS OF ANTENATAL CARE ATTENDANCE AMONG WOMEN IN THE REPRODUCTIVE AGE AT GURIEL DISTRICT, SOMALIA.

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Worldwide it is estimated that 303,000 of maternal deaths occurred in 2015. It is also estimated that in Somalia the maternal mortality rate is 669 deaths per 100,000 live births. Infact one out every 12 women dies due to pregnancy-related issues and one every nine Somali children dies before one year. Antenatal care attendance at four times in Somalia is 24%. Seventy nine percent of women deliver at home, and twenty-four percent of them delivery with skilled assistance. The major contributors to worsening maternal and neonatal mortality rate in Somalia are low awareness of the importance of antenatal care and inadequacy of subsidized ANC services. Most pregnant women are at greater risk for obstetric fistula due to the three delays. Antenatal care is the most important health intervention to reduce maternal and child mortality and morbidity, through complication readiness and preparing an individual birth plan. The main direct causes of maternal deaths in Africa are: postpartum hemorrhage (27.1%), hypertensive disorders of pregnancy (14.1%), complications of unsafe abortion (7.9%), obstructed labor (9.6%), and sepsis. The main objective of the study was to explore determinants of antenatal care attendance among women of reproductive age in Guriel, Somalia. The specific objectives were to determine the socio-demographic factors, economic factors, accessibility factors and level of awareness influencing ANC attendance. The study used descriptive cross-sectional community-based survey with structured questionnaires. The Study used systematic random sampling, the administered questionnaire was used to collect the primary data from the respondents. Data analyzing of quantitative raw data from questionnaires was coded and entered using SPSS 22.0 data entry program. The statistical mode such as chi-square test was used to test the relationship between the variables, and to test null hypothesis. In the study, estimated mean age was 28 years. The study concluded that most socio-demographic factors influenced ANC attendance. In the study marital status, education level, and parity showed significant statistical association with ANC attendance. The study findings showed that most economic factors played significant role in determining ANC attendance among respondents. The study results revealed that accessibility of health facilities was important to ANC attendance. Distance to health facility, cultural acceptability played significant role on ANC attendance. The study revealed that ANC attendance for the district was low according to the WHO standards and this explains the high maternal and infant mortalities recorded in the district. The research concludes that level of awareness on ANC services was high but unfortunately this did not contribute to increasing the rate of ANC attendance.

IMPLEMENTATION OF PRETERM BIRTH INTERVENTIONS AMONG HEALTH CARE PROVIDERS DURING PROVISION OF INTRAPARTUM AND PERINATAL CARE IN EMBU COUNTY, KENYA

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Preterm birth interventions (PTBI) are basic and specialized care packages designed to improve preterm birth outcome (PTBO) hence increase the survival rates of babies born preterm. Without PTBI, the survivors of PTB are at risk of facing lifelong disability and poor quality of life affecting the individual and family leading to productivity loss and socio-economic constraints. Globally PTB leads in causing neonatal and child mortality rate (CMR). Accounts for one million deaths yearly a risk factor to over 50% of all global neonatal death (NND). Despite the PTBI put in place in SSA and in Kenya neonates and children continue to die annually due to complications arising from PTB. Specifically in Embu County the rate of PTB increased by (24.6%) exposing survivors to life threatening health problems, social economic constrains and death. Efforts to reduce these deaths remain futile since, decline of childhood deaths related to prematurity remains low at 2.1% as compared to overall child death reduction of 4.1% annually. Moreover, Embu County has scanty information on PTBI. The main objective of this study was to assess implementation of preterm birth interventions among health care providers (HCP) in Embu County, Kenya. Specific objectives were; to determine level of implementation of PTBI, to establish social-demographic characteristics, to establish training related to PTBI and to determine health facility factors (HFF) that influence implementation of PTBI among health care providers during provision of intrapartum and perinatal care in Embu County. The study used cross-sectional design. Random sampling technique was used to determine the sample size of 94 HCP, while Purposive sampling technique was used to sample study hospitals and 5 Key informants. The study was conducted in three hospitals in Embu County. Questionnaires and Key informant interview (KII) guides were used to collect quantitative and qualitative data respectively. Data analysis, was done using SPSS version 21, descriptive statistics; Chi squares, Fisher’s test and binary logistic model to test the association between independent and dependent variables, to generate odds ratio (OR), confidence limits and variation between variables represented by Nagelkerke R Squared. Qualitative data was categorized in themes. Data findings were presented using tables and charts. The study results revealed that highest number (83%) of the respondents were female while the least (17%) were male. Highest number (48%) were aged above 35 years while the least (13%) were aged between 26-30 years. The results revealed statistically significant association between HCP level of education, experience, training related to PTBI and health facility with a p-value of (0.033, 0.024, 0.037 and 0.009) respectively. Highest implementation of PTBI was found among the HCP trained on EmOC (57%), of whom (69.2%) were associated with high implementation as compared to those who had low (32.8%) implementation. The study concluded that implementation of PTBI is influenced by socio-demographic characteristics; education (OR=0.947, p=0.157, FET=0.871), experience (OR=0.275, p=0.0024, FET=5.482), training related to PTBI (OR=3.15; 95% CI, p=0.023, FET=1.629) and adequacy of health facility factors (OR=2.538, p=0.007, FET=2.371). However, the study concluded that implementation of PTBI among health care providers during provision of intrapartum and perinatal care in Embu County was low at (52.7%) as compared to those who had high implementation at (47.3%).

PREVALENCE AND ANTIMICROBIAL SUSCEPTIBILITY PATTERNS OF SALMONELLA AND CAMPYLOBACTER SPECIES IN CHICKEN WASTE, BUNGOMA COUNTY, KENYA

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Antimicrobial resistance is a growing threat to public health and is driven by various factors including the overuse or misuse of antibiotics in poultry production which could lead to development of resistant bacteria that can be transferred to humans and hence compromise human medicine. The use of antibiotics in poultry production could be for vaccination/prophylaxis, treatment or growth promotion. This study was a cross-sectional study in Bungoma county that sought to establish the prevalence and antibiotic sensitivity of Salmonella and Campylobacter species, by sampling of chicken waste then analyzing it for presence of Salmonella & Campylobacter bacteria species and testing their sensitivity to 4 antibiotics. The aim of the study was to determine prevalence of Salmonella and Campylobacter species in chicken waste in Bungoma county, to determine the sensitivity of Salmonella and Campylobacter species to Tetracycline, Ampycillin, Imipinem and Co-trimazole antibiotics and to determine risk factors for Salmonella & Campylobacter infection and spread of resistant bacteria among chicken keeping households. Random sampling design was used to recruit 169 households where a duplicate of chicken waste samples was collected and a questionnaire issued to the farmers. The BS EN ISO 6579-1:2017 technique was used in the identification of Salmonella species and ISO 10272-2:2017 technique used for the detection and enumeration of Campylobacter species. The disk diffusion test was used for antibiotic sensitivity testing of the bacteria. SPSS was used for analysis; Logistic regression was used to measure sensitivity of the bacteria to the specific antibiotics and Pearson’s r analysis used to measure correlation among variables. The prevalence for campylobacter was higher in the county of Bungoma at 4.32% compared to that of salmonella at 1.44%. The use of traditional medicine was found less likely to cause presence of resistant bacteria. Risk factors identified for the development and spread of AMR associated with chicken production include; use of antibiotics for growth promotion, frequency of use of antibiotics and use of chicken waste as manure in farming. The study recommended that farmers should be encouraged to obtain already vaccinated chicks and the use of traditional medicine be promoted during chicken production. Further research should be conducted on the possibility of transfer of resistance through food crops.

INFLUENCE OF SOCIO-CULTURAL AND HEALTH SYSTEM FACTORS ON PARTNER PARTICIPATION IN LABOUR AND DELIVERY AT NYERI COUNTY REFERRAL HOSPITAL

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There are enormous benefits accruing from spousal support during childbirth including emotional comfort, improved family communication, bonding, pain relief without analgesia and positive birth experience. Unfortunately, in low income countries like Kenya which are known to be patriarchal male dominated societies where pregnancy and child birth is regarded as exclusively women’s affairs, partner participation in labor and delivery remains acutely low. The purpose of this study was to establish determinants of partner participation in labour and delivery at Nyeri County Referral Hospital. The objectives of the study were to find out the influence of knowledge of partner participation program, to assess the influence of socio-cultural factors on partner participation in labour and delivery and to determine the influence of health system factors on partner participation in labour and delivery at Nyeri County Referral Hospital. The study used the analytical cross-sectional design. The study was conducted in Nyeri county Referral hospital. The study targeted male
partners of post-natal women in the postnatal ward at Nyeri county Referral hospital. A total of 189 men were purposefully sampled and a researcher administered questionnaire was used to collect data. Descriptive methods such as frequency distribution, percentages, mean and standard deviation were used to summarize the data. Chi-square tests were used to assess relationships between the independent variables (knowledge, socio-cultural factors and health system factors) and the dependent variable (partner participation in labor and delivery). Statistical package for social sciences (SPSS) was used for data analysis. Significance was judged at p<.05 level. The findings were presented using tables and figures. There was a significant relationship (χ²=55.056, df=16, p=0.000) between ever hearing about partner participation program and partner participation in labour and delivery. There was a significant relationship (χ²=41.150, df=16, p=0.001) between knowledge of danger signs of pregnancy and partner participation in labour and delivery. There was also a significant relationship (χ²=41.769, df=16, p=0.000) between Awareness of Benefits of partner participation in labour and delivery and partner participation in labour and delivery. Among the socio-cultural factors gender norms (χ²=31.726, df=16, p=0.011) and societal expectations (χ²=60.167, df=16, p=0.000) were significant. Provision of information (χ²=60.194, df=16, p=0.000) and staff capacity (χ²=19.084, df=16, p=0.000) were significant among the health system factors. The study concluded that a concert of knowledge, socio-cultural and health system factors influence partner participation in labour and delivery. The study recommended health education efforts be stepped up to enhance the awareness of men on the partner participation program and benefits of spousal participation. It was also recommended that health workers especially midwives should also be trained to enhance their communication skills and now how of how to handle and address men in the delivery room so that they feel welcome.

ASSESSMENT OF ADHERENCE TO ANTIRETROVIRAL THERAPY AMONG CHILDREN BELOW 5 YEARS OF AGE IN NORTH KINANGOP SUB-COUNTY, NYANDARUA COUNTY, KENYA

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Dr. Nzomo Mwita

Despite the concerted efforts at achieving a 50% reduction in deaths resulting from HIV, a high number of children below the age of 5 years continue to get resistance to first line ART medicines and are second line ARV medication. Efforts to deal with this issue seems not to have taken root in many developing countries, including Kenya. HIV suppression still remains a big challenge in this age bracket with at least one in every six patients failing to achieve the required adherence levels of more than 95% for successful HIV treatment. The net effect is the increase in the AIDS related deaths among the under 5s preventing the country from attaining its SDGs commitment of lowering these deaths by 50% by 2015. The main objective of this study was to assess the adherence to ART among the under 5s in Kinangop Sub-county, Nyandarua County, Kenya. Community based cross sectional study design was used in this study. The study utilized purposive sampling in selecting the hospitals to develop sample frames and Simple random sampling technique to get a sample size of 195 subjects. Researcher-administered questionnaires with open and closed ended questions and Focused Group Discussions (FGDs) were used as the main data collection methods. Collected Qualitative data from FGD interview was translated into a common language and was thereafter typed into MS Word. It was then analyzed manually to fit into the study themes. On the other side, collected Quantitative data gotten from questionnaires used to be checked daily for completeness and was then coded for before it was entered into computer. Similar responses were collected together to form different
This research used univariate, bivariate and multivariate analysis. As for univariate analysis, population distribution by background characteristics was shown. While in bivariate analysis, the association between the dependent and independent variables was showed by cross tabulations then t-test values tested whether or not, the dependent and independent variables association was significant. For multivariate analysis, the study used logistic regression to analyze and determine the effect of explanatory variables has on the dependent variables. ART regimen characteristics had significant association with adherence in this study (t-test=8.7:1df: p=0.000) and were similar to findings by Van Dyke RB, et al., 2009. Duration of medication” and “whether the child was on other medication” were significance as far as adherence is concerned in this study (t-test=4.411:1df: p<0.005). The higher the level of education, the better the adherence (t-test=7.935:1df: p<.005), however there was no significance in the association between the caregivers’ ability to explain the medication regimen by the names of the drugs it contains and adherence. The study also found that Children who knew why they take ARVS drug had better adherence as opposed to those who did not know disclosure had significant association with adherence/non-adherence outcomes (t-test=10.757:1df: p=0.005). The findings of this study have being shared with the health care facilities involved and a manuscript submitted for publication to a pediatric ART adherence counseling journal for use in hospital and community settings.

UPTAKE OF COMMUNITY-LED TOTAL SANITATION APPROACH TOWARDS ATTAINMENT OF OPEN-DEFECATION-FREE STATUS IN SIAYA COUNTY, KENYA.

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By 2015, an estimated 2.4 billion people lacked basic sanitation and 15% still practiced open defecation globally. In Kenya, approximately 5.6 million people still defecated in the open. Siaya County adopted Community-Led Total Sanitation (CLTS) in 2010 as an approach to address the problem of open defecation. This study aimed at assessing the uptake of the CLTS approach in Siaya County, Kenya. A cross-sectional study was conducted among 370 randomly selected households. Structured questionnaires, Focused Group Discussions, and Key Informant Interviews were used to collect data. Descriptive statistics (mean, median, and standard deviation) was performed for quantitative data using SPSS version 20.0. To identify the factors associated with the CLTS uptake bivariate analysis was performed. Those factors with p-Values ≤0.05 were considered statistically significant. The qualitative data collected were thematically analyzed and used to support the quantitative results. A total of 370 respondents were interviewed. The mean age was 46.2 years (SD=15.2 Years), females were 242 (65%), 283 (76.5%) were married and 132 (35.7%) were age 40–49 years. Sixty-three percent (232/370) of those interviewed had attained primary education. Of the households visited, 303 (82%) had pit latrines, while and 307 (83%) had attained the Open Defecation Free (ODF) status. Of the 303 households with latrines, 97 (32%) shared with their neighbors who did not have, while for the 67 (18%) households that didn’t have pit latrines, 43 (64.2%) shared with their neighbors who had latrines. The ODF status increased from <12 in 2010 to 79 in 2017. Both marital status (χ² =0.004, p = 0.952), Education (χ² =2.19, p=0.334) and Occupation (χ²=2.404, p=0.493) were found not to be significantly associated with the uptake of CLTS approach. There was remarkable progress towards achieving ODF status in the study area. No significant association was found between CLTS uptake and marital status, education, and occupation. Some
CONTRIBUTION OF UNDERUTILISED CEREALS AND TUBERS TOWARDS URBAN HOUSEHOLD FOOD SECURITY AND DIETARY DIVERSITY IN RUIRU, KIAMBU COUNTY, KENYA

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Underutilized cereals and tubers can contribute to food security and in addition provide nutritional balance in the diet as they form a ready source of essential nutrients yet they have been neglected as the dependence on maize, rice and wheat as main cereals increases. The objective of this study was to assess the consumption of underutilized cereals and tubers in urban households and their contribution towards household food security and dietary diversity. A cross sectional analytical study design was adapted. Kahawa Sukari location, Ruiru, Kiambu County was purposively selected since it had households that cut across different socio-economic classes; four out of its six villages were randomly selected by simple random sampling. Individual households were selected by simple random sampling. A researcher-administered semi-structured questionnaire was used to collect information on demographic, socio-economic, dietary diversity, and food consumption patterns for the 347 households. Data were analyzed using the Statistical Package for Social Science (SPSS version 20.0) for the descriptive and inferential statistics. The Food Security Index was determined using the expenditure method. Dietary Diversity Score (DDS) established from fifteen food groups was used to assess diversity of the diet consumed by each household. The average household size was 4.1(±1.23) and 62.8 % of the households were found to be food secure. The mean DDS for the households was 10.27(±1.503). Almost all of the interviewed households, 98.8%, had a high DDS whereas only 1.2 % had medium DDS. Data from the consumption patterns show that 61.4 % of the households had consumed sweet potatoes, and 37.2 % had consumed arrowroots while only 6.3 % of the households had consumed yams in the previous seven days. The 24-hour recall showed that there was no consumption of cassava, yams or arrowroots. Chi-square test showed that household food security was significantly associated with socioeconomic factors like education (p<0.001), age of household head (p<0.001), occupation (p<0.001), house ownership (p<0.001). Owning some household assets was also significantly associated with household food security like sofa (p=0.002) and DVD (p<0.001). Chi-square test further showed a significant relationship between household dietary diversity and household monthly income (p<0.001), main sources of cash income (p<0.001) and household cooking facilities (p=0.010). No significant relationship was found between consumption of underutilized cereals and tubers and household food security or dietary diversity. Findings from this study may be used by health workers in the Ministry of Health to encourage urban consumers to make more use of underutilized cereals and tubers for dietary diversity and better household food security. For the Ministry of Agriculture, these findings would be useful for broadly based policy at national level to encourage production and consumption of underutilized foods.
Marginal mixed farming households are prone to frequent drought and hardly meet their food intake requirements which make the under-five children more vulnerable to malnutrition. The purpose of this study was to establish the determinants of nutritional status of children aged 6-59 months in marginal mixed farming households in Ntugi location, Tharaka Nithi County, Kenya. A sample of 106 households was randomly selected for data collection. Structured questionnaires, key informant guide and focus group discussion guide was used to collect data on demographic and socio-economic characteristics, feeding practices, water and sanitation, morbidity status and health seeking behavior. Statistical Package for Social Sciences (SPSS) version 20 was used in descriptive and inferential analysis. Anthropometric data was analyzed using ENA for SMART and interpreted using WHO (2006). The average household size was 5 members while the mean maternal age was 27.31 ± 0.60 years. More than half (67%) of mothers had not completed primary education. The mean household income was Ksh. 7,279 ± 1446 mainly (53.6%) from sale of farm produce. The mean household production from previous season was 236.89 ± 22.21 kg of cereals/grains and 259.78 ± 21.68 kg of legumes/pulse. Continued breastfeeding rate at one year was 92.3% and 66.7% for two years and above. All breastfeeding infants aged 6-8 months met the minimum meal frequency requirement. Less than half (47.3%) of the children had minimum dietary diversity. Minimum acceptable diet rate was 21.2% and 25.0% for breastfeeding and non-breastfeeding children respectively. Majority (81.2%) of the children who were sick two weeks prior to the survey had fever. Sixty five (65%) percent of the children were fully immunized while 61.1% of children aged 6-11 had received vitamin A supplementation within the last six months. Use of bush to dispose human waste was at 15.5%. The study showed that the stunted children were 32.1%, 20.2% were underweight and 7.3% were wasted. The morbidity status in the last two weeks prior to the survey was at 29.4%. The Pearson’s chi-square test showed that there was a significant association between the age of the mother and wasting for children aged 6-59 months (p = 0.008). Further, the study established that underweight and wasting was associated with household size (p = 0.009 and 0.029 respectively). Seasonal household food production was also associated with underweight of children. The County Government of Tharaka Nithi needs to domesticate National Agricultural Sector and Extension Policy through legislation to improve and sustain food production in marginal mixed farming households in the County. A longitudinal study on household determinants of under-fives nutritional status is recommended for further study.

DETERMINANTS OF PRE-CONCEPTION DIETARY PRACTICES AMONG FEMALE UNDERGRADUATE STUDENTS AT KENYATTA UNIVERSITY, KENYA

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Supervisors: Dr. Peter Chege

Dr. Eunice Njogu
Pre-conception nutrition is a key determinant of the pregnancy outcome and the health of a newborn. Since women are likely to conceive at some point in their lives, there is need to attain appropriate nutrition status in order to prepare the mother and the unborn child. Several factors including demographic and economic characteristics, nutrition knowledge and attitude are known to influence dietary practices. Several researches have focused on pregnancy. However, information about pre-conception and its determinants, especially in Kenya, is scanty and there is concern that women rarely consider their pre-conception dietary practices and nutrition status to be important. This study aimed to establish the determinants of pre-conception dietary practices among female undergraduate students at Kenyatta University, Kenya. The study adopted a cross-sectional analytical design. A sample of 422 female undergraduate students was randomly selected from Kenyatta University. A semi-structured questionnaire and focus group discussion guide were used to collect participants’ information. Body mass index (BMI) was used to assess the participants’ nutrition status. Knowledge on pre-conception dietary practices was determined based on nutrition knowledge scores (correct response: 1, incorrect: 0). Overall knowledge level was percentages of total correct responses categorized as low, moderate and high. Attitudes were measured using a five point Likert scale. Dietary practices were determined using a minimum dietary diversity for women (MDDS-W) and food frequency questionnaire (FFQ). Quantitative data was analyzed using SPSS version 20. Chi-square test was used to establish relationship between categorical variables. Regression analysis was used to determine factors influencing pre-conception dietary practices. Qualitative data from focus group discussions (FGDs) was organized and analyzed thematically. Descriptive statistics such as percentages and mean was used to describe data. All analyses were considered significant at p<0.05. Close to half (45.9%) of the participants had low knowledge on pre-conception dietary practices while majority exhibited a positive attitude towards pre-conception dietary practices (99%). The results showed that 31.7% of the participants were not fit to conceive based on their BMI while 36% had MDDS-W below the recommended of ≥5 food groups per day. Fruits and vegetables were consumed everyday by only 38.5% and 47.1% of the students, respectively. Chi-square test showed that MDDS was significantly associated with course of study (p=0.034), amount of money used on food (p=0.023) and Knowledge on pre-conception dietary practices (p=0.015). MDDS-W was significantly associated with nutrition status (p=0.044). Logistical regression analysis revealed that level of knowledge on preconception dietary practices (AOR=2.74, CI (1.21-6.17), P = 0.015), nutrition status (AOR=1.26, CI (0.17-9.01), p = 0.040) and amount of money spent daily on food (AOR=240.25, CI (13.47-4284.87), p < 0.001) were significant predictors of pre-conception dietary practices. Knowledge on pre-conception dietary practices is therefore vital in improving pre-conception dietary practices and subsequently improves nutrition status. Universities should come up with workshops and seminars for undergraduates especially where nutrition is not taught directly or indirectly. Additionally, policy makers should develop sustainable ways of ensuring that women of reproductive age are aware of ways to optimize nutrition before conception.

**STRATEGIES FOR ADDRESSING BARRIERS TO EFFECTIVE PARTICIPATION OF FAITH-BASED ORGANISATIONS IN THE CONTROL OF HIV-AIDS IN NAIROBI CITY COUNTY, KENYA**

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Human Immunodeficiency Virus (HIV) and Acquired Immuno-Deficiency Syndrome (AIDS) is not only a major public health challenge, but also a huge threat to global security, stability, and economic growth. One in five organizations currently engaged in HIV and AIDS programming is faith-based. Faith-Based Organizations (FBOs) have a wide reach and capacity to mobilize communities to respond to the HIV and AIDS crisis. The current study sought to establish the barriers which directly affect the operations of the FBOs thus compromising the quality and effectiveness of their responses. A purposive sampling design was employed in a cross-sectional study to assess internal and external barriers towards the effective participation of FBOs in the prevention and control of HIV and AIDS in Nairobi, Kenya. A total of 250 respondents from FBOs engaged in HIV and AIDS programmes were purposively selected. Data was collected using structured questionnaires and analyzed using Statistical Package for Social Sciences (SPSS). Descriptive statistics (frequency, means and standard deviations) of the responses were generated to establish the extent to which the respondents agreed with the various factors. Out of the 250 sampled FBOs; 52%, 26%, and 22% were affiliated to National Council of Churches of Kenya (NCCK), Evangelical Association of Kenya (EAK) and Organization of African Instituted Churches (OAIC) respectively. The internal barriers were lack of technical capacity in programme implementation, poor leadership and governance practices, inability to access funding from external donors, inability to build external networks and collaborations, theological and doctrinal conflicts, shortcoming in documenting HIV and AIDS work, and poor participation in public policy dialogues and planning. The external barriers were: inability to access reliable, factual and up-to-date information on HIV and AIDS, lack of donor support and commitments to FBO’s HIV and AIDS work, lack of political goodwill and governments’ facilitation and a negative attitude by other organizations towards FBOs’ involvements in HIV and AIDS work. Further, the study found that there was no significant difference in the influence of internal (mean, 2.34) and external (mean, 2.45) barriers on FBOs’ participation in HIV and AIDS responses. The study findings showed that FBOs could participate more effectively in the fight against HIV and AIDS if strengthening FBO’s HIV and AIDS programme management capacity, training FBO leaders on HIV and AIDS knowledge, building FBO’s capacity for resource mobilization and fundraising, building FBOs’ HIV and AIDS technical capacity and skills, challenging FBO’s negative doctrinal and theological issues, strengthening FBO’s governance and leadership, as well as building FBO's capacity on networking and partnership are strengthened. The study recommends that different collaborators implement identified strategies to enable FBOs address the barriers.

**EFFECT OF NUTRITION EDUCATION VIDEOS ON MOTHERS’ KNOWLEDGE AND PRACTICES ON COMPLEMENTARY FEEDING OF CHILDREN 6-23 MONTHS, NAIROBI CITY COUNTY, KENYA.**

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Optimal feeding of infants depend not solely on what they are fed but also how, when, where and by whom. Inappropriate feeding practices can cause negative consequences on the growth, development and a child’s life or survival in future. Data from a number of countries show that there are lots of efforts to improve child nutrition, but still, there are significant gaps in complementary feeding. In slum areas, there is an indication of little success of complementary feeding practices due to limited knowledge and negative attitudes towards the practice. The purpose of conducting this study was to explore the effect of using nutrition education videos on the maternal knowledge, attitudes, and practices on complementary feeding of children 6-23 months of age attending selected Maternal Child Health facilities in Ruaraka Sub-
The study involved an intervention group that watched the short nutrition video clips on complementary feeding and a control group that did not watch the videos from a different locality but shared similar characteristics with the intervention group. The sample size of 80 Mothers from control and 118 mothers from intervention who had children aged 6-23 months participated in this study. A researcher-administered questionnaire was expended to collect data which was afterwards analyzed using SPSS version 21. T-test was wrought to compare dissimilarities in continuous data amongst the two study groups on the socio-demographic characteristics, knowledge, attitudes, and practices on complementary feeding, and percentages were done to test for the effect realized on the study variables. P value of <0.05 was expended as the standard for statistical significance. Most households (83.6% for the control and 92.4% for the intervention) were headed by males. The mean age of the mothers was 25.3 years (24.8 years for control and 25.9 for intervention group). Most mothers were married (83.8% from control and 89.0% from the intervention group), Christians (95.0% from control and 99.2% from intervention), housewives (67.5% from control and 67.8% from the intervention), and had primary school education (38.0% from the control and 54% from the intervention) as their highest education level. There was significantly higher proportion of mothers in the intervention (100%) than in control (51.3%) who had the correct knowledge on exclusive breastfeeding (P=0.041). Similarly, the most mothers from intervention had good knowledge on age of initiating complementary feeding (100%) while control (96.3%) with P=0.021, feeding children from at least 4 food groups (30.0% for control group and 95.5% for intervention group) with a significant difference in these groups group (P=0.006). There was also a significant difference on knowledge mean scores between the control and intervention (P=0.001). A significant difference was found between intervention and control groups on complementary feeding for children aged 6-23 months (P=0.021) where mother in intervention area had better performance than the control. Mothers who were in the intervention area had better nutrition knowledge, and practices as compared to their counterpart, control group. Nutrition messages in the nutrition videos on Infant and Young Child Feeding Practices were easily understood by the mothers/caregivers as they watched then in the health facilities thus bring about behavior change. The use of videos on nutrition education can be of great significance in reducing knowledge gaps among the mothers and caregivers. The findings can be used by the Ministry of Health and other stakeholders to guide them in targeting during their intervention programs. A similar study in the rural set up is highly recommended for scaling out to communities at risk of poor nutrition indicators.

**COMPLEMENTARY FEEDING PRACTICES, MORBIDITY PREVALENCE AND NUTRITION STATUS OF CHILDREN AGED 6-23 MONTHS OLD IN MPIKA CENTRAL CONSTITUENCY, ZAMBIA**

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Dr. Vincent Nyau

Appropriate feeding is an effective strategy in improving the nutrition status of infants and young children. Malnutrition has been a major public health concern with significant negative effects in terms of morbidity, psychological and intellectual under development. Few studies have been conducted in Mpika District to characterize the impact of undernutrition in infants and young children. Therefore, this study sought to determine the complementary feeding practices, morbidity prevalence and nutrition status of children aged 6-23 months in Mpika Central Constituency, Zambia.
A cross-sectional analytical study design was adopted for the study on a sample of 165 mother/caregiver and child pairs. Proportionate and simple random sampling techniques were used to select a sample from the four wards. Data collection was collected through Researcher administered questionnaire in the homes of respondents. Data collected was on demographic and socio-economic characteristics, complementary feeding practices, morbidity prevalence and nutrition status. Dietary intake data was collected using 24-hour recall. Morbity data was collected based on a 24-hour recall. Anthropometric measurements: weight, length, child date of birth, Mid-Upper Arm Circumference (MUAC) measurements and presence/absence of edema were used to determine nutrition status of children using ENA for SMART software (2011). Qualitative data collected from Focus Group Discussions was coded and analyzed under thematic areas of study. Morbidity prevalence was assessed based on the presence and frequency of diarrhoea, fever and ARIs. Data was analyzed using descriptive and inferential statistics. Logistic regression analyses were used to determine the association between complementary feeding practices, morbidity prevalence and nutrition status. Probability-value of <0.05 was as the level of significance. Study results showed that the mean age of the children in months was 14.5±5.0. Introduction of Solid and Semi-Solid or Soft Foods to Children 6-8 Months was at 14%. Children who met minimum dietary diversity, minimum meal frequency and minimum acceptable diet were 43.8%, 69.1% and 26.1% respectively. About eight percent of the children consumed iron rich foods. Common illnesses were cough (56.2%) and diarrhoea (37.3%). Stunted children were 30.3%, 9.7% were underweight, 5.4% wasted and 1.2% overweight. Wasting was 4.8% by MUAC and no child had oedema. Children’s nutrition status predictors were mother’s age (Odds ratio [OR] =1.20, p=0.042), parity (OR=3.59, p=0.031), number of under five years old children in a household (OR=9.50, p=0.005), mother’s occupation (OR=0.55, p=0.036) and household’s income (p=0.014). Therefore, this study recommends the need to foster programmes that improve socio-economic status of households, which in turn improve complementary feeding practices and reduce illnesses, and consequently, nutrition status. Furthermore, studies should be conducted on complementary feeding practices, morbidity prevalence and nutrition status if they were affected by seasons.

NUTRIENT RETENTION AND SENSORY ACCEPTABILITY OF SOLAR-DRIED AFRICAN LEAFY VEGETABLES AMONG WOMEN OF REPRODUCTIVE AGE, KIAMBU COUNTY, KENYA

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Micronutrient deficiencies pose major health challenges in many African countries with certain population groups such as women of reproductive age being at a greater risk. African leafy vegetables form part of local agricultural biodiversity and have been part of the daily livelihoods of the local populations for many years. These vegetables hold promise in addressing micronutrient deficiencies if their supply and consumption are scaled up through the right application of appropriate postharvest technologies. The study adopted an experimental design to determine the retention of iron, zinc, β-carotene and vitamin C as well as sensory acceptability in three African Leafy vegetables; i.e. pumpkin leaves (Curcubita maxima), Fig-leaf gourd (Cucurbita ficifolius), and stinging nettle (Urtica dioica) subjected to various processing treatments including solar drying, blanching and cooking. About 10kg of fresh vegetables randomly sampled were purchased from Kiambu market, transported using cool box at 150C to Kenyatta University, appropriately packed and stored at 50C for processing and analysis. Solar drying was carried out using a locally fabricated solar dryer, blanching was done at high
temperature (80-1000c) for 5 minutes and cooking was done using ohms model electrical cooker with four plates set at medium temperature 1650C for 15-20 minutes. Iron and zinc were quantified using Atomic Absorption Spectrophotometer while β-Carotene and Vitamin C were quantified using Reverse Phase High Pressure Liquid Chromatography. All determinations were carried out in triplicate and mean values computed. Sensory evaluation was determined using the 9-point hedonic scale questionnaire administered to a sample of 30 women of reproductive age purposively selected from Kiambu County. Pumpkin leaves had the highest iron content amounting to 29.33 ± 0.474 mg/100g dw followed by Fig-leaf gourd at 25.38 ± 0.06 mg/100g dw. Fig-leaf gourd had the highest content of zinc at 5.51 ± 0.08mg/100g dw followed by pumpkin leaves at 3.307 ± 0.055mg/100g dw. Stinging nettle leaves had the highest pro-vitamin A (β-carotene) content of 34.69± 0.14 mg/100g dw followed by pumpkin leaves. Vitamin C concentration was highest in stinging nettle leaves 228.60±1.81mg/100g dw followed by Fig-leaf gourd 122.59 ± 0.09 mg/100g dw while pumpkin leaves had the lowest content 118.73 ± 0.15mg/100g dw of the vitamin. Both blanching and cooking had significant effect on the content of both minerals and vitamins in the leafy vegetables. Solar drying caused significant reductions (p ≤ 0.05) in the levels of vitamins in the vegetables, but it did not significantly change their mineral contents. Solar drying had the best retention of iron, zinc, and vitamin C. Vitamin A was well retained during heat treatments but was sensitive to solar drying. Vitamin C suffered the heaviest losses in all processing treatments. Highest retention of nutrients was achieved in Fig-leaf gourd compared to pumpkin leaves and stinging nettle leaves. Pumpkin leaves were given the best sensory rating among cooked fresh vegetables, while stinging nettle leaves was the most acceptable among solar-dried cooked vegetables. Cooked fresh vegetables were more acceptable than the cooked solar-dried ones except for stinging nettle leaves where the reverse was true. The study reveals that pumpkin leaves, Fig-leaf gourd and stinging nettle leaves are important sources of key nutrients after solar drying, blanching and cooking with a good retention of these nutrients. The study therefore recommends popularization of the solar dried ALVs as key sources of micronutrients.

**UTILIZATION OF PARTOGRAPH IN MANAGEMENT OF WOMEN IN LABOR AMONG NURSES/MIDWIVES WORKING IN MACHAKOS COUNTY, KENYA**

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Prof. Margaret Keraka

A partogram is a graphical representation of the fetal status, maternal status and progress of labor. Its proper interpretation assists in early identification of complications which may lead to morbidity and mortality. Health records from selected hospitals in Machakos County in regards to partograph utilization revealed that 60% of the records had a partograph attached with only 40% of them used correctly up to delivery. The study determined the utilization of the partograph in management of women in labor in Machakos County. The objectives of the study were to determine the level of utilization of the partograph, nurses related factors and health facility related factors influencing the utilization of the partograph. A cross-sectional study design was used. The study was conducted in selected hospitals within Machakos County. The study population comprised of 124 nurses working in maternity wards. Purposive sampling technique was used to choose study participants from selected health facilities. Structured questionnaires were used to collect quantitative data while focused group discussions were conducted and key informants interviewed. Data collected was organized and entered into computer software and analyzed using SPSS Version 24 and presented by use of tables, figures,
Logistic regression was used to assess the possible association and strength of association was measured using 95% confidence interval. From the study, level of utilization of the partograph among midwives was at 44.5%, nurses related factors influencing utilization of the partograph were negative attitude ($p=0.001$), and lack of training on partograph use ($p=0.001$). Majority (55.5%) of the files reviewed were not completed while monitoring labor, 63.7% of nurses said that use of partograph was time consuming, 80.9% needed supervision, 62.7% of the nurses working in maternity ward had not attended any workshop on partograph use. Health related factors that were found to influence partograph use were number of deliveries in labor ward ($p=0.001$) and institutional policies on partograph use ($p=0.001$), 53.6% of nurses conducted more than 5 deliveries per shift, 52.7% indicated that partographs were not available in labor wards while 68.2% said that institutional policies on partograph use were not implemented. The study concludes that utilization of partograph was poor which can be associated with negative attitude among nurses, lack of seminars and on job training, understaffing among nurses working in labor wards and lack of policies on partograph use in maternity department. The study recommends nurse managers in the health facilities to arrange for seminars and continuous medical education on partograph use, maternity in charges to offer supportive supervision and ensure regular supply of partograph papers and hospital managers to make a proposal to the County ministry of health to employ more nurses thereby addressing the issue of shortage in order to improve utilization of partograph among nurses working in maternity wards in Machakos County.

IMPLEMENTATION OF COMMUNITY LED TOTAL SANITATION PROGRAM IN KAJIADO COUNTY, KENYA

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Dr. Jackim Nyamari

Open defecation refers to defecating in bushes, fields, water bodies and other places that are open. Across the world, approximately 1 billion people are practicing open defecation. This is worse in sub-Saharan Africa where about 215 million people defecate in the open. In Kenya, an estimated 5.6 million people practice defecation in the open. The introduction of Community Led Total Sanitation strategy by the Ministry of Health has not achieved its goal of improved sanitation and hygiene due to poor implementation. The study sought to assess implementation of Community Led Total Sanitation in Kajiado County, Kenya. The specific objectives of this study included determining socio-cultural factors, functional pit-latrine to household ratio, knowledge level and attitude towards community led total sanitation in Kajiado County. The study used a descriptive cross-sectional study design adopting both quantitative and qualitative data collection methods. Quantitative data was collected using semi-structured questionnaires from selected household heads while qualitative data was collected using key informant interview schedules with 8 selected Key Informants. Additional qualitative data was obtained through Focused Group Discussion sessions with selected primary respondents. The study interviewed 303 household heads selected using systematic random sampling with a predetermined interval of 3. Descriptive statistics were calculated using Statistical Package for Social Sciences version 20.0 with the aid of Microsoft Excel program to generate frequency tables, graphs and pie-charts. Qualitative data was analyzed using thematic analysis and results triangulated with quantitative data as direct quotes or narrations. To test the relationship between study variables, Chi-Square tests done at 95% confidence interval ($p<0.05$) were used. The study results revealed that 27% of respondents had fully implemented community led total sanitation. Socio-cultural factors such as embracing use of latrines ($p=0.001$),
involving community in planning health programs (p=0.023), disposal of child excreta (p=0.001), responsibility for pit-latrine construction and herdsmen using pit-latrines (p=0.032) were significantly associated with implementation of Community Led Total Sanitation. The study results further revealed that 68.3% of respondents had low knowledge levels with 61.0% having negative attitude towards community led total sanitation implementation. Knowledge level (p=0.001) and attitude level (p=0.019) were significantly associated with implementation of community led total sanitation among respondents. The study concludes that the implementation level of community led total sanitation status in Kajiado County was low. This may be due to low knowledge levels and negative attitude towards its implementation. The study generated data on the implementation status of Community Led Total Sanitation in Magadi Ward, Kajiado County. These results would also be of use to the Ministry of Health for purposes of health education and policy formulation towards improved implementation rates of community led total sanitation to increase latrine coverage thus reduced negative health implications as a result of open defecation.

UTILITY OF CERVICAL CANCER SCREENING SERVICES AMONG WOMEN AGED 30-49 YEARS IN KITUI COUNTY, KENYA

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Dr. Benjamin M. Ndeleva

Cancer Cervix refers to malignant cell growth in the lower part of the uterus that opens into the vagina. Cervical cancer is one of the most prevalent cancers in developed countries and the third most common cancer among women worldwide, with an estimated 569,847 new cases and 311,365 deaths recorded in 2018. Cervical cancer is primarily associated with young women. Women aged 50 years and below accounts for 62%, of all cervical cancers. More than a million women in the world are living with cervical and most of them have no access to screening, treatment and palliative care, resulting in late treatment. Cervical cancer usually develops slowly, which means that most cases can be identified and managed when screening is performed regularly. The study sought to investigate the determinants of utilization of cervical cancers screening services among women aged 30-49 years in Kitui West Sub-County. The study population was women aged 30-49 years of age. A stratified random sampling technique was used to obtain 270 respondents from the study population (2542). Data was collected using self-administered semi-structured questionnaires issued to women aged 30-49 years in Kitui west sub-County. The study adopted a cross-sectional descriptive study design. The study used quantitative research methods to obtain data from selected respondents. Data from the respondents was analyzed using statistical package of social sciences (SPSS) in conjunction with Microsoft excel. The study used chi-square test calculated at 95% interval and a margin of 0.05% error to determine the relationship between dependent and independent study variables. The results found out that Majority of the participants 145 (53.7%) were aware of the cancer screening. There was a no significant relationship (p =0.054) between the awareness and cervical cancer screening services among women aged 30-49 years. The study established that 35% of the participants had been screened for cervical cancer while 65% had not been screened at all. The study established that, majority 152 (56.3) of the respondents had low knowledge on cervical cancer and there was a relationship between knowledge on signs (p=0.001) and prevention of cervical cancer (p=0.002) and utilization of cervical cancer screening services. Regarding perception there was a relationship between whether one perceived screening to be necessary (p=0.011), painful (0.0221) and screening was a procedure or commercial sex workers (p=0.026) and utilization of cervical cancer screening services among women aged 30-49 year. Based on the findings of this
study, it was concluded that, although majority of women are aware of the cervical cancer, the screening is low. There is therefore a need for more sensitization on the need for cervical cancer screening. The Ministry of Health should advocate for cervical cancer screening early enough and tailor the awareness through health education seminars in the community to help improved transfer of correct knowledge on cervical cancer screening services.

ROLE OF MUTUAL HEALTH SCHEMES IN SHAPING HOUSEHOLD FINANCIAL ACCESSIBILITY AMONG LOW-INCOME HOUSEHOLDS IN KIRINYAGA COUNTY, KENYA

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Mutual health schemes are emerging as an important cornerstone in healthcare financing in Kirinyaga County, where they are providing a patchwork of protection to low-income groups faced by low financial access to healthcare. While the schemes continue to gain ground, the extent to which they are improving health care utilization remains unclear because of weak evidence. Only a handful number of inquiries have been conducted, a paucity that underlined the objective of this study. The cross-sectional descriptive study investigated the role of MHS in healthcare utilisation. Data was collected from 308 randomly selected households with pre-documented membership to schemes, with a researcher-administered questionnaire and in-depth interview guide being the primary data collection devices. The data was analysed using SPSS version 23. Besides descriptive statistics, binary logistic regression was employed to explain the relationship between variables. Female respondents were the majority (59.1%), with the median age being 45.8 years. The overall household size among participants was small as each household had an average of 3.47 persons, with 72.1% noting they had formal education. The majority of respondents rated their health status as “good” (36.4%), “very good” (16.6%), or satisfactory (21.8%), as they could access prioritised care because of MHS membership. According to the results, 261 participants (84.7%) sought medical attention during the most recent health episode. Overall, there were gender differences in seeking medical attention, where females were utilizing health services more frequently when compared to their male counterparts. However, the variations were minimal based on the size of the HH, schooling differentials, age, as well as income earners. The results also confirmed that 83.93% of respondents visited formal providers, confirming key informants’ concept of MHS providing motivational benefits to seek care from professionals. However, the logit model ($\chi^2 = 73.937; \text{df}= 2; \ p < .001$) revealed that the scheme was less likely to help individuals cope when the payment was challenging. The logit model also confirmed varying influences of gender, age, the size of HH, education, and income in benefiting from schemes. The study concluded that the schemes are shaping household financial accessibility among low-income households, and recommended further research work to verify the results as the schemes have the potential to complement other financial arrangements in Kirinyaga County.
CULICINE MOSQUITO SPECIES DIVERSITY, HOST FEEDING PREFERENCES AND INSECTICIDE RESISTANCE STATUS IN TAITA-TAVETA COUNTY, KENYA

Munyao Vanessa Ngami-M.Sc

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Culicine mosquitoes are vectors of human disease-causing pathogens like lymphatic filariasis and several arboviruses such as dengue fever, chikungunya virus and so on. Due to intensifying land use land cover (LULC) with increasing pressure on natural environments because of urbanization and agricultural activities, there has been an increasing risk of mosquito-human contact leading to transmission of vector borne diseases. In recent years, along the coastal region, Kenya, there have been increased occurrences of emerging and re-emerging vector borne diseases, with subsequent social-economic concerns implications. Therefore, this study determined Culicine mosquito species abundance, diversity and their host feeding preferences in Taita-Taveta County, Coastal Kenya. A Cross sectional study design was adopted in this study. Entomological sampling was done in the months of March and October 2018, which are dry and wet season respectively. Adult mosquitoes were collected indoors and outdoors using CDC light traps and Backpack aspiration. The collected mosquitoes were sorted according to their sub-families as Anopheline and Culicine. The Culicine mosquitoes were identified morphologically into species and categorized according to their physiological status. The fully blood fed mosquitoes were tested for blood meal sources using Enzyme Linked Immunosorbent Assay (ELISA) for different hosts found within the peri-domestic environment mainly human, goat, chicken and bovine. For insecticide resistance characterization, mosquito larvae were collected using dipping sampling method, the mosquito larvae were reared into adults. The 3-5 old emergent mosquitoes were exposed to pyrethroids using WHO protocol. Three thousand two hundred and seventy-eight (3,278) mosquitoes were collected indoors (22.5%, n=738) and outdoors (77.5%, n=2,540). The collected Culicine mosquitoes were identified to be consisting of eighteen (18) species including; Aedes (7 species), Culex (8 species), Mansonia (2 species), Coquilletadia (1 species). Culex quinquefasciatus (69.1%) was the predominant species observed in all the six sites, though varied across the sites ($\chi^2=85.5, \text{df}=5, P<0.001$). Culex straitipes and Cx. Culicioma (0.03%) had the lowest numbers of mosquitoes. Overall, there was high mosquito species diversity ($H$) in outdoors ($H = 2.4339$) than in indoors ($H = 2.2523$) with even distribution ($EH$) being higher in indoors ($EH = 0.9064$) than outdoors ($EH = 0.8266$). Of the mosquitoes collected, 1,241 mosquitoes were tested for blood meal sources. Majority of the blood meals sources identified were from multiple blood meal sources (51.6%), single hosts (41.3%) and least were unidentified (7.2%). There was significant difference of Human Blood Index between indoor and outdoor for Cx. Quinquefasciatus species ($\chi^2=19.40, \text{df}=1, P<0.0001$). Culex quinquefasciatus showed some existence of resistance to bediocarb, deltamethrin, DDT and fenitrothion, but were found to be susceptible to Permethrin. The study demonstrated that Culicine mosquitoes were highly zoophilic. It is therefore essential to evaluate the impact of zooprophylaxis on arboviruses transmission. There is a need for more studies on species distribution and abundance beyond what this study has accomplished and conduct vector competence and blood meal assays for a comprehensive assessment of lymphatic filariasis and arboviruses risk to public health in Taita-Taveta, Kenya.
SEROPREVALENCE AND RISK FACTORS ASSOCIATED WITH RUBELLA VIRUS INFECTION IN PREGNANCY AND NEW BORN INFANTS AT KERUGOYA LEVEL 5 COUNTY HOSPITAL, KENYA

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Infection with Rubella virus is a public health concern because it may lead to serious consequences such as Congenital Rubella Syndrome (CRS) during early pregnancy. Introduction of the rubella virus vaccine in developed countries has since informed the need to assess the prevalence of rubella in the African countries and determine whether it is necessary to introduce a vaccine. This study, therefore, was carried out to determine the seroprevalence of the rubella infection in expectant women and their newborn infants. In addition, it assessed the risk factors that predispose pregnant women to rubella virus. This hospital-based cross-sectional survey was carried at Kerugoya level 5 County Hospital using the simple random technique. The study was done from April to June 2016. The study recruited 200 pregnant mothers due for delivery. Two (2 mls) of blood was collected from mothers and cord blood from their newborn infants. Blood was centrifuged to obtain serum which was used for the analysis. Samples were transported to the hospital laboratory where they were stored at -200C until the time of analysis. The samples were screened for rubella antibodies (IgG and IgM) using enzyme immunoassay method to determine the prevalence. Questionnaires were used to collect qualitative data. Data collected from the laboratory analysis and questionnaires were analyzed for association and differences using analytical software. Majority (53%) of the study participants were young adults, who were below 30 years. The highest proportion of mothers (60%) had attained secondary education. Some of the mothers (31.5%) were in small-scale enterprises. Most mothers were having a monthly income of less than US$ 100 per month. Most of the mothers had a household with more than 3 habitable rooms and no more than 3 members. Majority of the participating mothers had no knowledge about rubella. Association between active rubella infection among infants and the education level of the mother was statistically significant with a p-value p= 0.02, df= 2. The proportion of mothers who were rubella IgG positive was significantly dependent on the occupation of the mother p=0.03, df = 4. IgM rubella infection among mothers had a significant relationship with the mothers’ income bracket p=0.004, df = 3. There was a high prevalence of rubella IgG antibodies in pregnant women (91%) and their infants (95%) with a small proportion being unprotected to rubella infection (9%) and (5%) respectively. The prevalence of rubella IgM antibodies in pregnant mothers was (3.5%) while prevalence in infants was (2.5%). The major risk factors for rubella infection includes: Education level, occupation and level of income of the mothers. Vertical transmission rate was at (43%) which is of concern as it may cause CRS in the affected infants. Systematic rubella surveillance should be done routinely in the ante-natal clinic to enhance better health of the mother and avoid rubella transmission to the foetus. The current introduction of rubella vaccine in routine childhood immunization programme is justified. However women of child bearing age should also be included. This will ensure healthy pregnancy and delivery of healthy infants in Kenya.

PATIENT RELATED BARRIERS TO ADEQUATE BLOOD PRESSURE CONTROL AMONG ADULT HYPERTENSIVE PATIENTS SEEN AT KIAMBU LEVEL 5 HOSPITAL, KENYA

Antony Mogondo Kibore-M.SC
Hypertension is a key precursor to cardiovascular and renal disease in the world. According to WHO, the prevalence of Hypertension among patients was about 40% globally in 2008. In Sub Saharan Africa, the prevalence was about 46% for both sexes combined. WHO estimated that only 50% of hypertensive patients in the United States had adequate blood pressure control in 2018. According to a study done at the Nyeri Level 5 Hospital, Kenya, in 2014, only 33.4% of hypertensive patients had adequate control. Despite a lot of emphasis on treatment of hypertension, blood pressure control remained poor. Few studies had been done on the patient related barriers to adequate control. This study sought to establish the patient related barriers to adequate blood pressure control among adult hypertensive patients at Kiambu Level 5 Hospital. It was conducted at the medical outpatient chronic disease clinic. A sample of 330 patients was recruited. This was a cross sectional descriptive study utilizing quantitative approaches in data collection. Consecutive recruitment was done. A structured questionnaire was used for gathering of information. Analysis of acquired data was done using SPSS and comparison was done between independent and dependent variables. Continuous variables in this study were expressed using the mean, mode, median and standard deviation. All the identified categorical variables were reported as frequencies and proportions. The establishment of significant dependence of predictor variables on outcome was done using chi square. Multivariate logistic regression analysis was used to determine the predictor variables associated with inadequately controlled hypertension among adult patients seen at Kiambu Level 5 Hospital. Majority (71.5% (n=239)) were Females. The number of patients with inadequate blood pressure control were 58.7% (n=193). The prevalence of inadequate blood pressure control was significantly higher among males (69.2%, n=65). (p-value=0.009). The males were 54% more likely to be associated with the inadequate blood pressure control compared to females (AOR=0.543; 95%CI=0.323-0.914). Regular taking of drugs for the last 6 months was significantly associated with adequate blood pressure control (p-value=0.033). Patients with low adherence to treatment were 11 times more likely to have inadequate blood pressure control than those with high adherence (AOR=1.093; 95%CI=0.224-5.332), though the association was not significant (p-value=0.912). The other barriers including single status, inadequate knowledge, employment and duration since diagnosis did not significantly affect blood pressure control. In conclusion, being a male, low adherence and irregular drug use were highly associated with inadequate blood pressure control. Recommendations from the study included the need for better follow up of male patients and emphasis on adherence. Recommendations for further study include a follow up study on the impediments to the health seeking behavior of male hypertensive patients.

BLOOD PRESSURE PARAMETERS AND THE DEVELOPMENT OF CONGESTIVE HEART FAILURE AMONG HYPERTENSIVE PATIENTS AT KIAMBU COUNTY HOSPITAL, KENYA.

Dr. Isabell Mac'oduol-M.SC

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Supervisors: Dr. Joseph Thigiti

Dr. Lydia Maingi
An upsurge of Non communicable diseases (NCDs) has been noted globally particularly, in Africa and also in Kenya. Lifestyle changes have contributed greatly to the increase in NCDs. Congestive heart failure is on the increase globally with 1-3% admission rates and a 3-7% admission rate in Africa. Hypertension (HTN) plays a pivotal role in the evolution and syndrome of congestive heart failure where it is mostly non-ischemic in origin. Though it has been shown to play a key role in the development of congestive heart failure, a full analysis of the individual associations of blood pressure parameters that lead to congestive heart failure is yet to be done. Lowering the blood pressure has been shown to reduce the incidences of congestive heart failure. It would therefore be judicious to find out which blood pressure parameter confers a greater risk to one developing congestive heart failure and aggressively treat it in order to significantly reduce the progression to congestive heart failure. The objective of this study was to assess the individual blood pressure parameters as prognosticators of congestive heart failure (CHF) in hypertensive patients. A retrospective cohort study was carried out at Kiambu county hospital, Kenya on all congestive heart failure patients who met the eligibility criteria. Patient interviews with structured questionnaires were used by the researchers to collect data from the patients’ files provided by the medical records. The systolic blood pressure, diastolic blood pressure, pulse pressure and their association to onset of CHF were the outcomes of interest. Multivariable cox proportional hazard regression models were used to analyze how systolic BP, diastolic BP and pulse pressure related to the development of CHF. In total 205 patients files were used to extract the data. Of the 205 patient records reviewed, females were 141 (68.8%) and 194 (94.6%) were on hypertension medication with median time to CHF development estimated to be 4 years (range: 1-18). Pulse pressure of the range 55-60 mm Hg (AHR: 2.21; 95%CI: 1.16-4.21), patients with hypertension 5-10 years (AHR: 0.14; 95%CI: 0.088-0.223) and over 10 years (AHR: 0.023; 95%CI: 0.010-0.050) were significantly associated with the time to onset of CHF. High pulse pressure, female sex and lack of regular follow up was associated with the development of CHF. Health providers should adapt pulse pressure as a screening tool for developing CHF, educate patients on importance of regular follow up and initiate screening programmes for HTN. More population based studies in Africa matched with demographic characteristics of the patients should be undertaken to investigate their effects on CHF.

IMPLEMENTATION OF TOTAL QUALITY MANAGEMENT AT AGA KHAN UNIVERSITY HOSPITAL, NAIROBI CITY COUNTY, KENYA.

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Dr. Kenneth Rucha

The terms Total Quality Management and Continuous Quality Improvement are no longer used to show high class or feel good attitude but are practices put in place to gain an edge in the business, and have become woven into the very fabric of hospital operations. The role of Total Quality Management in a firm is to ensure integration of firms operations and processes to achieve clients’ satisfaction and meet organizational objective. This study sought to examine critical attributes for TQM implementation in Kenyan healthcare sector. The research study investigated the internal factors that drive quality then identify and describe the key ingredients that have contributed to the achievements of a high performing hospital. It was guided by four specific objectives; To identify the extent to which top management involvement affect implementation of TQM, find out how staff training affect implementation of TQM, determine the extent to which organizational culture affect implementation of TQM and determine how communication affects TQM.
implementation. A cross sectional research design employed. The study population was made up of staff working in Aga Khan University Hospital, Nairobi. Proportionate sampling was used to determine the sample size and select the study subjects. Primary data was collected from management, Medical doctors, nurses, allied health workers, hospitality, finance, Marketing, procurement, maintenance, and Quality assurance staff using a semi structured questionnaire. Data analysis was done with aid of statistical package for social sciences (SPSS) version 20, in conjunction with computer excel programme. Inferential statistics will be calculated using regression analysis done at 95% confidence level to determine the relationship between the study variables. The findings of the study indicated that all the four variables had a significance influence on the implementation of total quality management in Aga Khan University Hospital. Analysis from a regression output of the entire four variables is considered valid (F (5, 224) =97.656, P<.0001) which means that the Total Quality Management factors (Top Management Commitment, Employee Training, Organization Culture and Communication) can be used as predictors explaining differences in the implementation of Total Quality Management at Agha Khan University Hospital. The study recommended that as much as there is top management involvement in TQM, it is important for the facility top leadership to establish how best they can be involved in the implementation of Total Quality Management and find out how to implement TQM at all levels of operations. There is need to ensure that almost a quarter of the staff that has not been trained in quality management to be trained in order to ensure that all staff at all levels are aware of the role and obligation in delivering quality in internationally acceptable standard. The training needs to be designed in a way that it recognizes the present quality expectations in health organizations. Finally, there is need for improved communication of quality expectations in service delivery that include effective dissemination of information at every levels of management.

DYSLIPIDEMIA AND BLOOD PRESSURE CONTROL AMONG ADULT HYPERTENSIVE PATIENTS AT KIAMBU COUNTY HOSPITAL, KENYA.

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Non-communicable diseases are on the rise globally. Hypertension is one of the most common non-communicable diseases. Globally, the prevalence of hypertension among adults was estimated to be 24.1% in men and 20.1% in women in 2015 and the global prevalence of raised cholesterol was found to be 39%. Across WHO regions, Africa was found to have the highest hypertension prevalence at 27%. Blood pressure control among hypertensive patients still continues to be a major challenge. Findings from several studies suggest an association between dyslipidemia and suboptimal blood pressure control among hypertensive patients. There is limited data in Kenya on whether dyslipidemia causes poor blood pressure control. This study aimed to assess the relationship between dyslipidemia and blood pressure control among hypertensive patients attending Kiambu county hospital. This was to help in early diagnosis and management of dyslipidemia in the management of hypertension thus improve blood pressure control and help reduce complications related to uncontrolled blood pressure. The main objective of this study was to assess the relationship between dyslipidemia and blood pressure control among hypertensive patients. This was an analytical cross-sectional study. The study population was hypertensive patients attending Kiambu County hospital. Structured questionnaires were administered by a clinician for data collection. Data collected was entered and stored in Microsoft Excel 2013. Data was
Blood pressure control was associated with socio-demographic characteristics, clinical factors and lipid profile using chi square tests for categorical variables and independent t test for comparison of means. Multiple logistic regression models were conducted to determine independent factors associated with poor blood pressure control. Statistical significance was determined at 5% level (p value less or equal to 0.05). 251 hypertensive patients in Kiambu hospital were studied. Their mean age was 55.7 with females being more than males at 80.9% and 19.9% respectively. The mean systolic blood pressure was 145.1 mmHg and diastolic BP of 87.4 mmHg. Blood pressure was poorly controlled in 142 (56.6%) (95% CI 50.6-62.9%). High LDL levels was diagnosed in 82.1% of the patients, 23.1% had low HDL levels, 31.9% had high triglycerides and 59.8% had high total cholesterol. Patients with poorly controlled hypertension had a significantly higher mean total cholesterol (221.4 mg/dl) compared to the well-controlled group (mean 193.4 mg/dl), p<0.001. Similarly, LDL levels were significantly higher in the poorly controlled group (mean 142.3 mg/dl) compared to the well-controlled group (mean 121.4 mg/dl), p=0.001. HDL and triglycerides were not significantly associated to hypertension control (p>0.05). Drug adherence, male gender and total cholesterol were independently associated with poor blood pressure control. In conclusion, majority of the patients studied had poor blood pressure control and dyslipidemia was a major problem and it was associated with uncontrolled blood pressure. However, more studies are recommended for correlation.

**URINARY TRACT INFECTIONS CAUSED BY ENTERIC BACTERIA AND ANTIBIOTIC SENSITIVITY AMONG SYMPTOMATIC MALES VISITING SPECIAL TREATMENT CENTER, NAIROBI CITY COUNTY, KENYA.**

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Dr. Washington Arodi

Urinary tract infections are not as common in men as they are in women. However, when present, they are considered to be indicative of serious urological abnormalities and thus considered to be complicated infection in men. They can either be typical or atypical. Typical irritative lower urinary tract infection can be presented by most men with clinical symptoms such as frequency or urgency in micturition, nocturia, dysuria, and hematuria. The less common atypical urinary tract infection presents with clinical symptoms such as confusion, urine incontinence and is highly associated with elderly men. Due to the stigma and denial associated with urinary tract infections, male patients with urinary tract infections self-diagnose and use over the counter antibiotics leading to the mismanagement of disease and increase in antibiotics resistance. The study aimed at investigating the prevalence of urinary tract infections caused by enteric bacteria and antibiotic sensitivity among symptomatic male patients visiting special treatment center, in Nairobi, Kenya. A cross-sectional study was carried out among three hundred and eighty-four (384) male patients attending the special treatment center. The male participants were selected using systematic random sampling technique. Aseptic procedure of urine collection was explained to the patient and 10-15ml mid-stream urine sample collected. Urinalysis using dipstick was done, followed by culture on CLED and blood Agar. Kirby Bauer disc diffusion technique for antibiotic sensitivity was done using Ofloxacin, cefaclor, nitrofurantoin, Nalidixic acid, Augmentin, cefuroxime, minocycline, ciprofloxacin and gentamicin. Data was cleaned, coded and entered into the computer and analyzed using Statistical Package for Social Science software version 23. Both descriptive and inferential statistical test techniques were used and the output presented using tables and charts. The prevalence was 65.6% calculated based on the proportion of participants with UTI during the study period.
The Gram negative bacteria isolated were: Escherichia coli, Klebsiella pneumonia, Proteus mirabilis and Pseudomonas aeruginosa while Gram positive were Staphylococcus aureus and Staphylococcus saprophyticus. The most frequent bacteria isolated was Escherichia coli (42%) and the least was P. aeruginosa (4.7%). The occurrence of urinary tract infections was noted to be most common between the ages of 20-29 years. There was moderate relationship between P. mirabilis, S. saprophyticus and age ($r=0.698$, $r=0.85$). There was also a slight statistical significance between age and S. aureus ($p=0.046$). The most effective antibiotic to all bacteria was ofloxacin and the isolates exhibited resistance to nitrofurantoin, augmentin and nitrofurantoin. Sensitivity of P. mirabilis was 100% to cefaclor while P. aeruginosa was 100% resistance to all the drugs. All isolates demonstrated multidrug resistance to more than two drugs. The study therefore recommends a regular surveillance and research of antibiotic use in the management of UTI to avoid multidrug resistance which would otherwise impact on the increasing cost of care.

**INFLUENCE OF COMMUNITY PARTICIPATION ON SUSTAINABLE RURAL WATER ACCESS BY HOUSEHOLDS: CASE OF BUNGOMA NORTH SUB-COUNTY, KENYA**

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Supervisors: Dr. Phoebe Ndayala

Prof. Jane Rose Njue

Access to clean and safe water is a global concern. Besides socio-economic development, adequate access to water is a key ingredient in both health and wellbeing of humans. In Kenya, 70% of the population reside in the rural areas where only 49% of this population access safe drinking water. Bungoma Sub-County falls within the Lake Victoria North Water Services Board region with a rural water supply coverage of 44% (LVNWSB, 2012). This low coverage underscores the inadequate access to water for most households in the region. This study assessed the influence of community participation in sustainable access to water in rural areas. It focuses on how community participation in decision-making, resource contribution, water tariff charges and management factors influence sustainable rural access to water. Using a Cross-sectional survey study design combining mixed method approaches, the study covered 98% of the targeted 398 households with structured questionnaires. Key Informant Interviews were conducted among 32 WUA members and 2 County Government officials in the Water department. Systematic random sampling was used to identify targeted households while purposive sampling was used in identifying respondents for the KIIs. Data was entered and cleaned in MS Excel and exported to SPSS version 20 for univariate and bivariate analyses at 5% significance level. The study established high level of involvement of community in water supply management decisions (84%). No statistical relationship was established between level of involvement of community members in decision-making and level of sustainable rural water access ($p=0.106$) and community participation in water supply management processes ($p=0.424$). However, community members initiate most of the water projects with 66% contributing resources towards construction of water projects. There was no significant relationship between resource contribution for community water projects by the community members and level of sustainable rural water access ($p=0.234$). Seventy-four percent of the water supply projects are mainly operated, maintained and managed by the community water supply management committees. A significant association was established between responsibility for operation and maintenance of community water projects and level of sustainable rural water access ($p=0.000$). Community members in the study area mainly access drinking water through protected springs (50%). No significant relationship was established between payment of water
tariffs charged and level of sustainable water access (p=0.188). This study establishes that involvement of community members in decision-making, resource contribution; operations, maintenance and payment of water tariffs have high potential to improve level of sustainable access to rural water. The study established that level of responsibility in the operations and management of rural water resources significantly influenced the level of sustainable access to rural water. The study recommends that water sector stakeholders at the County and at National level should prioritize capacity-building initiatives for community members to help in the institutionalization of the operation and maintenance of community water projects and for sustainable access to rural water.

**DIETARY PRACTICES, NUTRITION STATUS, PHYSICAL ACTIVITY AND BLOOD PRESSURE LEVELS AMONG HYPERTENSIVE PATIENTS, AT THARAKA-NITHI COUNTY HOSPITAL, KENYA**

Mbae Dennis Mutwiri-M.SC

Department: Food, Nutrition and Dietetics

Supervisors: Dr. Judith Munga
Dr. Irene Cgada

Globally, hypertension affects about one billion people resulting in stroke, organ failure and high mortality. The consequences of secondary hypertension are severe in developing nations where hypertension is associated with diabetes mellitus and kidney diseases. The prevalence of hypertension in Kenya especially in the eastern region has been documented to be about 50%. Studies have found an association between hypertension and dietary practices with little evidence of studies on secondary hypertension. The physical activities among Kenyan adults has been found to be low with profound effects on individual nutrition status and blood pressure levels. There is paucity of literature in Kenya regarding dietary practice, nutrition status and secondary hypertension, especially in Tharaka-Nithi County. The study aimed at determining dietary practices, nutrition status, physical activity and blood pressure level among secondary hypertensive patients attending hypertension clinic at Tharaka Nithi County Referral Hospital. This was a cross-sectional analytical study where random sampling was used to select 234 participants with hypertension. A researcher-administered questionnaire was used to elicit and record information on socio-economic and demographic characteristics, medical characteristics, food intake. Anthropometry, blood pressure levels and physical activity levels were measured. Key informant interviews were conducted with the nutritionist, nurse and doctor at the clinic. Quantitative data was analyzed using SPSS software while NutriSurvey (2007) was used to analyse 24 hour dietary recall data. A p-value of <0.05 was considered statistically significant. Results of the study were presented in graphs and tables. The study population had a mean age of 52.51±11.08 years where 60.7% were from middle economic level and diabetes mellitus contributed 50.0% of the diseases present among the participants. The nutrition status of participants was poor characterized by 62.4% overweight and 88% with increased risk of cardiovascular diseases based on waist hip ratio. Majority (97%) achieved medium dietary diversity. The participants took most time (1159.60±1067.42 Min) in moderate activity and 52.1% had high physical activity levels. Uncontrolled blood pressure (≥140/90 mm Hg) was recorded among 42.7% of the participants. Blood pressure levels were associated with dietary diversity ($\chi^2=10.605; p=0.005$), frequency of consumption of fruits ($\chi^2=73.524; p=0.001$), body fat ($\chi^2=10.801; p=0.028$), waist hip ratio ($\chi^2=8.202; p=0.004$) and Physical activity ($\chi^2=12.377; p=0.002$). Uncontrolled blood pressure was predicted by medical characteristics (OR=50.884; p=0.001), nutrition status (OR=29.20; p=0.001), demographic characteristics (OR=0.014; p=0.037), dietary practices (OR=0.077; p=0.011) and physical activity level (OR=21.34; p=0.011). The participants with other disease diagnosis post hypertension were 5 times more...
likely to have uncontrolled blood pressure than those with none. Based on these findings, it is recommended that improvement of dietary practices, physical activity levels and nutrition status management be strengthened in the management of hypertensive patients especially those with secondary hypertension, where diabetes type II contributed 50% of diseases present among the study participants.

OVERWEIGHT PREVALENCE, DIETARY DIVERSITY, BODY SIZE PREFERENCE AND PHYSICAL ACTIVITY AMONG SEROPOSITIVE ADULTS ATTENDING KAYOLE HOSPITAL NAIROBI CITY COUNTY, KENYA

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Obesity are on the increase and is a major public health concern globally. Currently, there is a surge in overweight and obesity among the HIV-positive population in Africa. Overweight and obesity are associated with increased rates of chronic diseases globally. However, the identification and understanding of factors associated with overweight and obesity among persons living with HIV (PLHIV) remain uninvestigated in Kenya. This study aimed to determine the prevalence of overweight and obesity among seropositive adults and its relationship to dietary diversity, body size preference, and physical activity level?. The study adopted a cross-sectional analytical design conducted among 173 seropositive adults systematically sampled attending Kayole Sub-County Hospital in Nairobi County. A structured questionnaire was used to capture data on socio-demographic, dietary diversity, body size preference, and physical activity patterns and levels among seropositive adults. Descriptive statistics were used to describe the data, Bivariate and multivariate logistic regression model used to identify the association between overweight and obesity and dietary diversity, body size preference and physical activity. The prevalence of overweight was 24.3% and obesity at 15.6% among seropositive adults. However, females had a higher prevalence of overweight and obesity at 48.8% while that of males was 18.8%. The minimum dietary diversity was achieved by 79.7% of the seropositive adults. Among overweight respondents categorized by BMI, about 35.7% and 4.8% preferred overweight and obese body images respectively. Among obese respondents, 70.4% and 7.4% preferred overweight and obese body images respectively. 52% engaged in high physical activity level, 27.8% in moderate physical activity level and 20.2% engaged in low physical activity level. Multivariate analysis showed being female (Adjusted odds ratio (AOR)=3.65; 95% Confidence level [CI]=1.24-10.0; P=0.019), being in business as an occupation (AOR = 7.87; 95% CI=1.47-41.99; P=0.016), and achieving minimum dietary diversity (AOR = 4.67; 95% CI=1.34-16.34; P=0.016) distorted body perception (AOR = 3.26; 95% CI=1.3-8.22; P=0.012), while being dissatisfied with overweight (AOR = 59.246; 95% CI=10.86-323.07; P<0.05), normal nutritional status at enrollment to CCC clininc (AOR = 7.62; 95% CI=1.52-38.25; P=0.014), overweight nutritional status at enrollment to CCC (AOR = 14.2; 95% CI=2.09-96.46; P<0.05) were associated with overweight and obesity. Close to half of seropositive adults were either overweight or obese.

Findings have an implication on public health even though the study was based on a relatively smaller urban health facility and that various regions of Kenya vary in socio-demographic structure, dietary habits and physical activity patterns and levels. This study thus recommend institution of targeted weight management programs as part of routine HIV care with an emphasis on awareness of health consequences of overweight and obesity in addition to seropositive adults need to be sensitized on the rising trends, risk and measures they can take in order to avoid being overweight or obese.
COMPLEMENTARY FEEDING KNOWLEDGE, ATTITUDES AND PRACTICES AMONG CARE-GIVERS OF CHILDREN IN OUT-PATIENT THERAPEUTIC PROGRAMME IN NAIROBI CITY COUNTY, KENYA

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Complementary feeding is the greatest contributor to health and nutrition status of infants and young children. Malnutrition remains one of the greatest concerns in Sub-Saharan Africa region. In Kenya, national findings show inappropriate complementary feeding practices. Out-patient therapeutic programmes (OTPs) have been established to address severe acute malnutrition (SAM) among children 6-59 months of age. There are 6 OTP centres in Kamukunji sub-county in, Nairobi County. There is limited information on the knowledge, attitude and practices on complementary feeding among the caregivers of the children admitted into OTP centres. The main purpose of this study was to determine the knowledge, attitudes and practices (KAP) on complementary feeding among care-givers of children 6-23 months of age admitted into OTP centres in Kamukunji sub-County. The study adopted a cross-sectional analytical design. An exhaustive sample of 200 caregivers from four OTP centres in Kamukunji sub-county participated in the study. Data was collected from the caregivers using structured researcher-administered questionnaires and focus group discussion (FGD) guide, and from OTP programme staff using Key Informants Interview (KII) guide. Data was analysed using SPSS software (version 22). A p-value of <0.05 was used as the criterion for statistical significance. Caregivers’ mean score for knowledge on CF for children with normal nutrition status was 6.11± 2.33, out of a total score of 12, while for feeding children with Severe Acute Malnutrition (SAM) was 8.7± 2.63 out of a total score of 10. Eighty-eight percent (88%) knew the guidelines on how to give Ready-to-use therapeutic food (RUTF) to a child with SAM, 78% knew the time of introduction to complementary feeding, 100% knew that a child should be breastfed before administering the RUTF and 21% knew that breastfeeding should be increased and additional nutritious food given to a child during illness. For attitudes, the mean score was 24.1±11.73 out of 85 and 79.7% had a positive attitude towards the high nutritive value and the potential of RUTF to cure SAM, 67.5% had a positive attitude towards continued breastfeeding, and 61% had a positive attitude towards the recommended daily dietary intake for of RUTF. Almost all the caregivers (98.5%) introduced their children to complementary feeding at 6 months of age. Seventy-three percent of the children ate the recommended amount of RUTF per day. Maternal time constraints, low socio-economic status, and leakage of RUTF at the household through sharing were major barriers to optimal feeding for children with SAM. Lack of commitment in attending MIYCN education sessions was a major reason for low knowledge on complementary feeding for children with normal nutrition status. It is recommended that the Ministry of Health scale up Behaviour Change Communication (BCC) interventions for care-givers of children 6-23 months of age with a focus on complementary feeding knowledge, attitudes and practices specifically dietary diversity. The study findings may be utilized by the Ministry of Health at National, County and Sub county levels and the agencies dealing with child survival to establish strategies focusing on enhancing infants and young child nutrition among severely malnourished children through appropriate feeding. The findings also provide valuable information on the research efforts to rehabilitate children with SAM.
Access to clean and safe water is a global concern. Besides socio-economic development, adequate access to water is a key ingredient in both health and wellbeing of humans. In Kenya, 70% of the population reside in the rural areas where only 49% of this population access safe drinking water. Bungoma Sub-County falls within the Lake Victoria North Water Services Board region with a rural water supply coverage of 44% (LVNWSB, 2012). This low coverage underscores the inadequate access to water for most households in the region. This study assessed the influence of community participation in sustainable access to water in rural areas. It focuses on how community participation in decision-making, resource contribution, water tariff charges and management factors influence sustainable rural access to water. Using a Cross-sectional survey study design combining mixed method approaches, the study covered 98% of the targeted 398 households with structured questionnaires. Key Informant Interviews were conducted among 32 WUA members and 2 County Government officials in the Water department. Systematic random sampling was used to identify targeted households while purposive sampling was used in identifying respondents for the KIIs. Data was entered and cleaned in MS Excel and exported to SPSS version 20 for univariate and bivariate analyses at 5% significance level. The study established high level of involvement of community in water supply management decisions (84%). No statistical relationship was established between level of involvement of community members in decision-making and level of sustainable rural water access (p=0.106) and community participation in water supply management processes (p=0.424). However, community members initiate most of the water projects with 66% contributing resources towards construction of water projects. There was no significant relationship between resource contribution for community water projects by the community members and level of sustainable rural water access (p=0.234). Seventy-four percent of the water supply projects are mainly operated, maintained and managed by the community water supply management committees. A significant association was established between responsibility for operation and maintenance of community water projects and level of sustainable rural water access (p=0.000). Community members in the study area mainly access drinking water through protected springs (50%). No significant relationship was established between payment of water tariffs charged and level of sustainable water access (p=0.188). This study establishes that involvement of community members in decision-making, resource contribution; operations, maintenance and payment of water tariffs have high potential to improve level of sustainable access to rural water. The study established that level of responsibility in the operations and management of rural water resources significantly influenced the level of sustainable access to rural water access. The study recommends that water sector stakeholders at the County and at National level should prioritize capacity-building initiatives for community members to help in the institutionalization of the operation and maintenance of community water projects and for sustainable access to rural water.
ASSESSMENT OF COMMUNITY BASED WATER SUPPLY, CONSUMPTION, UTILIZATION AND PERCEIVED SUSTAINABILITY: A CASE OF RIRONI SELF-HELP WATER PROJECT, KIAMBU COUNTY KENYA

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The purpose of the study was to assess the influence of demography, water consumption level, water supply and water utilization on perception of CBWR sustainability at Rironi Self Help Water Project (SHWP) in Kiambu County, Kenya. The study objectives were: to determine the influence of demographic characteristics of project members on perception of CBWR sustainability, to establish the influence of water supply on perception of CBWR sustainability, to establish the influence of water consumption level on perception of CBWR sustainability and to assess the influence of water utilization on perception of CBWR sustainability. The study was guided by the general systems theory by Bertalanffy (1968). The study adopted a cross sectional survey research design. The research was carried out at Rironi, Limuru Central Ward in Kiambu County. Stratified random sampling was used to select nine geographical zones covered by the community based water project. From each zone, random sampling was used to select 297 respondents who participated in the study. The data was analyzed using the Statistical Package for the Social Sciences (SPSS) Version 24. Inferential statistics including Chi-Squares and Spearman Correlations were used to test relationships between variables. The findings revealed that the overall perception of CBWR sustainability was rated as moderate by 11%, high by 54%, and very high by 35% of the respondents. The results of the hypotheses tests showed that demographic characteristics had significant influence on the perception of CBWR sustainability as follows: gender ($\chi^2 = 27.117$, d.f= 2; $p = 0.001$), age, ($\chi^2 = 31.532$, d.f=8; $p = 0.001$), education, ($\chi^2 = 12.135$, d.f=4; $p = 0.016$), occupation ($\chi^2 = 23.010$, d.f=8; $p = 0.003$), household size ($P=0.001$, rs =0.240), duration of residence ($\chi^2 = 22.256$, d.f=6; $p=0.001$) and geographical zone ($\chi^2 = 113.862$, d.f=16; $p = 0.001$). The water supply and consumption variables that had a statistically significant influence on CBWR sustainability were: availability of secondary sources of water ($\chi^2 = 27.428$, d.f=4; $p=0.001$), water disruption in the dry months ($\chi^2 = 30.705$, d.f=8; $p = 0.001$), number days water was supplied ($P=0.001$, rs =0.250) and the volume of water consumed ($\chi^2 = 10.919$, d.f=4 $p = 0.027$).

However, the mode of water utilization had no significant influence on perception of CBWR sustainability. It was concluded that respondents’ demographic characteristics, amount of water supplied and amount of water consumed had statistically significant influence of the perception of CBWR sustainability. The study recommends the need to consider investment of water infrastructure in the SHWP, implement control measures to ensure that water supply is done equitably in the different geographical zones and reduce the variations in the number of days that water is supplied to members during the dry months. The SHWP should limit the expansion of the water supply coverage to a smaller geographical area. The SHWP members should adopt water conservation measures in order to ensure long term sustainability of community based water resources in the densely populated study region.

COMPLEMENTARY FEEDING PRACTICES, MORBIDITY AND NUTRITION STATUS OF CHILDREN AGES 6-23 MONTHS IN KURIA WEST, MIGORI COUNTY, KENYA

Lennah Nyatichi Nyakundi-M.SC
The nutrition status, health and survival of children 6-23 months of age are enhanced when a child is fed in accordance with the World Health Organization’s (WHO) feeding recommendations. Gender disparities in socio-economic status and cultural practices contribute to high rate of morbidity and mortality of infants and children of ages 6-23 months. This study purposed to determine the relationship between complementary feeding practices, morbidity and nutrition status of children ages 6-23 months in Migori County. This study used a cross-sectional analytical study design on 217 mother-child pairs selected using systematic random sampling from two locations. A researcher-administered questionnaire, focus group discussion guide and key informants interview guide were used to collect data. Data was entered and analyzed using SPSS version 20. Dietary diversity was assessed with 24-hour recall and 7-day food frequency questionnaire. The 24-hour recall was analyzed by use of Nutri-survey computer software. Data on anthropometry was analyzed using ENA for SMART and WHO 2006 growth standards cut-offs was used to determine the nutrition status of children. A P value of less than 0.05 was considered statistically significant. Qualitative data was arranged in general categories identified in the discussions and common themes established. The mean age of the respondents was 27.2±5.99 years and most of them (65.6%) falling between ages 20 to 30 years. Majority (88.1%) were married, (54.2%) completed primary level of education and subsistent farmers (33.3%). Majority (84.8%) of the breastfed children attained the minimum meal frequency unlike the non-breast-fed children (10.7%). Over half (63.2%) of the children met the recommended minimum dietary diversity with the most commonly consumed food groups being grains, roots and tubers (99.5%) then dairy products (80.1%). Barely 32.3% of children met the minimum acceptable diet. Over half (61.7%) of the children had been sick within the recall period of whom 57.2% sought medical assistance. Acute respiratory infections were the most commonly reported illnesses (28.0%). Under-nutrition by Z-scores was indicated by stunting (28.9%), underweight (9%) and wasting (5.5%). Underweight was associated with socio-demographic and socio-economic characteristics such as main source of income (p=0.003), husband occupation (p=0.010) and household income (p=0.045). Minimum acceptable diet was associated with maternal level of education (p=0.027), main source of income (p=0.003), average monthly income (p=0.005) and child’s age (p=<0.001). Complementary feeding and nutrition status were also found to be associated: underweight was associated with minimum dietary diversity (p=0.043), and minimum acceptable diet (p=0.048). Morbidity and nutrition status were associated such that stunting was associated with morbidity (p=0.024). Though most of the children (67.7%) did not meet the minimum acceptable diet, the presences of illnesses also were found significantly associated with severe stunting implying prolonged nutrition deficiencies. The study recommends use of behaviour change communication approach to emphasize on the importance of minimum meal frequency and dietary diversity.
Environmental pollution caused by the Municipal Solid Waste (MSW) incinerators has raised concerns about the quality of incinerators and the incineration process in Tanzania. Engineers and Scientists in general have appreciated that the installation of functional incinerators will increase the incineration process efficiency. Among the methods to achieve this is the application of mathematical modeling for the incineration process. Literatures have showed that related study in incinerators, incineration process and mathematical modeling in general has received little attention. The broad objective of this study was to optimize the design of municipal solid waste incinerators by using mathematical modeling and computer simulation. Computation Thermal Predictions (CTP) mathematical relations applying different types of incineration parameters including temperature, density, velocity and species concentration were formulated based on theories of incineration process with proper assumptions. The solution of the mathematical model developed was done and accomplished by computational fluid dynamics (CFD). Finite element method of numerical analysis was applied during the process to govern temperature and species concentration at different stack height of the model incinerator. Tests were performed on the physical model incinerator and data were analyzed after experiments. These data were applied in testing and verification of the mathematical models and provided the exact temperature and amount of flue gases which can be released from the stack without polluting the atmosphere. The results show that it is possible to forecast temperature and flue gases by the application of mathematical expressions. It also can be applied to develop more and accurate computational thermal predictions (CTP) model for the simulation of incineration process and experimentally regulate temperature and species concentration at different location of the incinerator. The results provided by the computational thermal predictions (CTP) were very close to those of experiments obtained from physical model. Therefore, there is an agreement between the empirical model and experiment as they show true trend of the incineration process.
Determinants of Active Transportation Among 10 – 12 Year Old School Children in Nairobi City County, Kenya

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Active Transportation (AT) contributes significantly to the health and wellbeing among children and youth. This benefit can in turn be carried over to adulthood. AT is an important factor in increasing levels of physical activity (PA) in children. The objectives of this study were to; assess AT to school and other destinations, determine barriers of AT to school and other destinations, examine the effects of socio-economic status on AT, determine difference in pedometer step count data and analyse difference in pedometer Moderate to Vigorous Physical Activity (MVPA) rates data for 10 – 12 year old children in high socio-economic status (HSES), mid socio-economic status (MSES) and low socio-economic status (LSES) regions in Nairobi City County. A cross-sectional descriptive research design was used to determine the participation in AT and resultant PA rates. Stratified random sampling was used to get 1,200 school children (boys and girls) aged 10 – 12 year old. Of the number sampled, 877 returned complete parental consent forms and duly filled questionnaires, attaining a response rate of 78.2%. Data on PA and MVPA was collected using PiezoRx® pedometer sets while data on AT, demographic characteristics, parents and children’s views collected through questionnaires. Chi-square test was used to compare the children’s responses on AT as well as rates of PA. Analysis of Variance (ANOVA) Test was used to ascertain difference in PA and MVPA across regions in Nairobi City County. A p-value of ≤0.05 was considered significant in the testing of hypotheses. Majority of the children 629 (71.7%) walked to and from school while 1 (0.1%) rode a bicycle to and from school. More children in LSES used AT to and from school and other destinations than the children from MSES and HSES. AT to and from school showed strong statistical association significance across the three regions of Nairobi City County. Safety affected AT choice more for children in LSES 214 (24.4%) than MSES 357 (40.7%) and HSES 306 (34.9%). Among the socioeconomic factor indicators, only the level of education of a parent/guardian and family ownership of vehicles determined the children’s choice of transport mode. Ownership of motorcycles and/or bicycles had no significant difference on the children’s choice of transportation mode. Most children achieved the recommended pedometer step counts on the first day $x=13,502.43$ and a weekly $x=12,490.53$ of wearing the pedometer. The study recommends that Nairobi City County in liaison with all stakeholders develop interventions for increasing AT among school going children. This should be done by developing safe routes to school, walking and cycling programmes that ensure local environment of schools’ catchment regions provide opportunities for children to walk and cycle. The results from this research may inform policy formulation on development of future school transportation systems and physical characteristics of schools.
INTEGRATION OF INVESTIGATIVE SCIENCE PROCESS SKILL TEACHING STRATEGY ON STUDENTS’ ACHIEVEMENT, PROBLEM SOLVING, MOTIVATION AT SECONDARY SCHOOL PHYSICS EMBU COUNTY, KENYA

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One of the challenges facing Kenya in the teaching of Physics in secondary schools is how to make learners acquire knowledge, build up capacity for critical thinking in solving problems in any situation and make an effort to enable them understand the application of content in real life situations and careers. Based on this challenge, the present study was designed to determine the effect of investigative science process skill teaching strategy on students’ achievement, problem solving and motivation in Physics. The study was guided by the following objectives; To determine students achievement in school physics when using investigative science process skill (ISPS) teaching strategy, To determine problem solving abilities of learners in physics when using ISPS teaching strategy, To establish if ISPS have any effects on students motivation towards Physics compared to conventional teaching strategies, to find out gender difference in achievement among the students taught through ISPS teaching strategy in physics, to establish if there is any difference in achievement among the students taught through ISPS teaching strategy based on school category. Theoretical framework of the study was based on constructivist theories of learning. Quasi-Experimental design was used. The research was carried out in eight schools in Embu County. Stratified random sampling technique was used to select participating schools, then simple random sampling was used to select and assign participating schools in experimental and control group. The sample was form three students. Research instrument used was: Students motivation scale (SMS), Physics Achievement Test (PAT) on the topic of Electricity (II) and an observation schedule was also administered to determine achievement as well as understanding of the topic “Electricity”. The research instrument was pilot-tested for validity and reliability. The reliability coefficient was calculated using Kuder-Richardson (KR-Formula20). A coefficient value of 0.768 was considered suitable for reliability of the instrument. Data was analysed using the analysis of variance (ANOVA) and chi-square and t-test. Hypotheses was tested at alpha (α) value of 0.05 level of significance using a computer Statistical Package for Social Sciences (SPSS) for Windows. The findings of the study demonstrated that ISPS enhanced academic achievement, problem solving and motivation in learning. It is hoped that the results of the study provide useful information to Physics teachers, curriculum developers, Quality Assurance and standards officer (QASO) and teacher-trainers.

 MOTIVATIONAL, AFFECTIVE AND SELF REGULATORY PROCESSES AS PREDICTORS OF ACADEMIC ACHIEVEMENT AMONG SECONDARY SCHOOL STUDENTS IN BOMET COUNTY, KENYA

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Poor performance in national examinations in secondary schools is still a major challenge. The cause of poor academic performance has been attributed to environmental and instructional practices with less focus on motivational, affective
and self regulatory processes which contributes to students' academic achievement. This study sought to find out how motivational, affective and self-regulatory processes affect academic achievement of secondary schools students. The purpose of the present study was to investigate motivational, affective and self-regulatory processes as predictors of academic achievement among secondary school students. This study was guided by the self efficacy and attribution theories. In this study, an ex-post facto (causal comparative) research design was used. The study was carried out in nine secondary schools in Bomet County, Kenya. The population was 2346 students in the 75 schools. The sample for the study consisted of 243 (126 females and 117 males) pupils drawn from the nine schools selected through stratified and random sampling techniques. The data on demographic characteristic, motivational, affective, self-regulatory processes and academic achievement was collected through adapted self report questionnaires and by accessing their pre mock and mock results of 2016 academic year from the county Education Office (CEO). Documentary surveys, interviews, observations and check lists were also used for data collection. Pilot study was carried out with a sample of 30 form three students from a mixed secondary school in Bomet County. This was done to better the reliability and validity of the research instruments. Both descriptive and inferential statistical procedures were used to analyze data from the sampled schools. Data was analyzed and tabulated using descriptive statistics generated from Statistical Package for Social Sciences. T-test was used to assess sex differences in the motivational, affective, self-regulatory processes and academic achievement of students. The Pearson correlation coefficient was used to assess the relationship between motivational, affective, self regulatory processes and academic performance. Multiple regression analysis was used to establish the predictive weights of the three variables on academic achievement. The study found significant relationships among motivational, affective, self-regulatory processes and academic achievement of students. T-test findings also indicated that there were significant gender differences in students' motivational, affective, self-regulatory processes and academic achievement of students. The study is significant in that it may help improve students' teaching learning strategies. In conclusion, the study found significant predictive model of academic achievement from motivational, affective and self-regulatory processes. The study came up with several policy recommendations and suggestions for further research. The study recommended that Parents should ensure that home provides children adequate emotional support and encouragement for their learning and that the government should motivate teachers through steady setting up of seminars, workshops and symposia in order to enhance academic achievement. Implications of the research are reviewed.

AVAILABILITY AND UTILIZATION OF SCHOOL RESOURCES ON STUDENTS’ ACADEMIC ACHIEVEMENT IN PUBLIC DAY SECONDARY SCHOOLS IN KISII COUNTY, KENYA

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The study intended to investigate the relationship between availability and utilization of school resources on students’ academic achievement in Public day secondary schools in Kisii County, Kenya. The concern was why the decline in students’ academic achievement in public day secondary schools in Kisii County when the government of Kenya is funding all public secondary schools through the Free Day Secondary Education (FDSE) program. The study was guided by the following objectives: To establish the level of availability and utilization of text books and its relationship to students’ academic achievement in public day secondary schools in Kisii County, to establish the level of availability and utilization of laboratory equipment and how it relates to students’ academic achievement in public day secondary schools in Kisii County, to establish the level of availability and utilization of library resources and its relationship on students’ academic achievement in public day secondary schools in Kisii County and to establish the level of availability and utilization of classroom equipment and its relationship on students’ academic achievement in public day secondary schools in Kisii County.
County. The study was guided by the production function model of education. The study adopted a correlational research design which involved students and teachers from the 246 public day secondary schools in Kisii County. The target population was 24266 participants comprising of 21843 form four students and 2,423 teachers in public day secondary schools in Kisii County. The sample size of this study was selected using on-proportionate sampling, systematic random sampling and purposive sampling techniques. Non-proportionate sampling technique was used to sample schools, systematic random sampling technique was used to sample students while teachers were sampled using purposive sampling technique. The Yamane simplified formula was used to calculate the sample size. The sample size was therefore 401 students and 25 teachers totaling to 426 subjects. Data collection was done by use of student questionnaire (SQ) and Teachers Interview Schedule (TIS). The data collected were both quantitative and qualitative. Quantitative data were analyzed using inferential statistics, Pearson"s Product Moment Correlational Coefficient analysis and multiple regression. Qualitative data were analyzed thematically and were reported as direct quotations. Findings from the analyzed data were presented as tables, figures and graphs. The study found out that school resources needed for teaching and learning were available in public day secondary school in Kisii County. These resources ranged from recommended textbooks and set books, basic laboratory equipment, libraries resources and classroom equipment. Among the facilities that were not available in public day secondary schools were libraries. The study revealed that availability and utilization of textbooks, laboratory equipment, library resources and classroom equipment had a relationship with students" academic achievement. It was concluded that the relationship was statistically significant \[F \left(4, 372\right) = 39.203, \ R^2 = .297, \ \text{sig.} < .05\]. A respectable variability (=30%) in student academic achievement was explained by the school resources. There is need therefore to avail all the basic school resources and ensure proper utilization of the said resources for students" academic achievement. The study recommends that, libraries should be put up in every public day secondary schools and conduct in-service training for teachers on proper utilization of the available school resources. This study will inform secondary schools" policy on resource allocation and utilization, generate more information to the Ministry of Education and education policy makers.

**PRINCIPALS' INSTRUCTIONAL SUPERVISION AND ITS INFLUENCE ON PEDAGOGICAL PRACTICES OF TEACHERS IN PUBLIC JUNIOR SECONDARY SCHOOLS IN BAUCHI STATE, NIGERIA**

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The purpose of this study was to investigate the effect of principal's instructional supervision on pedagogical practices of public secondary school teachers in Bauchi state, Nigeria. Specifically, the study aimed to assess the impact of principals' supervision of teachers' records on teachers' pedagogical practices. Additionally, to establish how principals' monitoring of students' progress affect teachers' pedagogical practices. And examine the extent of influence of principals' classroom observation on teachers' pedagogical practices. Furthermore, to find out if professional development programmes that principals facilitate influence teachers' pedagogical practices and identify main challenges of principals' instructional supervision in public secondary schools in Bauchi state. The study was hinged on Leithwood Theory of Transformational Leadership. A descriptive survey design was employed for the study. The target population comprised 285 principals of public secondary schools; 3,836 teachers and 37 area education officers in Bauchi South Geopolitical Zone. The sample included 29 principals of the selected schools; 384 teachers and 7 Area Education Officers, chosen by random sampling technique. Questionnaires were the main tools for data collection from teachers and principals. Similarly, data were collected through interviews with the Area Education Officers and documents checklist. Experts' review and piloting were used to improve the validity of the research instruments. Cronbach's alpha determined the reliability of the instruments. Descriptive and inferential statistics were used to analyze the quantitative data with the aid of SPSS. Thematic approach
was used to analyse the qualitative data. Simple linear regression was used to test the null hypothesis at \( .05 \) level of significance. The study found that principals' checking of teachers' records significantly affect their pedagogical practices \((R^2=.097, p<.05)\). And also revealed that principals' monitoring of students' progress significantly influenced pedagogical practices of teachers \((R^2=.099, p<.05)\). Furthermore, it was found that principals' classroom visitation significantly influenced teachers' pedagogical practices \((R^2=.138, p<.5)\). The professional development programme principals implement was found to have statistically significant influence on teachers' pedagogical practices \((R^2=.060, p<.05)\). The research discovered that many principals did not review students' classwork and assessment records. Additionally, it was discovered that the implementation school-level workshops, peer mentoring programme, review of teachers' documents and classroom observation in public secondary schools was inconsistent. Finally, the study revealed that inadequate funding for supervision activities and principals' lack of supervision skills had affected the quality of in-school supervision in public secondary schools. The study concluded that principals' instructional supervision significantly influenced pedagogical practices of teachers in public secondary schools. It was recommended that the State Ministry of Education should organize in-service training for principals to improve their skills of instructional supervision. The study also suggested that principals should intensify supervisory activities to promote instructions and academic achievements. Findings of this study may provide framework in organizing capacity building for in-school supervisory personnel.

INFLUENCE OF SEXUAL HARASSMENT ON HIGH SCHOOL STUDENTS’ SELF-ESTEEM IN SELECTED SECONDARY SCHOOLS IN NYAMIRA AND KIAMBU COUNTIES, KENYA

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Prof. Kisilu Kombo

Student sexual harassment has become a pervasive problem in institutions of learning worldwide. This is in spite of existing global and local laws, policies, rules and regulations. This has left thousands of students affected daily, regardless of their gender. Research findings suggest that sexual harassment negatively affects students’ self-esteem. However, many of these findings are based on contexts outside Kenya thereby leaving a huge gap in knowledge given that self-esteem is a critical component of student’s participation and achievement in school. The purpose of this study was to describe and explore sexual harassment in selected secondary schools in Nyamira and Kiambu counties and its influence on students’ self-esteem. The specific objectives of the study were: To determine the prevalent form of school-based student sexual harassment in different learning environments in selected secondary schools in Nyamira and Kiambu counties, to establish the influence of verbal sexual harassment on student self-esteem in the selected secondary schools in Nyamira and Kiambu counties, to investigate the influence of physical sexual harassment on student self-esteem in selected secondary schools in Nyamira and Kiambu counties, to find out the influence of visual sexual harassment on students’ self-esteem in selected secondary schools in Nyamira and Kiambu counties, to establish strategies used by schools in addressing school-based student sexual harassment in selected secondary schools in Nyamira and Kiambu counties. The study was guided by a theoretical framework based on Finkelhor and Browne’s (1985) Traumagenic Dynamics Model. The study utilized the descriptive survey research design adopting both qualitative and quantitative methods of data collection and analysis. The target population for the study was 24,513 persons comprising of 23,659 students, 678 teachers, 88 Deputy Principals and 88 Coordinators of G/C. The study sample was obtained through stratified random sampling which involved categorising the schools first into public and private schools and then further stratifying them into boys only, girls only and mixed sex secondary schools. From this stratification, Deputy Principals and Coordinators of G/C and class teachers were purposively sampled to participate in the study. Proportionate simple random sampling was used to obtain a sample of students from the two counties. Qualitative and quantitative data were collected by the use of a School Sexual Harassment Questionnaire (SSHQ), the Rosenberg Self-Esteem Scale (RSES), interview and Focus Group Discussion (FGDs) guides.
Quantitative data were analyzed using descriptive and inferential statistics while qualitative data were analyzed thematically and presented in narratives and in verbatim form. Findings revealed that sexual harassment was rife in secondary schools and that verbal sexual harassment was the most prevalent form of harassment reported by majority of respondents. The results established that sexual harassment had a negative influence on students’ self-esteem. The findings revealed that G/C is among strategies considered effective in addressing sexual harassment. The study recommended initiatives spearheaded by the Ministry of Education and supported by other stakeholders aimed at strengthening new and existing mechanisms of eliminating sexual harassment in schools and boosting students’ esteem levels including Guidance and Counselling services, observance of existing guidelines and policies and stakeholder sensitization forums in order to address school-based student sexual harassment which has a negative influence on students’ esteem.

DEVELOPMENT OF GIRLS’ EDUCATION AMONG THE KIPSIGIS OF KERICHO AND BOMET COUNTIES, KENYA: 1900-2000

Chepkemoi Mary Chumoh-PhD

Department: Educational Foundations

Supervisors: Prof. Daniel Namusonge Sifuna
Prof. Augustine Mambo Karugu

This study examined the development of Western Education for girls among the Kipsigis of Kericho and Bomet Counties from 1900 - 2000. There is growing literature on the role of the missionaries, Colonial Government and African Initiatives on the Development of girls’ education in Kenya. This literature confirms that missionaries pioneered girls’ education in various parts of Kenya. This study addressed a knowledge gap by focusing on the role of Missionaries, the Colonial government and the Kipsigis community in the development of girls’ education in two Counties. The objectives of the study were to document the factors that contributed to the development of girls’ education in Kericho and Bomet Counties, to identify the factors that contributed to the growth and development of Kipsigis Girls African School from 1947 to 2000 and to discuss the impact of the school on the Kipsigis community and Kenya as a whole. It utilized the structural functionalism theory that interprets society as structure with interrelated parts. It addresses the society as a whole in terms of the functioning of its constituent elements such as the family, school, religious organizations, economy and governments. It guided this study in showing the importance of the interdependence of the above elements in the development of the school. The study adopted the historical research design and the case study design and was carried out in Kericho and Bomet Counties, the South Rift Region of Kenya. The population of the study included knowledgeable community members and leaders, political and religious leaders, Old Girls of the school, beneficiaries of mission education, Former Kipsigis Girls’ School Principals, former staff and Education Officials, BoMand ex-BoM and the current School Principal. Purposive and Snowball sampling were used to identify the study’s population. Data for this study was both qualitative and quantitative, elicited through oral interviews, FGDs, document analysis and a questionnaire. The sources of data for this study were both primary and secondary while the Evaluation of data was done through External criticism, which aimed at establishing the authenticity, originality and genuineness of the data, and internal criticism aimed at evaluating the accuracy of the data. Qualitative data was analysed thematically and in accordance to the objectives of the study, while the quantitative data was analysed using simple statistics i.e. SPSS. The data was interpreted using logical generalizations, explanations and descriptions. The key findings reveal that the Africa Inland Mission (AIM) and World Gospel Mission (WGM) pioneered the education of girls in the two Counties. Secondly, the Colonial government and African initiatives through Kipsigis Local Native Council (KLNC) and Kipsigis District Education Board (KDEB) also played a key role in the establishment of Kipsigis Girls School, the first African school for girls in the two Counties. The study revealed that the school has transformed the lives of girls and women in the community and in Kenya at large immensely. In conclusion, the study recommended that the Government through the Ministry of Education should emphasize the provision of a holistic education that focuses on developing the character, leadership skills and the
personality of students, which the school has always focused on. It also recommended the importance of BoM's, parents and communities in supporting the educational facilities, since these were instrumental in the schools’ development and expansion.

**PARENTAL PERCEPTIONS, OUTCOMES AND LEGAL STATUS OF CHILD SEXUAL ABUSE DURING EARLY CHILDHOOD EDUCATION IN NAIROBI CITY COUNTY, KENYA**

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Child sexual abuse (CSA) is any sexual act between an adult and a minor or between two minors where one exerts power over the other. Research shows that sexual abuse has potential to cause short and long term harm. Owing to their developmental level, most children abused during their early years are unable to articulate their fears and consequently develop a consternation of negative outcomes associated with CSA. The objectives of this study were: to establish the prevalence of CSA in children aged 5-8 years in Nairobi City County; to explore the influence of different forms of child sexual abuse on children in Early Childhood Education ages 5-8 in Nairobi City County; to explore parental perceptions of effects of child sexual abuse in early childhood Education ages 5-8 in Nairobi City County; to analyse how psychological disorders associated with sexual abuse affect children in Early Childhood Education ages 5-8 in Nairobi City County; to investigate legal status of CSA in early childhood education. This study used a descriptive survey design and the sampling technique was purposive. It was based in Nairobi City County. The target population comprised of sexually abused children, their parents/guardians and policy makers. The independent variable for this study was CSA, while the dependent variable entailed parental perceptions, outcomes and legal status of CSA in early childhood education. The total sample size was ninety five (95) respondents who included forty five (45) children who had experienced CSA and forty five (45) of their parents/guardians and five (5) policy makers/key informants. The research instruments were piloted on a randomly selected sample of five (5) sexually abused children aged 5-8 years, their parents/guardians and one key informant at Child line Kenya. Cross validity was determined through peer feedback and content validity through expert opinion. Reliability was established through pilot testing of the instruments to ensure clarity and adequacy of items. The study instruments included Trauma Symptom Checklist for Young Children (TSCYC) and interview schedules for children and parents/guardians. The study yielded qualitative data which was analysed thematically guided by study objectives. Further, descriptive statistics were generated using percentages, frequencies and means. Results were presented in tables, figures and texts. Key findings included prevalence of sexual abuse among children aged 5-8 years in Nairobi City County, which was at 78% for girls and 22% for boys. Parents perceived CSA as having affected children through loss of precious learning time. Moreover, outcomes such as psychological disorders affected children through symptoms of anxiety, depression and Post Traumatic Stress Disorder (PTSD). The legal status of sexual abuse in early childhood education entailed various legislations and policies. The study recommended protection and strengthening of the family unit, training of stakeholders on CSA prevention. Inclusion of age appropriate life skills in school curriculums and teacher training programs on signs of CSA, assessment, reporting procedures, withdrawal of the bail option for those accused of CSA, introduction of stringent measures and operationalization of relevant legislations. This was therefore a significant study as it yielded recommendations for both policy and practice.
CONTRIBUTION OF THE GERMAN NEUKIRCHEN MISSION IN THE ESTABLISHMENT OF WESTERN EDUCATION IN TANA RIVER COUNTY, KENYA 1885 - 1986

Gitonga Peter Kimani-PhD

Department: Educational Foundations

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The study examined the contribution of the German Neukirchen Mission (GNM) in the establishment of Western education in Tana River County, Kenya 1885 to 1986. Western education and Christianity in Africa were introduced by Christian missionaries from Europe as early as the 16th century but took root in around the mid-nineteenth century. Later on, Colonial Governments further augmented the missionaries’ endeavours of offering formal education to Africans. A lot has been researched and written on missionary activities at the Coast, Central and Western regions of Kenya. Tana River County embraced Christianity and Western education through the works of the Methodist Missionary Society (MMS) and German Neukirchen Mission (GNM). The MMS and a few other missionary organizations like Holy Ghost Fathers (HGF) experienced hardships and shifted to the interior of Kenya where they registered great success. The GNM hung on and was doing well until World War I broke out and later World War II. These wars resulted in the repatriation of GNM missionaries who kept on struggling to come back and have maintained contacts to date. The reasons behind the success and resilience of the GNM in an area in which other mission groups failed deserve to be unveiled. Whereas extensive studies on the activities of other missionary groups like the Church Missionary Society (CMS), African Inland Mission (AIM), Holy Ghost Fathers (HGF), Universities Mission to Central Africa (UMCA) and Church of Scotland Mission (CSM) among others have been carried out, not much has been done on the GNM. The study had three objectives which were: To trace the origin and the ideology of the GNM; to examine the role of the GNM in the establishment and growth of Western education in Tana River County and to assess the impact of the establishment of Western education in Tana River County. The time frame was 1885 to 1986. This period covers the time Africa was partitioned and shared out among European powers – which influenced missionary work - to the year the first secondary school was established at Ngao i.e 1986. Ngao served as GNM’s mission base or station since the arrival of the missionaries in the region. The study was historical in nature and utilized a historical research design. Sources of data were both primary and secondary sources. Primary sources were mainly drawn from the Kenya National Archives (KNA) and schools and churches in Tana River. At the KNA for instance, vital primary information on GNM activities in Tana River and on educational commissions and reports that informed educational policy in Kenya in the study period were obtained. Document analysis was also utilized as a data collection method. The research instruments were interview schedules and Focus Group Discussions (FGDs). Respondents to these research instruments were retired educationists, civil servants and politicians, church leaders and village elders selected through purposive and snowball sampling techniques. Collected data was analyzed through qualitative and quantitative methods while documents were analyzed through external and internal criticism. The research findings acknowledged the contribution of the GNM in the advent of Western education in Kenya in general and in Tana River in particular and the impact of this education on the community, learning institutions and individuals ever since the missionaries’ arrival to present day and in future. This was achieved through identifying schools that were established by the GNM and still exist; the curriculum that was offered; the students who were products of these schools and how the latter impacted upon the Tana River community then and now. Recommendations were made on policy, infrastructure, archival materials and the possibility of reviving the GNM-Tana River relations. For instance, it was suggested that a tertiary level Educational Complex or Institution could be established in Tana River to propagate the educational initiatives of the GNM missionaries and educationists as well as meet the growing need of such an education in the region. Finally, areas related to the study topic that need further research were suggested.
INTEGRATION OF INFORMATION AND COMMUNICATION TECHNOLOGIES INTO INSTRUCTION IN THE NEPAD e-SCHOOLS, KENYA

Mogeni, Jackson Mobisa-PHD

Department: Educational Communication & Technology

Supervisors: Prof. Samson R. Ondigi
Dr. Bernard C. Mugo

Societies world over look upon the 21st Century education sector to produce learners who are ready for the present technological demands of the workplace. Integration of Information and Communication Technologies (ICTs) in education is seen as one of the best ways of preparing learners for the workplace. However, the education sector seems to lag other sectors in the uptake of ICTs. The NEPAD e-Schools initiative in Kenya is a Pan-African venture aimed to make learners and teachers ICT-literate, enable them access online information in their subjects, and benefit from e-learning and use ICTs in instruction. The focus of this study was to determine the extent of integration of ICTs into instruction in the NEPAD e-Schools in Kenya. Specifically, the objectives of the study were to: establish teachers’ readiness to integrate ICTs in instruction in the NEPAD e-Schools in Kenya; determine the extent to which ICTs are integrated in teaching and learning in the NEPAD e-Schools; establish the levels to which the NEPAD e-Schools are preparing teachers and learners for the digital world; determine teachers’ and students’ attitudes towards the use of ICTs; and, establish the challenges that teachers and learners encounter in integration of ICTs in instruction. The study was guided by three theories: Diffusion of Innovations by Rogers (2003); Unified Theory of Acceptance and Use of Technology by Venkatesh et al. (2003); and Technological, Pedagogical and Content Knowledge by Mishra & Koehler (2008). It adopted a descriptive survey design and targeted 6 e-Schools of which 5 were selected using stratified sampling. Principals and teachers who participated in the study were purposively sampled while students were randomly sampled. Both quantitative and qualitative data were collected using questionnaire, observation, and checklist. The instruments’ reliability was tested through piloting in one e-School. The questionnaires were re-tested and accepted at r=.70. Data were run for descriptive analysis: frequencies, percentages, measures of central tendency and measures of variability. The study revealed that teachers are insufficiently trained but willing to integrate ICTs. ICTs were inadequate and, sometimes, inaccessible. Schools lacked internet connectivity and consistent electricity supply. The frequency of ICTs usage by teachers was at least once a month, while the time students normally spent using ICTs was below 5 hours weekly; inadequately preparing them for the digital world. Most students demonstrated average practical skill levels in ICTs. Teachers’ and students’ attitude towards ICTs was positive. The challenges facing, teachers and learners included provision and maintenance of adequate, reliable, current and secure ICTs; limited internet; unreliable electricity supply; congested and inaccessible computer labs; and computer viruses. The study recommends, among others, that ICTs integration skills be made part of teacher pre-service curriculum, and in-service ICTs training be regular, extensive, and qualitative. The government should also provide schools with or assist them get more, quality, affordable, serviceable and sustainable ICTs as well as free or affordable, fully established and reliable internet. It should also lower tariffs and taxes on ICTs and internet to enhance access and/or use of ICTs in schools.

STUDENTS’ PERCEPTIONS OF TEACHER SUPPORT AND MOTIVATION AS PREDICTORS OF ACADEMIC ENGAGEMENT AND ACHIEVEMENT IN SECONDARY SCHOOLS IN MACHAKOS COUNTY, KENYA

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Poor performance among secondary school students in national examinations has been a major concern to education stakeholders. Although local research has linked poor performance to student, teacher, home and school factors, the social context within which learning occurs has received little attention. The purpose of this study was to determine whether students’ perceptions of teacher support and academic motivation predicts academic engagement and achievement among secondary school students in Machakos County, Kenya. Specifically, the relationships among students’ perception of teacher support, academic motivation, academic engagement and achievement were determined. Prediction equations and gender differences were also established. Self-determination and Expectancy-value theories guided the study. The study adopted a predictive correlational research design. The target population was form three students in public secondary schools in Machakos County, 2019. Purposive, stratified and simple random sampling were used to select 10 public secondary schools and 600 students (300 boys; 300 girls) in Machakos County. Data was collected using self-report questionnaires. Form three students’ mean scores for mid-term 1 2019 examination were used as data for academic achievement. Piloting of the instruments was done among 40 students selected from one public secondary school in Machakos County that did not participate in the final study. Quantitative data was analyzed using Statistical Package for Social Sciences (SPSS) version 22.0. Descriptive statistics summarized the data while inferential statistics consisting of Pearson’s Product Moment Correlation Coefficient, multiple regression, t-test for independent samples and ANOVA tested the research hypotheses at p < .05 level of significance. From the findings, both students’ perceptions of teacher support and academic motivation had significant and positive relationships with academic engagement (r (578) = .47, p < .05; (r (578) = .61, p < .05); with academic achievement (r (578) = .49, p < .05; (r (578) = .73, p < .05), respectively. Academic motivation was a stronger predictor of academic engagement (β = .50, p < .05) compared to students’ perceptions of teacher support (β = .23, p < .05). The prediction equation of academic achievement from academic engagement was significant (F (3,576) = 93.38, p < .05). No significant sex differences were found in both students’ perceptions of teacher support and academic motivation. Exploratory analysis found that students’ academic engagement varied by school type, while academic achievement varied by school type, age and sex of participants. School administrators should encourage self-determination among students to foster intrinsic motivation in a supportive learning environment. In-service teacher training programs should focus on strategies for enhancing students’ autonomy, competence and relatedness to enhance their academic engagement and achievement.

DRUG AND SUBSTANCE ABUSE AND THEIR EFFECTS ON GIRLS’ ACADEMIC PERFORMANCE IN SECONDARY SCHOOLS IN NAKURU COUNTY, KENYA

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Secondary school education is an important stage in the educational cycle of a child because it is the foundation for further education, training and work. Despite the importance of this level of education, girls’ academic performance in Nakuru County has generally been low. The unsatisfactory performance could be due to drugs and substance abuse given that the county had been experiencing an increase in number of cases of drug and substance abuse in schools. This study investigated drugs, substance abuse, and their effects on academic performance of girls in secondary schools in Nakuru County, Kenya. The objectives of the study were to establish: factors contributing to drug and substance abuse, sources and types of drugs and substances, strategies used to curb the vice and effects of drug and substance abuse on academic performance. The study adopted the descriptive survey research design and involved girls’ schools only. The accessible population comprised of 5,188 Form Threes, 74 Deputy Principals, 74 Guidance and Counselling (G&C) teachers, and 74 Parents’ Association (P.A) Chairpersons. Stratified, proportionate and simple random sampling techniques were used to
Influence of Tutors’ Instructional Practices on Students’ Academic Achievement in Distance Education Programme in the University of Cape Coast, Ghana

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Dr. Purity Muthima

Distance education has become an important complement of providing access to quality tertiary education. It is used as a means to build capacity worldwide through the use of technologies, either print, electronic or combination of them. Despite its prominence, distance education delivery has problems that raise issues of quality. This study sought to: assess the extent to which tutors’ direct teaching practices influence students’ academic achievement; establish the extent to which tutors’ class climate management influence students’ academic achievement; assess tutors’ motivational teaching practices’ influence on students’ academic achievement and assess the usefulness of the modules and its influence on students’ academic achievement on the distance education programme of University of Cape Coast (UCC), Ghana. The study hinged on the constructivist theory and employed the embedded mixed-method design which is a strand of the quantitative and qualitative method that integrates into a single study. The study was conducted in 23 study centres of the College of Distance Education, UCC, Ghana. The target population for the study was 6,313 made up of 5,644 Diploma in Basic Education Students, 661 tutors, a Provost, 4 Heads of departments (HoOs) and 3 Regional coordinators. Proportionate stratified sampling and simple random sampling procedures were used to select Students and tutors. The Provost, 4 Heads of department, 3 Regional coordinators were selected by purposive sampling. A sample size of 373 students and 249 tutors were used for the study. A questionnaire was used to collect quantitative data from tutors and students while the interview schedule was used to gather qualitative data from the Provost, Heads of departments and Regional coordinators. Data were analysed using descriptive and inferential statistics. Results from Standard Multiple Regression Analysis revealed that tutors’ direct teaching practices (p=.000<0.05, R² = 47.5%), class climate management
Perceived model usefulness was also found as a significant predictor of students’ academic performance at \( p = .000 < 0.05, R^2 = 21.5\% \). The implication is that means all these factors can predict improvement in students’ academic achievement. Therefore, the study concluded that tutors’ instructional practices significantly influenced students’ academic achievement at the University of Cape Coast, Ghana. The study further revealed instructional challenges such as delays in module supply, poor students preparation before interaction; students’ misbehavior during instruction; lack of resources affecting tuition; and difficulty of making changes to facts and limited policy information. The study recommends that the Training and Development Section of the university should train tutors on instructional practices to sustain delivery skills to improve students’ academic performance.

**PEACE EDUCATION AND ITS CONTRIBUTION TO PEACEFUL COEXISTENCE AMONG STUDENTS IN PUBLIC SECONDARY SCHOOLS IN NAIROBI CITY COUNTY, KENYA**

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Dr. Violet Wawire

There has been an upsurge of school violence (SV) in public secondary schools in Kenya despite numerous efforts to find a sustainable solution. This study therefore investigated the contribution of peace education (PE) towards promoting peaceful coexistence among students in public secondary schools in Nairobi, Kenya. The objectives of the study were as follows: 1) To establish the prevalence of SV in these schools; 2) To analyse the secondary school curriculum content so as to establish the existence of PE content; 3) To examine the teaching approaches used to promote peaceful coexistence; 4) To establish how the participation of students in co-curricular activities enhanced their skills for peaceful coexistence; and 5) To explore the PE strategies used to promote peaceful coexistence among students. The study was guided by the Social Contract Theory and the Transformative Learning Theory to not only gain an in-depth understanding of the underlying dynamics of SV but also provide insights into how PE influences peaceful coexistence. An explanatory sequential mixed methods design was used to first collect quantitative data, and then qualitative data to gain further in-depth interpretation of the results. Quantitative data analysis involved calculation of frequencies and cross tabulation of variables. Qualitative data were coded and thematic patterns and relationships identified to give meanings to the statistical patterns that emerged from the data. The study generated four major findings: First, prevalence of violence impedes the inculcation of peace values thereby resulting into lack of peaceful coexistence. Second, the secondary school curriculum and in particular Christian Religious Education CRE and History and Government contain PE content. Third, learner-centred teaching approaches promote values such as cohesion, mutual respect, tolerance, teamwork amongst students thereby creating a non-violent school community. Fourth, co-curricular activities play an important role in promoting peaceful coexistence amongst students by encouraging interactions, hence neutralising the risk of violence. The study, therefore, concluded that there was limited PE contribution towards promoting peaceful coexistence among students in public secondary schools in Nairobi County. The study recommended a review of the secondary school curriculum by the Kenya Institute of Curriculum Development (KICD) to include more PE content especially in compulsory subjects, and to ensure transformative teaching approaches are used to instil peace values that promote positive change of behaviour among learners. Further research should focus on in-depth content analysis of other school documents such as strategic plans, mottos, visions and missions so as to provide further understanding of the contribution of PE content towards promotion of peace.
TEACHERS’ PERCEPTION OF TRANSITION PREPAREDNESS BY LEARNERS WITH PHYSICAL DISABILITIES TOWARDS EMPLOYMENT: JOYTOWN, JOYLAND AND MOMBASA SPECIAL SECONDARY SCHOOLS, KENYA

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Dr. Margaret Muragami

The study examined factors influencing teachers’ perception on transition preparedness for learners with physical disabilities (PD) towards employment: Joytown, Joyland and Mombasa Special Secondary Schools for physically handicapped in Kenya. The study was carried out in Joytown Secondary School in Thika West, Kiambu County, and Mombasa Secondary in Mombasa County and Joyland Secondary School in Kisumu County. Descriptive survey research design was used to establish teachers’ competency, learners with PD views on pre-vocational activities, teachers’ opinion on policies and legislations implemented for persons with disabilities and challenges learners with PD encountered. The study adopted both quantitative and qualitative research designs where mixed method was employed in data collection and analysis. Purposive sampling was used to select the three physically handicapped Special Secondary Schools, which were the earliest to be established by missionaries in Kenya. The piloting of the instruments was conducted in Joytown special school to form three learners and all teachers teaching form one and form three who were not included in the main study. The researcher targeted 540 teachers, 30 administrators and 830 learners with physical disabilities in which 10 percent was drawn to give sample size of 54 teachers, 83 learners with physical disabilities and 3 administrators from the three selected schools. The administrators were interviewed while the teachers and learners filled the questionnaires. Self-efficacy theory is a concept derived from theories of social learning developed by Albert Bandura, which was used to interpret dynamics for teachers’ perception in relation to preparedness of learners. Quantitative data were analyzed using Statistical Package for Social Sciences (SPSS) and results presented using tables, frequencies, and percentages while Computer Assisted Qualitative Data Analysis System (CAQDAS) was used to analyze interview schedule, correlated of the results using Pearson Product Moment Correlation Coefficient formula (r) of 0.8 was considered appropriate judgment of the reliability of the research tools. The importance of this study, prompted the teachers in special schools to develop positive perception in learners transition preparedness towards employment, improved teaching strategies, the importance of learning resources and pre-vocational activities, and established solutions to the problems learners with PD encountered. The researcher recommended that Teacher Service Commission (TSC) advise Kenya Institute of Curriculum Development (KICD) to revise curricula for learners with special needs education. They include: lesson time allocation, mode of assessment and subject matter to include activities of transition, propagation of job evaluation and matching skills to actively ensure empowerment of learner’s abilities in planning for post-secondary goals achievement such as gainful employment which has a futuristic relevance, widens the scope of individual economic activities, and reduces the burden of dependency on others.

PROXIMAL PREDICTORS AND OUTCOME OF ACADEMIC BUOYANCY AMONG FORM THREE SECONDARY SCHOOL STUDENTS IN MIGORI COUNTY, KENYA

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Dr. Joyne Mugambi
Students from Migori County persistently perform poorly compared to those of the neighbouring Counties. Studies in Migori County have concentrated more on other factors affecting academic achievement and left out academic buoyancy. Yet reviewed literature indicates a link between academic buoyancy and academic achievement. The aim of this study was therefore to investigate if there was a relationship between proximal predictors and academic buoyancy, to establish the predictive role of proximal predictors on academic buoyancy and subsequently the prediction of academic achievement from academic buoyancy with sex as the moderator variable. The researcher employed resilience theory and used explanatory sequential mixed methods design to collect data from secondary students of form three. The study targeted all form three students in Migori County, Kenya. Participating schools and students were sampled using purposive, stratified, cluster and simple random sampling. A total of 469 participants were drawn from 21 secondary schools. Academic Buoyancy Scale and, Motivation and Engagement Scale (High school) were adapted and used to collect quantitative data. An in-depth interview comprising 10% of those students found buoyant from the analysis of quantitative data were used. Through document analysis of the student’s academic records, academic achievement was thus inferred. To establish the validity and reliability of the research tools, a pilot study was conducted. The pilot study sample comprised of 47 participants drawn from co-educational and single sex secondary schools. Qualitative data were thematically analyzed while quantitative data were analyzed using SPSS. The statistical tests used included Pearson’s r, simple and multiple regression, and independent samples t-test together with descriptive statistics. All hypotheses were tested at \( p < .05 \) level of significance. The results revealed strong positive and statistically significant correlation between academic buoyancy and self-efficacy \( (r (469) = .76, p < .05) \); a weak positive but statistically significant correlation between academic buoyancy and; self-control \( (r (469) = .18, p = .05) \); academic engagement \( (r (469) = .22, p < .05) \); and teacher-student relationship \( (r (469) = .19, p < .05) \). Additionally, a very weak non-significant positive correlation coefficient \( (r) \) was established between academic anxiety and academic buoyancy \( (r (469) = .04, p > .05) \). The independent samples t-test did not establish any significant gender differences among the study variables. Regression analysis revealed that self-efficacy, teacher-student relationship and self-control significantly predicted academic buoyancy and further, academic buoyancy significantly predicted academic achievement. In conclusion therefore, self-efficacy, teacher-student relationship and self-control have an effect on academic buoyancy, and subsequently, academic buoyancy affected student’s academic achievement. This study therefore recommends that intervention be directed towards enhancing students’ self-efficacy, self-control and teacher-student relationships which have a bearing on academic buoyancy and subsequently, academic achievement.

**INFLUENCE OF INSTRUCTIONAL STRATEGIES AND LEARNING ENVIRONMENT ON ACADEMIC ACHIEVEMENT OF STUDENTS WITH HEARING IMPAIRMENTS IN SELECTED PUBLIC UNIVERSITIES IN KENYA**

Peninnah Mbaluka Laki-PHD

Department: Early childhood & Special Needs

Supervisors: Dr. Nelly Otube

Dr. Daniel Muindi

The purpose of this research study was to investigate and analyse the influence of instructional strategies and learning environment used by lecturers on academic achievement of students with hearing impairments in selected public universities. The objectives of the study were: establish support services in the learning environment for students with hearing impairment, identify the teaching methods used by lecturers to teach students with hearing impairments, identify the resource materials used to instruction of students with hearing impairments, determine whether the lecturers who teach students with hearing impairments, have relevant skills and establish the influence of instructional strategies and learning environment on academic achievement of students with hearing impairments. The research adopted a descriptive survey design whereby both quantitative and qualitative approaches were used. A pilot study was conducted to establish the validity and reliability of the research instruments. Data was then collected from lecturers, Dean of
students’ affairs, chairpersons of Departments that offer university common units and students with hearing impairments. The universities were selected due to the fact that they admit students with Special Needs; hence, they have rich information on the theme of the study. Target population was composed of three Deans of Students’ Affairs, 15 chairpersons, 462 lecturers and 70 students with hearing impairments. On data analysis, the statistics were generated by means of statistical package of social sciences (SPSS) version 22.0, while qualitative data was analysed through narrative analysis and thematic approach. The findings revealed that lecturers who teach student with hearing impairments are not inducted on relevant teaching methods and 50.2% of them mainly modify seating position of students with Hearing Impairment. Selected public universities have no policy guidelines for students with HI. The study also revealed that lecturers are not specially trained to teach students with HI. Resource materials used were fair as reflected by 55.7% of students with HI. The selected public universities have inadequate resource materials for students with Hearing Impairments. Additionally, across the selected public universities medium of instruction was significantly different ($\chi^2 = 42.298, P = 0.0001$). Students’ respondents showed that the number of sign language interpreters were crucial but not enough for students with hearing impairments. Following these findings, the study recommended University Councils to avail bursaries for students with HI, and Higher Education Loans Board (HELB) to allocate more funds to students with hearing impairments pursuing higher education in public universities to enable them to purchase hearing aids which are expensive.

**EFFECT OF SCHOOL HEADS’ TRANSFORMATIONAL LEADERSHIP PRACTICES ON STUDENTS’ ACADEMIC ACHIEVEMENT IN PUBLIC SENIOR HIGH SCHOOLS IN KUMASI METROPOLITAN, GHANA**

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Dr. Hellen Kiende Guantai

Transformational leadership practices have the capacity to deal with the leadership ills confronting secondary education in Ghana. The study sought to determine the effect of school heads’ idealized influence, inspirational motivation, intellectual stimulation, and heads of schools’ individual consideration leadership practices on students’ academic achievement in public Senior High Schools (SHS) in Kumasi Metropolitan, Ghana. The study adopted the transformational leadership theory espoused by James McGregor Burns (1978) and supported by Bass (1985). The convergent parallel design, a mixed methods approach was engaged for this study. The target population was 17370, consisted of 19 heads of schools, 2122 teachers, and 15229 students. This study on the basis of Slovin’s sample calculation formula sampled 424 teachers and 552 students from the 19 schools selected. The study further employed Kothari’s proportional representation method to determine sample size for teachers and students for each school. The study used random sampling technique to sample students and teachers from the schools. Data were collected with questionnaire and interviews. Experts in Educational Management were requested to address the content validity of the data collection instruments for the study. Cronbach’s Alpha test indicated a value of 0.9, showing that the instruments were reliable. Descriptive and inferential statistics were used to analyze the quantitative data. In descriptive statistics, frequency, weighted average, standard deviation, and percentages were used. OLS regression analysis was employed to determine the effect of the independent variables on dependent variable. The study controlled for factors (sex of student, family structure of student, average age of teachers in a school, sex of teachers for a school, average educational attainment of teachers in a school, average teachers’ rank in a school, average number of years teachers have spent in a school) that could influence students’ academic achievement. Analyzed quantitative data were presented in tables. Qualitative data was analyzed thematically and analyzed data presented in narratives and in verbatim forms. The study used 5% significance level. The study found out that idealized influence, inspirational motivation, intellectual stimulation and individualized consideration had significant positive impact on students’ academic achievement. The leadership practice that had the highest regression value was inspirational
motivation, which was 1.0. The study recommends that school heads should adopt transformational leadership practices to ensure improvement in students’ academic achievement.

EFFECT OF TUITION FEES WAIVER ON EQUITY AND INTERNAL EFFICIENCY IN PUBLIC SECONDARY SCHOOLS IN BUNGOMA COUNTY, KENYA

Herman Joseph Wachiye-PHD

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Supervisors: Dr. Jackline K.A. Nyerere
Dr. Thaddaeus O.Rugar

Tuition fees waiver in education has the potential to promote equity and internal efficiency in public education at all levels in all Counties in Kenya. When the government of Kenya introduced tuition fees waiver in public secondary schools in 2008, the students’ enrolment generally improved. However, their progression and composition by their household socio-economic status in these schools in Bungoma County remained unknown. The problem of this study therefore was to answer this central question: what effect did the tuition fees waiver have on equity and internal efficiency in public secondary schools in Bungoma County for the period 2009 to 2014? The purpose of the study was to analyze the effect of the tuition fees waiver on equity and internal efficiency in public secondary schools in Bungoma County for the period 2009 to 2014. The specific objectives of this study were to: 1) determine the student composition by their household socio-economic status in public secondary schools in Bungoma County; 2) determine the effect of the tuition fees waiver on the crude cohort wastage rates in public secondary schools in Bungoma County for the period 2009 to 2014; 3) determine the effect of the tuition fees waiver on the student pass rates in KCSE in public secondary schools in Bungoma County for the period 2009 to 2014; 4) determine the effect of the tuition fees waiver on the average number of years per graduate in public secondary schools in Bungoma County for the period 2009 to 2014. The study applied the outcome evaluation theory and was guided by a descriptive survey research design. The population comprised of 115 public secondary schools and 40250 students from Bungoma County. The sample was constituted by applying simple random sampling, proportional sampling and purposive sampling techniques. The research tools comprised of a student questionnaire set and two document analysis guides. Data was analyzed both descriptively and inferentially by calculating the means, percentages, Gini coefficient and by applying the two related sample t-test respectively. The findings revealed that: 1.6% of the students were from the poor income households, 33.6% were from the low income households, 46.9% were from the middle income households, 15.5% were from the middle upper households and 2.4% were from the upper income households. The Gini coefficient for the student enrollment by the household incomes was 0.14, or a Gini index of 14%. With regard to the student wastage rates, the crude cohort wastage rates reduced significantly from a mean of 33.28% before the fees waiver to 15.02% after introduction of the waiver, with a p-value of less than 0.05(p<0.05). The student pass rates in KCSE increased significantly from a mean of 70.53% before the fees waiver, to a mean of 75.82% after the waiver, with a p-value of less than 0.05 (p<0.05). The average number of years per graduate reduced significantly from a mean of 5.73 years before the fees waiver, to a mean of 4.54 years after the waiver, with a p-value of less than 0.05(p<0.05). In conclusion, students from the middle and upper income socio-economic households are the most enrolled in the public secondary schools in Bungoma County. In addition, the waiver had a significant positive effect on the crude cohort wastage rate, student pass rates in KCSE, and the average number of years per graduate in public secondary schools. On the basis of these conclusions, the study recommends that the Government of Kenya should uphold the tuition fees waiver, but adopt the targeted allocation policy when allocating the fees waiver, besides scaling up the level of funding toward public secondary education.
EFFECT OF ANIMATIONS IN E-LEARNING MATERIALS ON STUDENTS’ PERFORMANCE IN PHYSICS AMONG SELECTED SECONDARY SCHOOLS IN NAIROBI CITY COUNTY, KENYA.

Wambua Joseph Muteti-PHD

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This study focused on the effect of the animations embedded in e-learning materials produced at the Kenya Institute of Curriculum Development. The first objective of this study was to determine the influence of instructional values inculcated by animations embedded in Interactive Digital Content (IDC) on performance of learners in Physics. The second objective was to determine the effect of animations on the concentration span of learners while learning Physics and the last one was to develop a process model for development of quality animations in Physics education. The third one sought to find out if animations enhance conceptual understanding of text within the interactive Physics digital content. Lastly, this study sought to develop an instructional model. It was guided by the Paivio’s dual —coding theory of learning and was done in Nairobi County. Four public secondary schools were purposively sampled out of sixty public secondary schools in the County. One hundred and four students from the sampled schools were involved in the study. Quasi—experimental research design was used. The instruments used in collecting data were piloted in two schools. After piloting, the instruments were validated and made more reliable. During the study, a pre-test was administered to the learners selected to participate in the control and experimental groups and their performance was determined and their scores were recorded. Treatment was given to the two schools in the experimental group where they were given IDC with animations. The control schools were given content without animations. Both groups were given a post — test after interacting with the provided IDC to determine their performance on the topics tested during pre-test. Data was analysed using descriptive statistics and inferential statistics. The scores were recorded for both groups and the data collected was analysed to determine whether there was a significant difference in the performance of the learners in the two study groups. The findings from the study showed that performance of the learners who used the IDC with animations improved significantly. After comparing the means of the learners in the two study groups, during pre-test, the mean posted by learners in the control group was 11.35 while learners the experimental group posted a mean of 15.40. The difference between the means of the two groups in pre-test was calculated using T-test which gave t (90.48) = -1.60, p = 0.64. This shows that the difference between their means was not significant and therefore the groups dealt with were of equivalent ability. During post-test, learners in the control group posted a mean of 12.88 while their counterparts in the experimental group had a mean of 25.27. The significance of the difference between the two means was calculated using T-test which gave t (102) = -3.45, p = 0.001. This shows that there was a significant difference between the means posted by the subjects in the two study groups during the post-test. The results from the data collected from the teachers’ questionnaire, learners’ questionnaire and the observation schedule show that learner’s conceptual understanding of Physics content was enhanced when they used animations and similarly, use of IDC provided stimulus variation more hence extending the learners’ concentration span. It is therefore recommended that the Ministry of Education should review the policy on instructional materials to include Physics IDC with animations and emphasize that Physics educators should use such content.

SENIOR HIGH SCHOOLS PREPAREDNESS FOR INTEGRATION OF COMPUTER BASED INSTRUCTION IN TEACHING AND LEARNING OF SOCIAL STUDIES IN NORTHERN REGION, GHANA

Iddrisu Bariham-PHD

Department: Educational Communication and Technology
Computer Based Instruction (CBI) is an instructional innovation which helps to improve on the quality of instruction. CBI support learners develop critical thinking, creativity and collaboration skills needed to function effectively in this 21st Century. The Government of Ghana rolled out the ICT in Education Policy (2015) to transform the education. But current literature does not show the extent to which schools, teachers and students were prepared for the application of CBI in the instructional processes. The study, therefore, explored schools’ preparedness for the integration of CBI in Social Studies instruction among secondary schools in the Northern Region, Ghana. The research aimed to establish school administrators, teachers, and students’ perceptions towards the use of CBI in teaching and learning of Social Studies; assess schools, teachers, and students’ level of preparedness for the integration of CBI in Social Studies instruction; investigate the extent to which CBIs are integrated into Social Studies instruction; establish the relationship between the demographic characteristics of Social Studies teachers and their integration of CBI in Social Studies instruction; explore challenges teachers and students faced when employing CBIs in Social Studies instruction; and suggest strategies to deal with the challenges. The study was anchored on the Theory of Planned Behaviour (Ajzen & Holmes, 1976), and the Diffusion of Innovation Theory (Rogers, 1995), and adopted the convergent mixed research methods design. The target population was 7,906 participants from which 972 students, 84 teachers were randomly sampled to complete questionnaires, and 12 heads of school and a Director for ICT were purposively sampled for the interviews. Questionnaires were employed to collect data from teachers and students. Heads of schools and Director for ICT were interviewed. Qualitative data from the interviews were validated using member check and analyzed thematically and supported with anecdotal. A checklist was used to collect data on schools’ digital infrastructure. Using Cronbach’s alpha formula, questionnaires were pre-tested to ensure reliability. Questionnaire for the teachers were accepted at $r=0.89$ and that of the students at $r=0.73$. Descriptive statistics (percentages, mean and standard deviation) were used to analyze the findings from demographic information of the respondents, teachers and students’ perceptions of CBIs integration, preparedness for CBI integration, and the extent of integration of CBI in Social Studies instruction. Inferential statistics (correlation, multiple regression and t-test) were used to test the null hypothesis to determine if there was a significant relationship between teachers’ variables and their use of CBIs in Social Studies instruction. The hypotheses were at $\alpha = 0.01$ and 0.05. The qualitative data were recorded in audio files (MP3), categorized, transcribed and imported to qualitative data analysis software (MAXQDA) for final analysis and reporting. Data presentation was made using percentages, charts, graphs, and frequencies. The findings discovered that there was no significant relationship between teachers’ variables and their CBI integration in Social Studies instruction. Head teachers, teachers and students although had positive perceptions towards CBI (total mean perception scores: teachers $M=3.8$, $SD=0.8458$, students Mean=$3.4$, $SD=1.3794$), they hardly incorporated CBI in Social Studies instructions (total CBI integration scores: teachers $M=2.2$, $SD=1.217$ and students $M=1.2$, $SD=0.9771$), due to lack of internet and computers, poor ICT skills, limited budgetary support, inadequate digital infrastructure, and lack of school-based ICT policies. From the findings, the study recommends in-service training, and provision of budgetary support, supply of digital infrastructure and hiring of ICT experts to provide support to the teachers and students for effective utilization of CBI in teaching and learning in order to improve students’ learning outcomes.

INSTRUCTION AND ASSESSMENT ACCOMMODATIONS AS PREDICTORS OF ACADEMIC ACHIEVEMENT OF LEARNERS WITH PHYSICAL DISABILITIES IN SOUTHERN PROVINCE AND KIGALI CITY, RWANDA.

Mutezigaju Flora-PHD

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Dr. Beatrice Bunyasi Awori
The purpose of this study was to determine the degree to which instruction and assessment accommodations predict academic achievement of learners with Physical Disabilities in inclusive primary schools in Southern Province and Kigali City, Rwanda. Specifically, the study sought to establish the academic achievement of learners with Physical Disabilities in inclusive primary schools, establish the relationship between adapted curricula, adapted instructional materials/facilities, instructional methods, assessment accommodations and academic achievement of learners with Physical Disabilities. Anchored by the Social Model of disability theory, the study adopted a correlational research design. The target population involved 36 headteachers, 437 primary school teachers, 109 learners with Physical Disabilities and 2 National heads of departments at Rwanda Education Board. A sample of 11 head teachers, 66 teachers, 55 learners with PD and 2 National heads of departments at Rwanda Education Board was used. Purposive sampling technique was used to select schools, headteachers, learners with PD and National Heads of departments. Stratified sampling technique was used to select teachers. Questionnaires were used for teachers and headteachers, Focus Group Discussions for learners with PD, Interview Guide for National Heads of departments, Lesson Observation Schedule, and Document Analysis Guide. Expert judgment and Split Half technique were used to test instruments’ validity and reliability respectively. Descriptive statistics were used to describe instruction and assessment accommodations and Pearson’s Product Moment Correlation Co-efficient was used to establish the relationship between variables. ANOVA was used to establish the difference in the academic achievement of learners with PD based on the type of schools. Finally, Multiple Regression analysis was used to measure the quality of the prediction of academic achievement of learners with Physical Disabilities. Qualitative data were analyzed using a thematic approach and verbatim reporting. Results revealed that there was strong evidence of poor academic achievement of learners with PD in Primary Leaving National Examinations. Results further revealed that there was a significant difference in the academic achievement of learners with PD based on the type of the schools they attended (F (92.63) =11.84, p = .001). The study found that all instruction accommodations were good predictors of academic achievement of learners with PD (Use of adapted curriculum, (r (64) =.475, p = .001), availability and use of adapted instructional materials/facilities, (r (64) =.843, p =.001), use of recommended instructional methods (r (64) =.589, p = .001)). The study further established that all assessment accommodations were powerful predictors of academic achievement of learners with PD (provision of extra time (r (64) =.707, p =.001), provision of rest break, (r (64) =.246, p =.047), provision of special venue (r (64) =.481, p =.001), and provision of scribes (r (64) =.731, p =.001). The study recommended an increase in the budget for the provision of adapted instructional materials. Teachers should be trained on curriculum adaptations and teaching methodologies. Setting and marking of examination should be re-evaluated by Rwanda Education Board.
This study was necessitated by the fact that some parents in the ACK Diocese of Murang’a south have challenges with some of their children because they engage in drugs and substance abuse, irresponsible sexual behaviour, and instead of working to develop society, some have destroyed even what had been invested by their parents. The church has a responsibility of assisting parents in their parenthood. Part of the mission of SPU is to develop servant leaders who will serve the church holistically. However, some clergy have challenges in assisting parents to parent their children, resulting in maladjustments among family members. The study was based on the following objectives: to establish whether the SPU prepares the clergy to teach biblical parenthood programs; to examine whether the Anglican clergy teach parents biblical parenthood programs; to examine whether the Anglican parents apply biblical parenthood programs on parenting; to find out whether Anglican parenthood programs are effective in helping the Anglican children to be responsible, and; to establish the Agikuyu parental cultural practices that could strengthen parenthood among Anglican Christians. The study reviewed literature concerning training of the clergy; the role of the clergy in parenting; parenthood responsibilities; Anglican Church parenthood programs; and Agikuyu parenthood cultural practices. The study was informed by the attachment theory, the psychosexual theory, and the psychosocial theory. The sampling techniques used were the Purposive, Snowball and the Stratified random. The total population for the study was 19057. The target population was 1996 and the total sampled was 255. The researcher interviewed 218 respondents. In percentages, the target population was 10.5% of the total population, the total sampled was 13% of the target population, and the total respondents were 85.5% of total sampled. The study used descriptive survey design. Descriptive data analysis was done whereby quantitative data was categorized and coded in the statistical package for social science (SPSS) to generate frequencies and percentages. The study established that St Paul’s University (SPU) teaches units like pastoral counselling and chaplaincy, but does not have a chronological and integrated unit on parenthood. In addition, the clergy occasionally, teach parents biblical parenthood programs. However, this was found to be wanting because some parents who have gone through these programs still have challenges as seen in the irresponsible behavior of some of their children.

PARTICIPATION OF WOMEN PARLIAMENTARIANS IN KENYA’S LEGISLATIVE PROCESS 1963-2017

Lucy N. Kihia-Mathenge-PHD

Since independence up to the 11th Parliament (1963 to 2017) in Kenya, the increase in the number of women in Parliament has been slow. The highest ever attained number was 86 in the 11th parliament (2013-2017) save for affirmative action. Though the number of women MPs in Kenya has been low (160) since independence to the 11th Parliament, compared to male MPs (1,832), there has been an average achievement in delivering the gender agenda in the
The gradual increase in numbers of women MPs since independence has not translated into a significant increase in delivery of the gender agenda (UN Women 2017). The objectives of this study are: establishing bills tabled by women MPs since independence to 11th Parliament that could benefit the welfare of women in Kenya, evaluating achievements by women parliamentarians since independence to 11th parliament in delivering bills which translate into laws, examining the challenges encountered by women MPs in executing their legislative roles during the study period, and determining the best strategies and support that can enhance performance of women legislatures in delivering bills and laws that benefit women in Kenya, to bridge any knowledge gap identified in the study. The study applied the Theory of Change as expounded by Avril Blamey and Mhairi Mackenzie (Vogel, 2012), to explore new possibilities and environment for political change in order to deliver the gender agenda. Descriptive survey and interview schedules were used. The target population was 160 women MPs, elected or nominated, in Parliament during the study period. Due to the small target population, a sample size of 46 respondents were sampled by stratified random sampling and purposive sampling for the study. The sampling criteria was 10 percent sample in each strata (Mugenda, 2003). Women who had served for more than one term or held key positions in Parliament during the study period were purposively sampled for in-depth information including opinion leader in Parliament, leaders of women organizations and academia. Face to face interviews with the respondents were done. Quantitative data was analyzed using descriptive statistics that entailed mean scores and standard deviations. Quantitative data was presented in frequency distribution tables, pie charts, and bar graphs to summarize and organize it so as to explain relationships among categories. Qualitative data was categorized into common themes, presented in narrative and verbatim forms. Women did not contribute equally in Parliament with respect to moving bills that had impact on women’s welfare in Kenya. This was mainly attributed to lack of experience in the legislative process and parliamentary procedures which could be addressed through capacity building and support networks. In conclusion, the performance of women in parliament since independence up to 11th parliament had an average mean score of below 3.0 (mean<3.0). The study recommended that the State, political Parties, Civil Society Organizations and other stakeholders should support capacity development for women in Parliament, for a transformative institutional change.

AFRICAN INDIGENOUS PENTECOSTAL CHRISTIANITY IN UGANDA WITH REFERENCE TO THE DELIVERANCE CHURCH IN BUSOGA (1974 – 2012)

Moses Stephen Isabirye-PHD

Department: Philosophy and Religious

Supervisors: Prof. Philomena N. Mwaura

Dr. Zacharia W. Samita

This study examines the phenomenon of African Indigenous Pentecostal Christianity (AIPC) in Uganda, using the Deliverance Church (DC) in Busoga as a case. The study aimed at investigating the history, factors and trends that birthed the DC in Uganda in general and Busoga in particular, as a breakaway of mainstream Christianity. It interrogated the theology and practice of the DC and evaluated the DC contributions to spiritual, social and economic developments of Busoga. The study used a cross-sectional survey nonexperimental design employing both quantitative and qualitative methods. The data collection methods were questionnaire survey, interview guide, focused group discussions (FGDs), participant observation (PO) and content analysis of sermons and other teachings. The study findings indicate that the DC originated from the COU. The founders started with a quest for an African authentic Church of Christians, Christ-delivered to embody and carry his deliverance by the Spirit of God’s kingdom to the outside world. This marked the origin of the name ‘Deliverance Church’. The first DC leaders having experienced deliverance focused on every member being a Spirit-filled minister, doing mission and evangelism of witnessing for Jesus in the world. The study unveils why these African Pentecostal leaders left mainstream churches, and how the DC and COU developed a relationship of dialogic contextualization, where the DC continued building on the COU Christian foundations, while consolidating the mission...
character of their church. Evidence of this continuing dialogic contextualization reflects in DC beliefs, practices and projects directly bequeathed from those of the COU. This climax saw a leading founder Dr. Stephen Mungoma, accompanied by other members, cross from the DC back to equal positions of responsibility and accountability in COU. The thesis argues that the DC’s Pentecostal success in mission theology and practice stems from its adoption of the old ‘selfs’ for Anglican mission, to build a church that is self-governing, self-supporting, and self-propagating. There is more evidence of the DC using COU ministry patterns such as doctrine, wedding liturgy, funeral rite, e-vangelicalism, leadership and faith and order - to boost the Pentecostal mission vision, pastoral care and counselling and ministry. Regarding ministerial training, theological education originally viewed with suspicion by the DC leaders in the 1970s; calling it ‘spiritual cemetery adding no spiritual value to the person concerned, was later embraced. By the time of this study, some were attending theological / Bible colleges. DC started pursuing socio-economic development goals; a decade after COU had launched it in Busoga. The study concludes that AIPC of the DC in Busoga, has live roots in mainstream Christianity, which issue into origin, growth and bearing fruit in Pentecostal mission and ministry. The originality of the study lies in a comprehensive inquiry into that origin, growth and bearing fruit of the DC in Busoga; it traces its roots to the theology, tradition and doctrine of the mainstream Christianity, re-interpreted for Pentecostal mission strategic needs. From this root grows the shoot of AIPC in Uganda, the DC in Busoga an important product of it.

VOCABULARY LEARNING STRATEGIES EMPLOYED BY KENYAN LEARNERS OF CHINESE AS A FOREIGN LANGUAGE IN KENYAN UNIVERSITIES

Susan Wanjiru Wachira-PHD

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Supervisors: Dr. Joyce Wangia

Dr. Purity Nthiga

Dr. Milcah Chockah

This study is a description and analysis of vocabulary learning strategies employed by Kenyan learners of Chinese as a foreign language. Vocabulary learning strategies are contextualized within the larger area of language learning strategies which are accounted for within the cognitive theory of learning that the study was based on. The objectives of the study were: to describe the type of vocabulary learning strategies employed by Kenyan CFL learners; to describe the frequency of VLS use by Kenyan CFL learners; to establish the relationship between duration of Chinese language study, sex, previous language learning experience, field of study, level of CFL learning and VLS; and to investigate how VLS relate to performance in the speaking skill of Kenyan CFL learners. Purposive sampling was used to select two Confucius Institutes from Kenyatta and Egerton universities while stratified sampling was applied in selecting respondents at different levels of learning, namely beginner and intermediate levels. Data once collected using the vocabulary learning strategies questionnaire by Schmitt (1997) and HSKK oral tests was coded and entered into SPSS templates for cleaning and analysis and presented in tables and figures. Descriptive statistics (means and standard deviations), test of independence (Chi-square) and analysis of variance (ANOVA) were used for data analysis. The study mainly found out that Kenyan CFL learners were medium strategy users. It also revealed that cognitive strategies were the most commonly used followed by memory and metacognitive strategies. In addition, it was established that there is a significant relationship between sex, level of learning, field of study and VLS use. Learners also used other strategies that mainly involved the use of technology which were not in the questionnaire. Learners whose field of study was Chinese performed better in speaking skill than Science and Art majors. The study recommends that learners be made aware of strategies during Chinese language lessons so that they can fully utilize them. Furthermore, there should be more emphasis on strategies that involve the use of technology due to the nature of the language. The research findings provide useful insight for the development of curriculum for teaching Chinese in Kenya.
EFFECTIVENESS OF COUNSELLING SERVICES ON ACADEMIC PERFORMANCE AND RETENTION RATE OF UNDERGRADUATE STUDENTS IN SELECTED UNIVERSITIES IN KENYA

Jane Gathoni Nyutu-PHD

Department: Psychology

Supervisors: Dr. Merecia Ann Sirera
Dr. Wilfridah Olaly

Counselling is an essential pillar in student support services. However, there is a shortage of empirical data on the effectiveness of counselling services in enhancing academic performance and retention rate in all universities in Kenya. The study focused on establishing the effectiveness of counselling services in improving academic performance and retention rate of undergraduate students in universities in Kenya by employing the common factor and self-determination theories. The study used a quasi-experimental design and phenomenological design. The target population was 514 first-year undergraduate students taking bachelors of medicine and surgery programme and 6 counsellors in two public universities in Kenya. The accessible sample population was 140 students. Purposive sampling was used to select the two public universities for the study. Simple Random sampling was used to obtain a sample size of 104 students. All the 6 counsellors were incorporated in the study as respondents. Data was collected using observation, questionnaires, and focus group discussions. The independent variable in this study was counselling services, while the dependent variables were academic performance and retention rate. Validity was ensured by comparing the first semester results with results of the second semester to counter the testing threat. The reliability of the instruments ranged from Alpha indexes 0.76 to 0.91. The researcher trained four research assistants who helped in administering the research instruments to the participants. Quantitative data was analysed using descriptive statistics, namely frequencies, percentages and inferential statistics (2-way ANOVA) with the aid of Statistical Package for Social Sciences (SPSS-20). Hypotheses were tested at a 0.05 level of significance. The qualitative data was analysed thematically according to the objectives of the study. The study found that the status of counselling services in the two selected universities was favourable with adequate counselling rooms, adequate basic facilities, appropriate location and accessibility to counselling services. There were statistically significant differences between the experimental group and control group means as determined by a two-way ANOVA (F (1.99) = 4.470, p = .037), revealing that counselling services significantly influences students’ retention rate. Counselling equipped students with knowledge and skills that helped them deal with developmental issues that often interfered with their studies hence higher retention rate. On academic performance, the study revealed that students who seek counselling services perform academically better than those who do not as determined by a two-way ANOVA (F (1.96) = 4.441, p = .038). Counselling facilitated the acquisition of problem-solving and study skills, including time management that enabled the students to do well in their studies. Despite the availability of counselling services, not many students benefit from the service due to challenges such as high student enrolment against thin counselling staff and negative attitude towards seeking counselling help due to peer influence. Based on the findings, the study recommends that psycho-education be integrated as a mainstream programme in counselling services; more students should be enrolled in the psycho-education programme.

EFFECTIVENESS OF BRIEF MOTIVATIONAL INTERVIEWING INTERVENTION FOR TREATING GAMBLING DISORDER AMONG UNIVERSITY STUDENTS IN KENYA: A RANDOMIZED CONTROLLED TRIAL

Maroma Fabio Ogachi-PHD

Department: Psychology

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With the high uptake of gambling in Kenya, especially among University students, it is inevitable that some of them may end up suffering from gambling disorder. Apart from compromised psychological health, disordered gamblers experience difficulties in their financial and social wellbeing. Currently, there is lack of evidence based interventions for gambling disorder that have been developed and empirically tested in Kenya. This research sought to establish the efficacy of Brief Motivational Interviewing Intervention (BMII) for treating gambling disorder among university students in Kenya. The intervention was guided by Motivational Interviewing principles and was delivered in psycho - educational group format. The study had four specific objectives; to find out the prevalence of gambling disorder among gamblers; to determine the efficacy of BMII in decreasing gambling disorder symptoms; to determine the efficacy of BMII in decreasing frequency of gambling and; to determine the efficacy of BMII in decreasing typical amount of money placed per bet. The research design used was a parallel group, two arm, superiority randomized control trial. The treatment group received the intervention; BMII. The control group did not. The study targeted university students who gamble. Multistage sampling approach was used. Simple random sampling was used to select the university. Purposive sampling was used to select the study participants. Randomization was then used to assign the participants to the treatment and control groups. A total of 228 students participated in the study. The findings of the study revealed that a majority (69.3%) of participants were disordered gamblers while 68.9% gambled more than twice a week and 56.6% of the participants typically placed between 51 - 100 Kenya shillings per bet. One way ANOVA was calculated to determine the differences between control and treatment groups at pre - test and post - test. Paired samples t - tests were calculated to test the hypotheses. The results revealed that there were significant differences in symptoms of gambling disorder between treatment and control group at post - test at p<.05, (F (1,193) = 24.637, p=.000) and that BMII was efficacious in decreasing gambling disorder symptoms at p<.05 (MD =-1.733, t (100) = -7.087, p<.000). On frequency of gambling, the results revealed that there were significant differences between control group and treatment group at post-test at p<.05 {F (1,192) = 48.005, p=.000} and that BMII was efficacious in decreasing frequency of gambling at p<.05, (MD= -.683, t (100) = -6.072, p=.000). There were also significant differences in terms of typical amount of money placed per bet between control group and treatment group at post - test at p<0.05, {F (1,192) = 8.274, p=.004}. BMII was found to be efficacious in decreasing typical amount placed per bet at p<.05 (MD= -.455; t (100) = -3.294, p=.001). BMII was established to be efficacious in treatment of gambling disorder among university students. It is recommended as an evidence - based intervention that can be utilised in gambling disorder treatment among university students in Kenya.

MABADILIKO YA MAANA ZA LEKSIAS ZA KISWAHILI: MTAZAMO LINGANISHI WA KIKALE NA KISASA

Tiru Mutwiri Gichuru-PHD

Department: Kiswahili

Supervisors: Prof. Ireri Mbaabu

Prof. Kitula King’ei

The purpose of this study was to investigate semantic changes in Kiswahili lexemes by comparing the pre-20th century Swahili and the modern Swahili from selected texts. The study identified lexemes that have undergone meaning change and then investigated the factors that had influenced the direction of change, the semantic relationship between the new and the old form of meaning and further, the general impact of semantic change on Swahili lexicon. The study was guided by the Cognitive Semantic theory, as the main theory, and the Semantic field theory which was needed in explaining internal relationships between words. The tenets of Cognitive Semantic theory employed in this study were derived from the works of Lakoff (1987); Taylor (1999); Lee (2001); Croft and Cruse (2004); Vyvyan n.w. (2006) and Lemmens (2017). The main tenet of Cognitive Semantic is that linguistic cognition is an inextricable phenomenon of overall human cognition. Cognitive Semantic describes the meaning associated with a lexical item as conceptual, embodied, dynamic and essentially encyclopedic. Thus lexical units cannot be understood independent of larger knowledge structure. The
Semantic field Theory, developed by Jost Trier in 1931, emphasizes that words should not be considered in isolation, but in their relationship to semantically related words. Words are set in areas or fields within which words interrelate and define each other. The data for this research was collected from selected pre-20th century Swahili texts such as Utenzi wa Hamziyya (1652) and Al Inkishafi (1749) and Krapf (1882), and from the field by conducting interviews and by administering questionnaires. The study concludes that there is a high frequency of lexemes that has undergone semantic changes during the period studied. The study found that meaning extension and metaphor are the most productive type of meaning change during the period studied. The study found that change of meaning of Swahili lexemes is grounded on our physical and social experiences which arises and is tied to how we construe different structures in the society. In fact, the study found that the historic evidence derived from socio-political, economic, technology and language development accounts for most observable changes in Swahili lexicon. The study also found that semantic changes have a direct impact on Swahili lexicon and day to day language use. For instance, they lead to polysemy which causes lexical ambiguity and growth of metaphoric form of language. Other lexemes have become vague or obsolete. The results of this research therefore, will contribute to the study of phenomena of change in Swahili lexicon, dictionaries development and comparative linguistics.

**IKISIRI**


### INFLUENCE OF ORGANIZATIONAL PRACTICES ON TIME MANAGEMENT AND OUTCOMES: THE FEDERAL INLAND REVENUE SERVICE IN SOKOTO METROPOLIS, NIGERIA

**Bashir Bello - PHD**

**Department:** Sociology, Gender and Development Studies

**Supervisors:** Dr. Francis Keere
Dr. Henry Rono

Organizations are primarily designed to achieve some specific goals. The fact remains that workers in every organization have a role to play for the purpose of achieving goals which organizations are designed to achieve. Directly or indirectly, therefore, workers“ commitment to the realization of organizational goal is a major parameter that can be used to measure the performance of organization. One of the indices of workers commitment to the realization of organizational goal is their ability to report to work on time and leave work at the appropriate time. Although, there are other factors that may affect realization of organizational goals, workers“ management of time remain vital area of focus. The study objectives were to: identify how workers“ time management influenced the performance outcome, examine the performance and targets (outcomes) in FIRS, examine how characteristics of the workers influenced time management; examine the influence of Federal Inland Revenue practices on workers time management; and establish ways to improve time management and performance in service organization. The study adopted the following questions: What has been the target and performance in service organizations? To what extent has time management influenced the performance outcome? To what extent has the characteristics (Age, gender, education, marital status) of the workers influenced time management? To what extent has the organizational practice (Recruitment, promotion, motivational incentives, training, competence and sanction) influence workers“ time management? Both the quantitative and the qualitative methods were used to conduct the research. The researcher employed the use of Statistical Package for Social Sciences (SPSS 20), STATA, tables, graphs, frequencies, percentages, Likert scale, analysis of variance and regression process to analyze the collected data and measure the relationships between the dependent and independent variables (the hypotheses). The researchers also employed the use of Nvivo software (Version 10) to process and analyze the qualitative data collected. The findings of the study revealed that workers“ time management has influence on organizational outcome. The research identified that organizational practices such as recruitment, promotion, motivational incentives, basic salary, allowances, training, competence, sanction and penalty as well as the characteristics of workers such as the age; sex; marital status; level of education; occupational status and the number of years in employment influence workers“ time management. The study also found that there was need to improve on the various organizational practices because these practices had a lot of influence on how workers managed their work time. Based on the findings of the study, it was recommended that the management should improve the organizational practices so as to improve workers“ commitment to work as well as improve the outcome of the organization. It was also recommended that there should be penalties for workers who poorly managed organizational time.

A MORPHOPHONOLOGICAL ANALYSIS OF BORROWED SEGMENTS IN EKEGUSII LANGUAGE: AN OPTIMALITY PERSPECTIVE.

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Language phonotactics and morphotactics are very significant in determining linguistic borrowing. Despite this significance, fewer studies have explored this interplay. This study undertook a morphophonological analysis of borrowed segments in Ekegusii. To achieve this, the study described the phonological adaptations, phonological processes that shape the patterns of the borrowed segments in Ekegusii, established both the phonotactics and morphotactics of the Ekegusii language that constrain borrowing and ascertained the extent to which Optimality Theory accounts for borrowing in Ekegusii. The Optimality Theory as proposed by Prince and Smolensky (1993 and 2004) and Kager (1999) as well as Generalized Alignment Theory by McCarthy and Prince (1993a) were used in the study. A descriptive linguistic fieldwork design guided this study. This study targeted proficient adult Ekegusii speakers both male and female who were neither too young nor too old, had all their own teeth and did not have any speech disorders. To arrive at the appropriate study
sample, purposive sampling was used and it was carried out in two stages. First, the researcher sampled two hundred words from Ekegusii dictionary, then supplemented from introspection. Secondly, the researcher sampled three proficient adult Ekegusii speaker respondents (two males and one female) who were interviewed to overtly realize the sound patterns in the Ekegusii borrowing processes. Data collection instruments included a wordlist which was subjected to the respondents through interviews which were recorded to yield spoken data. Data analysis revealed that loanwords in Ekegusii undergo both phonological and morphological adaptations. First, on phonological adaptations the findings revealed that English vowels tend to be substituted with those in Ekegusii which they have shared features in terms of horizontal and vertical tongue position, tenseness as well as shape of the lips. On consonantal segments, data showed that the sounds that were adapted shared at least the major-class features, laryngeal, manner and place features with those they replaced. In addition, segments that are unmarked and preferred cross linguistically were adapted over the marked ones. OT constraints accounted for all the phonological and morphological processes whereby markedness constraints dominated the faithfulness constraints. Phonotactics of Ekegusii language that constrain borrowing were revealed at two levels: segmental and syllabic. On the morphological adaptations, it was established that borrowed segments are mapped to different noun classes with the prefix marker being the overriding factor. It is expected that this study will contribute to the existing literature on Bantu languages in relation to borrowing within the framework of Optimality Theory.

EFFECTS OF INMATE CHARACTERISTICS AND INSTITUTIONAL CAPACITY ON PRISON REHABILITATION OUTCOMES IN SELECTED PRISONS IN NAIROBI CITY COUNTY, KENYA

Queenter A. Ondigo-PHD

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Various studies continue to report minimal or negligible impact of rehabilitation on reoffending and reintegration to community environment. More specifically, the proportion of sustained prison releases reduces rapidly within the first three years largely because of re-arrests, re-convictions and return to prison and the rate is even more acute in developing nations and Sub-Saharan Africa. In view of this persistent challenge, this study examined rehabilitation outcomes of inmates particularly in respect to their prerelease readiness to return to lawful livelihoods and community environment. Life course perspective and socio-economic vulnerability theory were used to identify phases of life associated with socio-economic vulnerabilities leading to increased crime risks, rehabilitation challenges and reoffending tendencies. Specific objectives of the study were; to identify characteristics of the prison inmates and related risks, to examine rehabilitation outcomes and readiness towards prison release, to identify types of rehabilitation practices and usefulness, to examine the institutional capacity and sustainability, to examine the influence of inmate characteristics on the rehabilitation outcomes, and to identify key challenges affecting prison rehabilitation programmes and necessary interventions. The study applied cross-sectional survey design. The target population for the study were 800 inmates serving their sentences in Nairobi Industrial Area Medium Prison, Nairobi West Prison and Langata Women Prison all based in Nairobi County. The three institutions were better placed to provide the inmate with extensive rehabilitation including industrial attachment and experience because of their proximity to the largest industrial area. Sample size of 286 was determined using Krejcie and Morgan, (1970). Both qualitative and quantitative data were obtained through key informants, FGDs and survey questionnaire. Analyses of data with the use of SPSS included descriptive statistics, cross-tabulations and regression analyses. Results indicated that majority of the inmates were young, with limited education, vulnerable occupations and lived within extreme poverty. Considerable proportion of the inmates were women and had limited family support and social capital. Rehabilitation outcomes were substantially limited or inadequate in all indicators including compliance to institutional rules, participation of inmates in the design of their respective rehabilitation plans, access to apprenticeship, engagement on productive activities among others. The study concluded that rehabilitation practices should be guided by
life course perspective, socio-economic vulnerability and desistance theory. The study recommends review and expansion of prison rehabilitation to; strengthen rehabilitation along the UN guidelines including 2015 minimum rules and the various roadmaps, ensure provision of adequate resources particularly in terms of personnel, facilities, equipment and budgetary allocations, incorporate and expand prison industries in order to expand apprenticeship, work experience and to generate revenue and adopt a rehabilitation plan for each inmate incorporating post-release support follow up.

**GENDERED ACCESS AND CONTROL OF LAND, DAIRY PRODUCTS AND THEIR INFLUENCE ON HOUSEHOLD WELFARE IN MURANG’A COUNTY, KENYA**

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This study sought to investigate the gendered access and control of land and dairy products with a focus on their influence on household welfare. The study was done in Murang’a County -Kenya, guided by the following objectives: to establish the status of access and control of dairy products and land by men and women; to examine the status of welfare in households practicing dairy farming and perceptions of men and women on the influence of access and control of land and dairy products. Additionally, the study identified strategies that can be put in place to enhance access and control of land and dairy products for improved household welfare. Four null hypotheses were also tested to establish the relationship between gender and access as well as control over land and dairy products. The study was guided by the Marxist feminism theory advanced by Friedrich Engels (1884) and Women Empowerment Framework (WEF) by Sarah Longwe (1991). The study utilized cross-sectional research design while purposive sampling technique was used to select Kigumo Sub-county as the area of the study. Further, simple random sampling technique was used to select four hundred and forty-two (442) male and female headed households practicing dairy farming in the Sub-county to participate in the study. Selected community leaders and key county officers were included as key informants. To generate the required data, the study utilized interview schedules for the selected male and female household heads, a guided questionnaire for the key informants and an observation checklist. Quantitative data was analyzed through the use of Statistical Package for Social Sciences (SPSS) while qualitative data was analyzed on the basis of study objectives. The study established that the main dairy products included dairy cows, milk, manure, calves and biogas which were found to be differently accessed and controlled by men and women. It is these differences in the control and access to the land and dairy products that were found to have differential influence on household welfare. The household welfare was gauged on the basis of the parameters drawn from the Kenya Constitution 2010 Article 43 on social and economic rights namely health, housing, food, water and education. In this respect, the study established that women and men’s access and control over land and dairy products had a relationship with the provision of household welfare based on the above parameters, as further confirmed by the testing of the null hypotheses. Male and female household heads were found to hold different perceptions on gender and access/control to resources with a bias against women, mostly influenced by culture, religion, awareness on legal requirements and individuals’ level of formal education. The study identified and recommended gender awareness raising, enhancement of adult education program, enforcement of legal requirements on human rights as the main strategies for enhancing gender equity on access and control over land and dairy products for enhanced household welfare.
SCHOOL OF PURE & APPLIED SCIENCES

FIRST PRINCIPLES STUDY OF STRUCTURAL, ELECTRONIC AND MECHANICAL PROPERTIES OF LANTHANUM FLUORIDE AND LANTHANUM DOPED BARIUM FLUORIDE

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Lanthanum Fluoride (LaF₃) has several applications for instance, in electrodes manufacture, fluorescent lamps and fiber optic devices due to its high heat capacity. Barium fluoride (BaF₂) is an alkaline-earth element with a wide band gap with many optical applications, such as lithography. BaF₂ has been established as an excellent candidate that is useful for hosting optically active centers (OAC). Lanthanide elements have been used as dopants in BaF₂ lattice to achieve the desired optical properties, which has not been fully explored. With these vast applications of these compounds, it is necessary to carry out complementary theoretical investigations on their properties to explore full applications. The structural, electronic, mechanical and optical properties for LaF₃, BaF₂ and BaF₂:La have been investigated in this current work using computational modeling. These properties have been studied using the generalized gradient approximation (GGA) employing pseudopotentials and plane wave basis sets as implemented in Density functional theory. Lattice constants and bulk modulus for LaF₃ were calculated and the values obtained were found to be in good agreement with experimental and other theoretical values. Density of states and energy band structure for LaF₃, BaF₂ and BaF₂:La have been obtained along high symmetry points in k-space, respectively. A band gap of 7.79eV was obtained for LaF₃ which is an underestimation in comparison to the 9.0eV of experiment. Values of elastic constants calculated for LaF₃ are comparable with those from other experimental and theoretical calculations. LaF₃ exhibits mechanical stability from the obtained elastic constants. Doping BaF₂ with La reduced the band gap and introduced new energy bands within the band gap from the charge compensating fluorine. The elastic constants calculated for BaF₂:La show a decrease in the first two elastic constants with no change in the third component of the elastic constants compared to the pure BaF₂. This has been attributed to the lattice distortion introduced by the La atom. From the defect formation energy calculated, nearest neighbor (NN) formation energy was found to be -26.48eV compared to the next nearest neighbor (NNN) of -27.58eV. It was observed that the next nearest neighbor is most favorable in BaF₂ lattice. For optical properties, there was a shift in the absorption coefficient from 5.32 m⁻¹ to 6.25 m⁻¹ of BaF₂ when doped with La. The refractive index of BaF₂ is obtained as 1.52 compared to experimental value of 1.45. The obtained refractive index is in good agreement with experimental values. The introduction of La atom together with the interstitial fluorine affects electronic, mechanical and optical properties of BaF₂.

SYNTHESIS OF (R)-1-METHYL-4-(1-METHYLETHENYL) CYCLOHEXENE MULTIFUNCTIONAL DERIVATIVES AND THEIR EFFECTS ON JATROPHA CURCAS AND ALGAE BIOFUEL BLENDS

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There is a growing increase in biofuel consumption around the world. Currently there is a desire to enhance biodiesel and biodiesel blends properties by use of multifunctional additives. This project sought to evaluate the miscibility of fatty acid ethyl ester blends from algae and Jatropha curcas L. oils and also synthesise hydrogenated and oxygenated derivatives of d-limonene as potential additives. Sampling of citrus peels was done from Milly Fruit Processors and Kongowea Mombasa. Algae were from Shimoni in Kwale, Shelly beach Mombasa, Jamvi la Wageni Mtongwe Likoni, English point Mombasa. J. curcas seeds were from contracted farmers in Shimba hills, Kwale County. Extraction of citrus oil containing d-limonene was done by use of hexane and liquid/Sc CO2. Catalytic synthesis of hydrogenated and oxygenated limonene derivatives was done using palladium on alumina Pd/Al2O3 and palladium on hydrotalcite Pd/HT respectively. Algae and jatropha seeds were dried, blended and extracted using hexane. The algae and citrus biomass were saccharified then fermented to obtain bioethanol. The algae and jatropha oils were transesterified using bioethanol, blended to form JAB then 2 – 10 % limonene and additives added to 20% JAB to form JABLA. GC-MS and FTIR spectrophotometers were used for characterisation. Determination of physicochemical and fuel properties was done using standard methods. Antimicrobial assay of JAB20 and JABLA was done using paper disc diffusion method. The properties of JAB and JABLA were then compared with those of diesel fuel and standard B100 biodiesel. The yield of orange oil was 5.748±0.719 %w/w using hexane. Pd composition of Pd/Al2O3 and Pd/HT was confirmed using XRF spectrometry to be 5% and 4.74% respectively. Characterisation showed that the oxidation products were mainly endo- and exo-epoxides, dihydrocarveol, carveol and carvone and hydrogenated products p-menthene, cis-p-menthane, trans-p-menthane, (S)-1-methylene-4-(1-methylethyl)cyclohexane and (R)-1-methylene-4-(1-methylethyl)cyclohexane. Bioethanol from citrus biomass was 9.42±1.031 % v/w. Algae oil produced 57-62% FAEE and J. curcas oil 63-70% FAEE. Characterisation of the ethyl esters showed mainly dodecanoic acid, tetradecanoic acid, pentadecanoic acid and hexadecanoic acid ethyl esters from algae oil and hexadecanoic acid, octadecanoic acid and 9z-octadecenoic acid ethyl esters from jatropha oil. JAB 5-20% was miscible, physicochemical and fuel characteristics showed that there was significant effect on the J. curcas FAEE calorific value, kinematic viscosity, pour point and cloud point with p < 0.05. The 2-8 % d-limonene additive showed effect on properties of JAB20 density, calorific value, kinematic viscosity, flash point, cetane index, pour point and cloud point with p<0.05 except for CFPP with a p = 0.215. For 2-8 % hydrogenated d-limonene additive showed effect on density, calorific value, kinematic viscosity, flash point, cetane index, pour point and cloud point p<0.05. The 2-8 % oxygenated d-limonene additive had effect on density, cetane index and pour point p < 0.05 according to data obtained using STATA/SE 13.0 and Xlstat at 95% confidence level two -tailed. JABLA showed no significant difference in fuel properties with petroleum diesel and standard B100 biodiesel p=0.110. The 8% oxygenated d-limonene also showed Pseudomonas aeruginosa growth inhibition of 23.20 ± 0.80 mm and Candida albicans growth inhibition of 25.30± 0.30 mm. From the findings the additives have beneficial effect on physicochemical and fuel properties of J. curcas and R. grande biofuel blend for increased sustainability and longer shelf life hence potential additives to the biofuels.

CHARACTERIZATION AND CONTROL OF PATHOGENIC PARASITES IN NILE TILAPIA (OREOCHROMIS NILOTICUS LINDAUS 1758) IN FISH-FARMING SYSTEMS IN BUNGOMA COUNTY, KENYA

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In Kenya, fish farming has been expanding in recent years, with Government support through financial and input subsidies to small scale farmers. The sub sector generates a variety of benefits such as food and nutrition and develops trade. However, the sub sector faces the challenges of fish diseases, given that the fish production facilities support high -density living conditions that are favorable for spread of parasitic diseases. Besides, when fish that is infected is consumed by
humans, the humans may be infected, especially when eaten fresh. Infected fish lowers their market value and sanctions may also be imposed on fish exports. Knowledge of fish parasites in aquaculture systems as well as treatment options available would enlighten fish farmers on the specific actions to take in order to harvest quality fish. The study was cross sectional carried out in Bungoma County from August 2015 to December 2017. The main objective of the study was to characterize and evaluate control options of pathogenic parasites present in fish farming systems in Bungoma County. Bungoma County was chosen for this study because it is one of the Counties that has high potential for fish farming. The County hosts one out of the public fish farms and hatcheries at Chwele besides authenticated private fish hatcheries. Hatcheries are sources of fish fingerlings as well as training and demonstration centres for fish farmers. At every fish pond, six water quality parameters were assessed using a portable auto sampler. Farmed Nile tilapia was randomly sampled to determine the pathogenic parasites and bacteria present in various organs. Commercial fish feeds were also purchased from two fish feed millers in Bungoma County and assessed for parasite presence. Polymerase Chain Reaction (PCR) and genetic sequencing analysis were conducted in order to assess the genes responsible for antimicrobial resistance. The data was entered into Micro Soft Excel (Windows 10) spreadsheet and analysed by SPSS Software. It was found that there was significant difference only in temperature of the pond water sampled across the sub counties (F=15.5; df=5; p<0.001). Helminthes recovered were Pallisentis tetraodontis, Pallisentis spp., Acanthocephalus spp., Procamallanus spp. and Philometroides spp. from Nile tilapia and Cleidodiscus spp. from pond water. Bacteria that were isolated from Nile tilapia were Vibrio vulnificus, Vibrio parahaemolyticus, Aeromonas hydrophila, and Pseudomonas aeruginosa. In fish pond water, Aeromonas hydrophila was isolated while Streptococcus iniae was isolated from fish feeds. Besides, there was a significant difference in distribution of total viable aerobic colony counts in fish ponds water across the different sub counties (H=6;df 5; P<0.041). Furthermore, it was found that there was significant difference in the distribution of Aeromonas hydrophila in fish ponds across the different sub counties (H=3;df;P<0.016). The external parasites were eliminated by formalin (36% formaldehyde) at concentration of 25ppm for 1h and Hydrogen peroxide at 75ppm for 30 min. The bacterial isolates were found to be significantly different in responses to antimicrobial agents (OLR;df= 16; P<0.00). When the bacterial isolates were subjected to PCR, all five bacterial pathogens isolated from fish, pond water and fish feeds were found to contain blaTEM gene amplified at 424bp. The sequences blaTEM gene returned 100% identity with GenBank Accession number; BankIt2236899 Seq1a MN114035 to Seq 9b MN114052). This study found that the blaTEM gene was present in recovered Vibrio parahaemolyticus, Aeromonas hydrophila, Pseudomonas aeruginosa and Streptococcus iniae. It is recommended that Formalin and hydrogen peroxide as well as potassium permanganate should used to manage fish helminthes in the ponds.

BIOMASS-BASED FERTILIZER FORMULATION USING CHEMICALLY DECOMPOSED AGRICULTURAL WASTES AND EVALUATION OF ITS EFFICACY IN GROWING MAIZE

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Utilization of the conventional fertilizers such as NPK, DAP, CAN and Urea by smallholder farmers in developing countries like Kenya has remained dismal due to high retail prices as well as environmental and soil related concerns such as P-fixation, leaching and volatilization. Organic fertilizers generated using traditional composting methods come in handy despite own challenges of long composting periods, imbalanced nutrients and environmental impacts of pathogens. The long composting period can be shortened through chemical decomposition of selected farm wastes that can provide balanced nutrients. The objective of this study was to utilize chemically decomposed agricultural wastes to formulate a biomass-based fertilizer and evaluate its efficacy in growing maize. Selected agricultural waste (maize cobs, maize stalks, sugar cane bagasse, sisal leaf pulp and cattle horns/hoofs) were analyzed for nutrients N, P, K and Ca to determine their
suitability for formulating a Biomass-Based Fertilizer (BBF). Results indicated that the agricultural wastes had varied levels of macronutrients sufficient to support use in fertilizer formulation. The acidic sisal leaf pulp required basic conditions to decompose. The lye from burned maize cobs was used to digest sisal leaf pulp to give a basic coas ash sisal digest (CASD) product while cattle horns and hoofs soaked in peracetic acid gave an acidic horns and hooves digest (HD) product. HD (acidic) was mixed with CASD (basic), (HD: CASB) in varying ratios to give different fertilizer formulations namely, BBF0 (0:1), BBF1 (1:1), BBF2 (2: 1), BBF3 (3:1), BBF4 (1:2) and BBF5 (1:0). The formulations had pH varying from 6.82±0.15 to 8.41±0.27 and would provide macronutrients in the ranges of 1.0-3.9 g (N), 0.002-0.17 g (P), 0.001-6.30 g (K) and 0.08-9.20 g (Ca) per plant environment. Fertilizer formulation BBF1, with pH above 7.5 and macronutrients 2.31% N, 0.08% P, 2.5% K and 3.46% Ca, was used in efficacy study carried out in Lugari, Kakamega county because of the acidic nature (pH<7.0) of the field soils. Plant height and yield of maize under the BBF1/BBF1 and that under the DAP/CAN schedules were comparable, but differed significantly from those of maize in the plots without fertilizer schedule. Side dressing maize whose leaves developed purple coloration (phosphorus deficiency) with freshly prepared BBF1 cleared P-deficiency symptoms in ≤ 7 days. Chemical decomposition of agricultural wastes produces digests that blend into a BBF formulation that is effective in promoting growth and yield of maize crops.

MODIFIED BIO-SORBENTS FOR PRE-CONCENTRATION OF ESSENTIAL TRACE ELEMENTS FROM RAW AND FERMENTED SELECTED FOODS

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Prof. Ruth N. Wanjau

his study reports a new method of pre-concentrating Zn2+, Fe2+, Mn2+, Mo6+ and I- ions present in food stuffs using modified bio-sorbents. These elements are in low levels in many food stuffs commonly consumed and some are way below the recommended daily intake (RDI). Examples of mitigating such situations include the addition of iodine to table salt in minute portions. However, table salt in foods increases sodium levels causing problems to consumers with high blood pressure. Dietary iron supplements have been used by people with iron deficiency in their bodies. Stomach upsets and pain, constipation, nausea and vomiting have been reported as some of the side effects of taking iron supplements. There is need therefore to find a way of increasing their levels in food intake. A possible route for this is to pre-concentrate these elements from common foodstuffs using readily available bio-sorbents. Maize cobs (Zea mays L.), common beans husks (Phaseolus vulgaris L.) and millet tassels (Eleusine coracana L.) which have traditionally been used either to make animal feeds or manure were used as pre-concentrating agents through adsorption. Another route is through fermentation followed by pre-concentration. The bio-sorbents were separately chemically modified and characterized to confirm the presence of the anchored functional groups using Fourier Transform Infrared (FT-IR) spectroscopy. Sorption capacities of essential trace elements by chemically modified and unmodified biomaterials were investigated separately using batch sorption experiments. Sorption parameters such as pH, concentration, contact time and dosage of both modified and unmodified forms of adsorbent were investigated. Essential trace elements present in black nightshade (Solanum nigrum L.) leaves, spinach (Spinacia oleracia L.) leaves and pumpkin (Cucurbita maxima L.) flesh aqueous extracts were determined without pre-concentration, after pre-concentration, and in fermented samples followed by pre-concentration. Best adsorption pH values ranged between 5.0 to 6.0 for Zn2+, 4.0 to 4.5 for Fe2+, 6.0 to 6.5 for Mn2+, 4.0 to 6.0 for Mo6+ and 5.0 to 5.5 for I-. The optimum concentration for all ions was found to be best below 50.0 mg/L while adsorption dose was best below 60.0 mg. The results show adsorption fitted more to the Langmuir model which had R2 values in the range 0.9957 to 0.9999 than Freundlich model with R2 values in the range 0.6710 to 0.9632 for all adsorbents. Sorption kinetics indicates pseudo second order model can be used to explain the rate determining step. The results show that fermentation increased the concentration of the essential trace elements in the solution. The
elements were then pre-concentrated with pre-concentration ratios of up to 5.0 being achieved. The bio-sorbents are re-generable up to ten times. The results from this study have a potential application in the preparation of dietary supplements for human consumption. The study therefore recommends that this new method of preconcentration be adopted in large scale production of dietary supplements.

THE IMPACT OF CLIMATIC VARIABILITY AND MALARIA CONTROL INTERVENTIONS ON MALARIA PARASITE PREVALENCE AND VECTOR ABUNDANCE IN WESTERN KENYA

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The World Health Organization estimated annual global malaria mortality to be at 405,000 deaths in 2018 making malaria one of the most important diseases in the world. In Kenya, malaria control measures have been put up, however, the ongoing climate change and climatic variability is proving to be a great challenge. The aim of this study was to investigate the impact of climatic variability and malaria control interventions on malaria parasite prevalence and vector abundance in western Kenya. This was a longitudinal study where the same population was studied over a continuous period of time. Six sites; Iguhu, Emakakha, Marani, Kombewa, Rae and Miwani were selected for the study. Indoor resting mosquitoes were collected monthly from 2012 to 2014. Outdoor mosquito collections were done using rotator traps every two hours between 6pm-8pm during the same time period. Human behaviour study was also conducted in the study sites to show when the study participants stayed outdoors. Polymerase chain reaction was done to confirm species and Enzyme linked immunosorbent assay was done to confirm sporozoite infectivity. Bed net ownership in the study sites was analysed. Malaria parasitological surveys were conducted in 100 randomly selected children aged between 6-15 years in 2002-2003 and 2012-2015 in Iguhu to determine parasite prevalence and densities of sexual and asexual stages. Age-dependence in parasite infections was compared between the pre and post intervention period. Climate and clinical data were analysed from Iguhu and Marani from 1980 to 2015. Data on vector abundance, various malaria control interventions and asymptomatic malaria cases was collected from the study sites. The effects of temperature and rainfall on malaria parasites and vectors was shown using Poisson regression analysis. The results revealed 58.2% Anopheles gambiae were collected and 41.8% Anopheles funestus. Fifty percent of the study population stayed indoors in the study sites between 08.00pm-06.00am. Bed net ownership in 2012 averaged 87%. Plasmodium falciparum parasite prevalence among children ≤ 15 years of age reduced from 43.5% in the pre intervention period to 11.5% in the post intervention period, a 73.7% reduction in the post intervention period. Parasite densities per ml of blood of P. falciparum between the pre and post intervention period increased by 71.2%. The geometric mean gametocytaemia in Iguhu was 106.4 parasites/μl, in the post intervention period. Prevalence and density of P. falciparum showed no age-dependency during post-intervention period. Maximum temperature and rainfall were highly associated with the density of An. gambiae (χ²=2.44, d.f = 1, P= 0.015). Malaria cases showed a positive significant relationship with a 4-month moving average of the total monthly rainfall despite control. In conclusion, insecticide treated bed net use led to early feeding of malaria vectors before dawn and before dusk. The use of both bed nets and Artemisinin combination therapy for a prolonged period of time reduced parasitological resistance and transmission blocking immunity. Increased rainfall and maximum and minimum temperature led to the increase in malaria transmission even in areas where interventions were in place. Sustained use of insecticide treated nets as a component of integrated vector management is recommended to reduce early feeding of mosquitoes and prevent malaria transmission in children. Continuous surveillance of Plasmodium parasite transmission is also recommended to identify new malaria hotspots due to climatic variability.
EFFECT OF SPATIAL DIELECTRIC FUNCTION ON THE TOTAL ENERGY OF CUBIC QUANTUM DOTS AND FREQUENCY DEPENDENT DIELECTRIC FUNCTIONS IN BINARY SEMI-CONDUCTORS

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Spatial and frequency dependent response functions of medium-direct band gap binary semiconductors were studied at both nanoscale and in bulk form using ab initio method. To understand why the total energy and the band gap energy of semiconducting materials at nanoscale, such as quantum dots, vary with the particle sizes, this study has invoked dielectric function of binary semiconductors from spatial dependent point of view. Moreover, this study has addressed the discrepancy between theoretical results and experimental data when studying bulk semiconductors which was attributed to failure of full implementation of dielectric function which is frequency dependent. Yester years, failure to implement frequency dependent dielectric functions have been attributed to computational demand which has, in this study, been made possible through the use of High Performing Computation (HPC). At nanoscale, Herrman0s spatial dependent dielectric function was applied in the Hamiltonian when determining total energy of on-center donor impurity in gallium arsenide Quantum-Dot (QD), where the QD was embedded in a matrix of gallium aluminium arsenide. This was necessitated by the fact that behaviour of semiconductors at nanoscale completely deviate from those of their bulk systems. This was studied using both Bloch functions and atomic-like basis functions; the latter from perturbative point of view. The effect of both room temperature and hydrostatic pressure of one atmosphere, on the total energy, were also studied and implemented using Bloch functions. MatLab computation mathematical tool, version 2015, was used for solving relevant Schrodinger equations and for simulation purposes. In bulk systems, frequency dependent dielectric functions of gallium arsenide (GaAs), indium phosphide (InP) and cadmium telluride (CdTe) were studied under the influence of electromagnetic radiations with wavelengths in the range between infrared and visible light. These materials are candidates for heterojunctions such as those that are used to fabricate solar cells and in laser technology. Quantum en-source package for research in electronic structure, simulation and optimization (ESPRESSO) computer code version 5.2.1 with plane waves self consistent field (PWSCF) computer package was used to determine their ground state electronic properties while Yambo computer code version 4.1.4 and BerkeleyGW version 1.2.0 were used to determine their excitation energies and optical properties. From this study, spatial dependent dielectric function was found to give total energy of quantum dots that is higher than that of commonly used dielectric constant. Atomic-like basis functions resulted to higher energies compared to those obtained using Bloch functions. The combined effects of room temperature and atmospheric pressure were found to increase the total energy. This was more pronounced from dots whose size were more than 2:5nm and 3:5nm for spatial independent and spatial dependedent dielectric functions, respectively. Also, electronic structures and optical absorption got from the solution to Bethe-Salpeter Equation was compared with that based on Random Phase Approximation in the presence of the local field (RPA+LF) using Yambo. From frequency dependent dielectric functions, it was observed that different binary semiconductors are excited differently by electromagnetic radiations at different frequencies. From this observation, frequency dependent dielectric functions invoke full interactions in real systems and when considered, optical absorption spectra was found to predict well the order in which heterojunctions should be arranged in optoelectronic devices for optimal output. This study recommends theoretical study of semiconducting materials from full frequency dependent dielectric functions so that the obtained electrical, electronics and optical properties can compare well with those from experimental data.

SYNTHESIS, CHARACTERIZATION, BIOASSAY AND DENSITY FUNCTIONAL THEORY STUDIES OF CATIONIC IRON HALF SANDWICH COMPLEXES OF SELECTED HETEROFUNCTIONAL ACTIVE PHARMACEUTICAL AGENTS

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The molecular modification of purely organic drugs by the incorporation of a metal atom is an active area of research. However, there is paucity of data in the use of half sandwich organometallic fragments and in particular the cationic iron half sandwich, $[\eta^5-C\equiv S(H)\equiv C(O)2Fe]^+$, in structural modification of drug molecules. The cationic iron half sandwich organometallic fragment provides a metal centre that could participate in biochemical reactions with potentially the desirable benefit of conferring new or modified modes of action of the drug molecules. Therefore, the objective of this study was to modify the molecular structures of the active pharmaceutical agents (APAs); 3-aminosalicylic acid (3-ASA), 4-aminosalicylic acid (4-ASA), 5-aminosalicylic acid (5-ASA), terizidone (TZD), ethionamide (ETH), prothionamide (PTH) and linezolid (LZD) by the incorporation of the cationic iron half sandwich organometallic fragment. A two pronged approach involving molecular modelling and organometallic synthesis was employed. In molecular modelling, the molecular geometries of the seven selected drug molecules were optimized and their local and global reactivity indices calculated in order to predict their ligation behaviours towards the iron half sandwich. The most stable molecular geometries and spectroscopic properties of the seven active pharmaceutical agents and their organometallic complex salts were predicted computationally using the DFT functionals; B3LYP, CAM-B3LYP and PBE0PBE and 6-311g(d,p), 6-311g(2d,p) and LANL2DZ basis sets in Gaussian 09 and 16. Experimentally, the iron half sandwich organometallic salts of the APAs were synthesized, purified and characterized by FT-IR spectroscopy, 1H and 13C NMR spectroscopy, and elemental analysis. Antibacterial susceptibility tests of the new compounds against selected gram-positive and gram-negative bacteria showed that the LZD and TZD complexes had good abilities to inhibit the growth of the tested bacteria with comparable or better growth inhibition ability than their corresponding free ligands. Furthermore, the incorporation of the cationic iron half sandwich organometallic moiety to 3-ASA, 4-ASA, 5-ASA, ETH and PTH conferred antibacterial activity against the selected bacterial strains hence broadening the drugs spectra of activity. Therefore, the structural modification of APAs by the incorporation of the iron half sandwich can be pursued as a means of enhancing the usefulness of drugs.

NUTRITION SENSITIVE INTERVENTION WITH SELECTED AFRICAN INDIGENOUS LEAFY VEGETABLES AMONG SCHOOL GOING CHILDREN IN MACHAKOS COUNTY, KENYA

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The 2014 Kenya Demographic Health Survey (KDHS) and Micronutrient Survey report showed malnutrition among children aged 5-11 years in Kenya. In particular, malnutrition in Machakos County manifested as stunting (26.3 %), wasting (6.3 %), underweight (12.7 %), marginal vitamin A deficiency (VAD) (33.9 %), anemia (16.5 %), zinc deficiency (82.5 %) and iron deficiency (9.4 %). African Indigenous Leafy Vegetables (AILVs) such as Vigna unguiculata and Amaranthus cruentus can be used to fight malnutrition in school-going children, based on their high micronutrient levels, but they need to be made more available to these children. The cultivation of AILVs as well as their consumption can be optimized through school
garden establishments and the effect of the AILVs’ consumption on the children’s nutrition status accurately determined. This is to generate data to support the recommendation by 2014 KDHS that food based intervention through garden establishment can fight malnutrition. However, empirical data to support this recommendation employs determining body mass index, a limited technique as compared to deuterium dilution isotope (DDI) method that measures fat free mass (FFM) and fat mass (FM). The objective of the study was to determine the effect of consuming school garden-sourced vegetables on nutritional status of school children in Machakos County, Kenya. This was an experimental cross over design study with 4 weeks in between phases, phase I (13 weeks) and II (12 weeks). In phase I study subjects (children aged 6-10 years) who met the inclusion criteria were grouped as experimental (Kangundo, N=66) and control (Kilalani, N=46). The experimental group fed on a recipe of Vigna unguiculata and Amaranthus cruentus grown in school gardens of Kangundo and Kilalani primary, Machakos, with an accompaniment of a mixture of maize grains and beans once a day, 5 days a week per phase while the control group had only the accompaniment. The baseline information on dietary practices, morbidity, socio-demographic, economic factors and anthropometry of children were collected using a structured questionnaire. Hemoglobin (HB) was measured by a hemoglobinometer, while levels of Fe and Zn in raw and cooked recipe and in blood samples were determined using AAS procedure. The body FFM and FM was determined by DDI method and saliva analyzed by Fourier Transform Infrared (FTIR) spectroscopy, while serum retinol and BC were analyzed by HPLC. Baseline results showed poor consumption of indigenous vegetable (< 20 %), high morbidity (> 40 %), low socio-economic status of the parents/guardians (> 95.6 % who earned <Ksh.10, 000 month), the anthropometry and low HB results indicated malnutrition. The garden sourced vegetable recipe contained sufficient levels (mg/100g) of Fe 55.465 ± 0.419, Zn 3.430 ± 0.054, and BC 4.299 ± 0.010 to meet the RDA for children. At end line, the study subjects’ body composition as indicated by the FFM and FM as well as the Fe, Zn and BC levels significantly improved (p < 0.001) during both intervention phases. Further, there was a positive micronutrient impact, as shown by significantly higher levels of Fe, Zn, BC, Retinol and HB in the experimental group as compared to the control group at end line (p < 0.001) during both phase I and II. Since consumption of AILVs improves nutritional status of school going children the study recommends promotion of school gardens and consumption of school-garden sourced AILVs to improve nutrition of school going children.

**BIOPROSPECTING FOR ANTI-MOSQUITO PHYTOCHEMICALS ASSOCIATED WITH OLFACITION AND LARVICIDAL ACTIVITIES FROM SELECTED KENYAN PLANTS**

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Mosquitoes are of high public health concern since they are significant disease vectors of different tropical and subtropical life-threatening diseases like malaria, dengue, yellow fever, chikungunya, zika virus and encephalitis. Use of synthetic insecticides for control of mosquitoes causes development of resistance in vector species and have negative effects to the environment and human. This study aimed to find alternative, effective tools against these vectors from plant essential oils. Plant-based products are promising alternatives of low-toxicity, eco-friendly and low-cost. Oils from air-dried aerial parts of Satureja biflora, Satureja abbyssinica, Conyza newii and Plectranthus marrubioides from Aberdare and Ocimum kilimandscharicum from Kakamega in Kenya were extracted using Clevenger apparatus. Oil yields were determined and analyzed by Gas Chromatography/Mass Spectrometry. Repellency of the oils was assessed on adult mosquitoes in ‘WHO arm in the cage’ method, while 3rd instar larvae were used to assess larvicidal activities based on WHO protocol. Oil with better larvicidal activity was formulated into a water-miscible solution for laboratory and semi-field testing. GC linked to EAG detector was used to determine the constituents that elicited chemosensory responses from the antenna of An. gambiae. Individual constituent contribution to mosquito repellence was established through a subtractive -combination
bioassay. From the results, oils from different habitats and seasons showed qualitative and quantitative differences. Thirty-three (33) compounds were identified in S. biflora oil with 3 chemotypes based on location: geranial (31%) /neral (24%) / linalool (12%) of Kinale, linalool (28%) /nerolid (21%) / β-pinene (7.4%) of Nyahururu, and geranial (27%) /nerolid (21%) / linalool (16%) of Kieni-Gakoe. S. abyssinica had also 33 compounds comprising majorly menthone (44.1%) and pulegone (33.3%). C. newii had 19 components forming 2 chemotypes p-mentha-1,8-dien-7-yl acetate (24%) / limonene (23%) / 5-methyl-2-phenyl-2-hexenal (21%) associated with Nyahururu, and p-mentha-1,8-dien-7-yl acetate (27%) / limonene (38%). P. marrubioide and O. kilimandscharicum had 35 and 41 components respectively. The major compounds in P. marrubioide were carene-2-δ (18.7%) and camphor (17.9%), whereas for O. kilimandscharicum was camphor (36.6%) and limonene (18.6%). C. newii (Nayahururu) S. biflora (Kieni) and S. biflora (Nyahururu) gave a high repellence of ED50 at < 1.95 ppm, whereas S. biflora (Kinale) had ED50 at < 2.35 ppm against Ae. aegyptei and An. gambiae. Besides, C. newii had strong repellence with ED50= 0.5 ppm against An. gambiae. Comparatively DEET gave the highest protection time of 389 min against An. gambiae, followed by C. newii (cream) against the 3 mosquito species; 241, 206 and 60 minutes for An. gambiae, Cx. quinquefasciatus and Ae. aegypti respectively. S. biflora cream gave 208, 180 and 56 minutes against An. gambiae, Cx. quinquefasciatus and Ae. aegypti respectively. The major compounds in P. marrubioides were carene-2-δ (18.7%) and camphor (17.9%), whereas for O. kilimandscharicum was camphor (36.6%) and limonene (18.6%). C. newii (Nayahururu) S. biflora (Kieni) and S. biflora (Nyahururu) gave a high repellence of ED50 at < 1.95 ppm, whereas S. biflora (Kinale) had ED50 at < 2.35 ppm against Ae. aegyptei and An. gambiae. Besides, C. newii had strong repellence with ED50= 0.5 ppm against An. gambiae. Comparatively DEET gave the highest protection time of 389 min against An. gambiae, followed by C. newii (cream) against the 3 mosquito species; 241, 206 and 60 minutes for An. gambiae, Cx. quinquefasciatus and Ae. aegypti respectively. S. biflora cream gave 208, 180 and 56 minutes against An. gambiae, Cx. quinquefasciatus and Ae. aegypti respectively. Addition of vanillin to the cream formulation resulted in a longer protection time of 382 min against An. gambiae. Nine EAG-active constituents were identified. Perillyl alcohol and α-pinene increased repellency, while neral, geraniol, perill aldehyde and cinnamaldehyde-α-pentyl reduced the repellency of the respective blends. Limonene and linalool interchangeably increased or decreased the repellence based on the resulting blend. O. kilimandscharicum oil showed the highest larvicidal effect against 4 mosquito species, with LD50 of 0.292 and 0.41ppm at 24 and 48 hrs respectively against An. gambiae larvae. The O. kilimandscharicum water miscible formulation recorded a LC50 of 0.13, 0.14, 0.16 and 0.13ppm against larvae of An. gambiae, Ae. aegypti, Cx. quinquefasciatus and An. arabiensis respectively. In a semi-field setup, the larvicidal formulation at 0.5ppm on day 8 attained 100% larval reduction when B.ti had 96.5%. The larvicidal and repellent results of the plant formulations generated in this study have demonstrated high potential for practical application in control of mosquito vector borne diseases and need to be deployed for large scale field trials and registered with the relevant bodies for adoption for control of mosquitoes.

OPTIMIZATION OF NUTRIENTS RELEASE PARAMETERS IN SYNTHESIZED HYDROGEL MINERALS ANCHORED MATERIAL FOR GROWTH OF SELECTED PLANTS IN EMBU COUNTY, KENYA

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Soil is the natural basis for plants growth as it not only provides support, water and minerals, but also helps to aerate the roots for proper development. However, due to the ever-growing population, available land is becoming a challenge. Urbanization also leads to insufficient surface for food production, as the arable land is used for settlement. This has further been exacerbated by erratic climatic conditions. Due to such limitations, this has compelled other options to be considered. Such options are growing of plants in soilless media that include hydroponic crop production and growing plants in sand, gravel or other liquids where the requisite nutrients are added. These methods allow a more efficient use of water and fertilizers, as well as better control of climate and pest factors. Despite the success in hydroponic production, there are challenges in that there is need for air circulation in the nutrient rich solution, plant support mechanism and disposal of the high concentrated nutrient solution into the environment after use putting a stress to the already stressed natural resource. Due to such limitations, there is a need therefore to come up with a method that will address such challenges. However, growth and propagation of plants for food crop can be made possible in soilless media if suitable
conditions are provided. The objective of the study was to synthesize a solid phase nutrient anchored substrate material for growth of selected plants watered by hydrogels of bio origin. The substrate material was synthesized and then characterized using Fourier Transform Infra-Red (FTIR) and Nuclear Magnetic Resonance (NMR) to confirm the modification. Suitable minerals were then anchored by complexation in the substrate material and this was confirmed by X-ray Photoelectronic Spectroscopy (XPS). The release parameter and concentrations of the minerals was investigated using Differential Pulse Anodic Stripping Voltammetry (DPASV) and Flame Atomic Absorption Spectroscopy (FAAS) respectively. The substrate material was watered using hydrogels synthesized by modification of biomass. The modified biomaterials were characterized using Thermo Gravimetric Analysis (TGA), UV –Vis and FTIR spectroscopy. It was observed that mineral released increased with decrease in pH and at a pH value of 5.5, 90% of the nutrients were available for plant uptake. It was found that complexation of Fe2+ had a stability constant of $1.99 \times 10^{14}$ M$^{-1}$. This implies that the non-biodegradable material has a potential application as a media for plants growth. The swelling ability of the hydrogels was investigated. It was found that the modified biomaterials had superabsorbent properties as the same had a capable of holding 30 times by mass content of water within 5 minutes of exposure. The plant growth media plus each respective hydrogels were then used for the growth of some selected plants (Spinacia oleracea L., Solanum tuberosum L. and Carica papaya). The modified biomaterials had a retention capacity of 90% for the first 4 weeks of application. It was also observed that growth analysis using the leaf area index were higher on plants grown in 10 g plant growth substrate media watered by 50 g of the cellulose-urea and cow dung-urea gels which were found to have an average growth rate of 0.045/wk. This growth was made possible by adequate aeration provided by volume variations of the gel and support provided by the solid particles of the soilless media. The hydrogel watered substrate was done in potted plants as well as in artificial gardens to grow vegetables rich in nutrients and the findings extrapolated for growth of some selected plants in an arid area. Therefore the synthesized materials have a potential application for the growth of crops in arid areas.

DIGESTIBILITY, GROWTH AND ECONOMIC PERFORMANCE OF NILE TILAPIA (OREOCHROMIS NILOTICUS) FED ON A MIXTURE OF PLANT PROTEIN DIETS IN CAGES

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Fish feed is one of the critical components in aquaculture production and accounts for over 60% of total operational costs with protein component being the most expensive ingredient. Traditionally, fishmeal (FM) has been the primary dietary animal protein source. However, with dwindling capture fisheries, FM has become increasingly scarce and expensive due to its demand from human consumers and livestock feed manufacturers. This in turn makes the cost of fish feeds expensive leading to low profit margins in farmed fish. Therefore, there is need to identify alternative, low cost, and nutritionally balanced sources of protein for the growth of the industry. Although plant-based protein sources are viable alternative in replacing FM, there have been no studies on mixture of plant proteins to establish their economic utility in fish farming. This study evaluated the effects of replacing freshwater shrimp (caridina nilotica) meal (FSM), with varying levels of soybean (Glycine max) meal (SBM), cottonseed (Gossypium spp) meal (CSM) and sunflower (Helianthus annuus) meal (SFM) on growth performance, digestibility, whole body composition and economic returns in diets of Nile tilapia (Oreochromis niloticus). Fingerlings averaging 25g in body weight were stocked in net cages installed in three 800m2 fertilized earthen ponds. Each pond had 15 cages evaluating five diets with three replicates for a culture period of six months. Three experimental set ups were designed to evaluate the efficiency of a combination of SBM with other plant protein sources in replacing FSM in fish diets. In trial 1, five isonitrogenous (30% CP) and isocaloric (3.5 kcal g$^{-1}$) diets were formulated, substituting Fresh water shrimp meal with Soybean meal at rates of 0, 25, 50, 75 and 100%. Trial 2 similar diets
as above were formulated replacing fresh water shrimp meal with a combination of SBM, CSM and SFM at rates 0, 25, 50, 75 and 100%. In Trial 3, similar diets as in experiment 2 were formulated replacing FM with a combination of CSM and SFM at rates 0, 25, 50, 75 and 100%. All fish were fed twice daily at 10% of their body weight. Data were expressed as means and standard error of the mean. Growth and proximate composition were analyzed using one-way ANOVA at p< 0.05, and differences among treatment means identified using Tukeys Multiple Range Test. Results from the study in trial 1, showed that fish fed on D0 had higher final weight (p<0.05) than those fed on D1, D2 and D3, while D4 had the lowest weight. In trial 2, fish fed on D1 showed growth performance that did not differ significantly from fish fed D0. However, highest FM replacement (100%), significantly (p<0.05) reduced growth performance. In trial 3, DO and D1 had significantly (p<0.05) higher mean weights than the rest of the treatments. In the three trials, similar survival was observed among treatments, but digestibility of protein decreased significantly (p<0.05) with increasing inclusion levels of PPSM in the diets. In trial 1, the ash content of carcass decreased significantly with increased levels of SBM. In trial 2, fish accumulated increasing levels of ash and crude fat with increasing levels of PPSM. In trial 3, crude fat increased significantly across all dietary treatments while ash content decreased with increasing levels of PPSM. Diet D3 in trial 1 was more economically viable although it was not significantly different (p>0.05) from D1 and D2. In trial 2 and 3, D0 and D1 were not significantly different hence D1 was more viable because it was cheaper than D0. Based on these findings, the present study concludes that the use of either pure fishmeal or fishmeal containing a mixture of 25% of plant proteins diets leads to similar growth performance in O. niloticus, the fishmeal containing the mixture of 25% plant proteins remarkably reduces the production costs and achieves higher profits than when the pure fishmeal is used. The present study therefore, recommends that for desirable net returns plant proteins can be used in fish farming.

**MODELLING JIGGERS INFESTATION AND INTERVENTIONS IN HUMANS: A CASE STUDY OF MURANG’A COUNTY, KENYA.**

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Tungiasis is a parasitic skin disease caused by jiggers, also known as sand fleas. The disease predominantly affects impoverished populations living in Sub-Saharan Africa, the Caribbean and South America. In areas especially with limited or no interventions, jigger’s infestation remains a problem. Mathematical models have been used for decades to inform public health policies and have been useful for the evaluation of control strategies and interventions. While some studies may have been done on jiggers, majority of them focused on social aspects of the disease. Very few mathematical models have been done on jiggers infestation. Considering the results and the interventions that come from models on vector borne diseases, a model on jiggers infestation and interventions in humans would be useful for the policy makers and government to intervene and come up with a solution to this menace. In this thesis, we present two deterministic mathematical models. First, we present a deterministic model with four compartments that represent the dynamics of the human population and an age-structured model for the flea. Second, we incorporated media campaigns in the first model with the aim of investigating the potential role of awareness through media campaigns on jigger’s infestation dynamics. We introduce a class of those that are aware in which the awareness does not completely protect individuals from jiggers. The model equilibria are computed and stability analyses carried out based on the reproduction number $R_0$. Sensitivity analysis is performed on the model parameters and the results suggest that the effective infestation contact rates, as well as the rate at which the larvae develop into adult fleas are the main parameters that fuel jigger’s infestation. Bifurcation analysis reveals that the model has an intrinsic backward bifurcation whenever the parameter that accounts for the proportion of larvae that develop into adult female fleas involved in jiggers transmission is included. The model points to control of the flea through treatment of infested humans and enhancing efficacy of media campaigns.
Zoonotic nontuberculous Mycobacteria (NTM) cross infect a wide range of domestic animals, wildlife and man causing various diseases. Despite the public health implications associated with mycobacterial infection and the existing close interaction of pastoralists and camels, information on diagnosis and epidemiology of zoonotic NTM amongst camels and closely associated community members is scanty. The present study was a one-health approach study involving diagnosis and epidemiology of zoonotic NTM infection among dromedary camels and associated household members in Samburu East sub-county. The study was cross sectional covering camels slaughtered at county abattoirs as well as household members and camels. Abattoirs sampled included Isiolo and Athi-River camel abattoirs, where all sampled camels were confirmed to have come from Samburu east. Household camel sampling strategy involved stratification of the study area to Wamba and Waso rearing areas. Sampling at abattoirs was consecutive for camels identified to have TB-like lesions during meat inspection. People presumed to have TB from amongst the sampled households were requested to provide a sputum sample. Screening of lactating camels for Mycobacteria infection was done using single intradermal comparative tuberculin test (SICCT) in a consecutive sample of 612 lactating camels from 83 households. A consolidated milk sample from all four mammary quarters was collected from 238 tuberculin test reactive camels. Post mortem (PM) examination was conducted on 1600 camels originating from the study area. A semi-structured questionnaire was administered to collect data on risk factors from 83 respondents. All milk, sputum and tissue samples were analysed at Kenya Medical Research Institute (KEMRI)/Centre for Respiratory Disease Research (CRDR) enhanced BSL2 laboratory using mycobacteriology, molecular speciation using GenoType® Mycobacterium line probe assay (HAINLifescience), drug susceptibility testing, 16S rDNA sequencing and phylogenetic analysis. This study was conducted between April, 2017 and December, 2018. Results indicated that the proportion of M. bovis and M. avium reactors was estimated at 6.05% and 39.38% respectively. Out of 238 milk samples, 57 (23.95%) had culture positive acid fast bacilli (AFB). Out of 132 suspected lesions on PM, 27/1600 1.69% (binomial 95%, CI: 1.11%-2.45%) were AFB positive on culture. Of the 48 sputum samples, 7 were AFB culture positive. The NTMs were observed to occur widely in various samples analysed, including post mortem lesions: M. fortuitum 17/27 (62.96%), M. scrofulaceum 3/27 (11%), M. szulgai 2/27 (7.4%); camel milk samples: M. szulgai 20/57 (35.09%), M. monacense 5/57 (8.77%), M. litorale 4/57 (7.02%), M. fortuitum 3/57 (5.26%), M. lehmannii 3/57 (5.26%), M. elephantis 3/57 (5.26%), M. duvalii 3/57 (5.26%); and in Human sputum samples: M. fortuitum 1/48 (2.08%), M. szulgai 2/48 (4.16%), and M. litorale 1/48 (2.08%) among others. These findings demonstrate high levels of infection with NTM in both humans and camels. Camel post mortem analyses revealed bronchial, mediastinal lymph nodes and lung lobes were most affected tissues. Several NTMs of medical importance with varying level of commonly used TB drugs sensitivity. The pattern of resistance to first-line TB drugs was as follows: Isoniazid (100%), rifampicin (97.9%) and ethambutol (65.3%). All NTM species isolated were highly resistant to first-line TB drugs. Camel breed, age, production system, origin of new introductions, migration and herd size were identified as risk factors for infection in camels (p<0.05). Surveillance and notification systems for NTMs including specific immunological test for NTMs diagnoses are needed. The public health significance of NTM in camels and humans needs further unravelling.

EFFECTS OF PROBIOTICS ON GROWTH, FLESH QUALITY AND HEMATOIMMUNOLOGICAL STATUS OF CULTURED NILE TILAPIA (Oreochromis niloticus) IN KIRINYAGA COUNTY, KENYA

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Nile tilapia (Oreochromis niloticus) culture in Kenya is mainly conducted in low input ponds where supplementary feed is given alongside pond fertilization. Excess nutrients in the culture water in form of nitrogen (N) and phosphorus (P) may make the culture environment susceptible to invasion by disease-causing microorganisms. In the recent past, probiotics have received much attention as a new strategy in fish health management and have been documented to improve fish growth performance and immunity in fish cultured in recirculating systems. However, their effect in tilapia cultured in low input ponds is still relatively unknown. In this study, monosex O. niloticus fingerlings with a mean weight of 39.75 ± 0.05 g were randomly stocked at 50 fish m⁻³ in 1.25 m³ cages in low input earthen ponds. The fish were fed twice daily at 3% body weight on seven isonitrogenous (28% crude protein) diets supplemented with either Saccharomyces cerevisiae (1×10¹⁰ CFU g⁻¹) or Bacillus subtilis (1×10⁹ CFU g⁻¹) at different levels as follows: No probiotic (Diet 0); S. cerevisiae at 2 g kg⁻¹ (Diet 1), 4 g kg⁻¹ (Diet 2) and 6 g kg⁻¹ (Diet 3); and B. subtilis at 5 g kg⁻¹ (Diet 4), 10 g kg⁻¹ (Diet 5) and 15 g kg⁻¹ (Diet 6) for a period of 7 months. The fish were sampled monthly for weight and length measurements. Hemato-immunological parameters were determined by blood sampling and hematological analysis for red blood cells, white blood cell and hemoglobin counts. Blood serum assay was conducted using commercial enzyme-linked immunosorbent assay (ELISA) kits to determine the serum protein, albumin, globulin levels and lysozyme activity. Microbiological samples were analyzed through sub-culturing to obtain pure cultures on nutrient media and enumerated through standard methods. Results of the trials indicated that the highest performance was achieved with Diet 2. The highest final weight (255.31 ± 3.19 g), Specific growth rates (SGR) (0.77±0.01% day⁻¹) and feed conversion ratio (FCR) (1.61 ± 0.02) were recorded in fish fed Diet 2. This was followed by fish fed Diet 5. Results of growth performance analysis indicated that fish fed on probiotic-supplemented diets had significantly better growth, nutrient utilization and FCR than fish fed on the control diet (P < 0.05). Probiotic supplementation significantly affected the body composition of the fish (P < 0.05). Saccharomyces cerevisiae at 4 g kg⁻¹ (Diet 2) led to significantly high protein (86.06%) (P < 0.05) while B. subtilis at 5 g kg⁻¹ (Diet 4) led to significantly higher protein (89.40%) (P < 0.05). Crude lipid and ash content were significantly lower in the fish fed probiotic supplemented diets (P < 0.05) compared to the control. Results of hemato-immunological analysis indicated that haemoglobin (Hb), red blood cells (RBC), white blood cells (WBC), serum protein, albumin, globulin and lysozyme activity were higher in fish fed on probiotic-supplemented diets and lower in the control group (Diet 0). Probiotic significantly affected hemato-immunological parameters (P < 0.05). Fish fed on probiotic supplemented diets retained the probiotics in their guts and had lower microbial load in their muscle (P < 0.05). This study shows that incorporation of probiotics in diets of Nile tilapia in low input ponds promotes growth performance, enhances body composition, improves immunity and manipulates gut microbiota of fish. The two probiotics differ in effect at different levels of application. Probiotic S. cerevisiae exhibited the best performance at 4 g kg⁻¹ while B. subtilis had the best performance at 10 g kg⁻¹. Probiotics are therefore recommended for use in low input fish culture systems for better nutrient utilization, higher yields and improved fish health for increased aquaculture production.
Food borne infections are an important public health concern worldwide with most being caused by pathogens that are zoonotic in nature. Among the most common food borne infection is listeriosis, caused by Listeria monocytogenes, a bacterium that is widely distributed in nature and which has been isolated in a wide array of foods. It mainly affects immunocompromised individuals including pregnant women, neonates and the elderly. Currently, in Kenya, there is no published data on the presence of this organism in ready to eat foods. The aim of this study was therefore to determine the prevalence, serotypes, virulence factors, genetic relationship and antibiotic susceptibility of L. monocytogenes from ready to eat meat products and milk products in Nairobi and its environs. A total of 570 samples; 350 milk products and 220 meat products were collected from selected retail markets in the study area. Isolation and identification was done as per the Bacteriological Analytical Manual protocol, and out of the 570 samples, 49 (8.59%) tested positive for Listeria spp after amplification of a 370 bp region of the prs gene. Twenty-one (42.8%) of these isolates were from milk products namely; milk powder (4.76%), short life pasteurized milk (4.76%), long life pasteurized milk (14.29%) and pasteurized milk from dispensing machines (76.19%). The rest, 28/49 (57.2%) were isolated from meat products namely; ham (7.14%), brawn (46.43%), polony (28.57%), salami (3.57%) and ready to eat meat bites (14.29%). Speciation of the Listeria isolates was done through multiplex PCR and of the 49 isolates, 22 were confirmed as L. monocytogenes through the amplification of a 509 bp region of the Lmo1030 gene. Of these L. monocytogenes isolates, 77.27% were from milk products while 22.72% were from meat products. The highest prevalence, 68.18 % was from dispensed milk while the lowest, 4.54% was from short life milk, long life milk and ham. Of the other 27 Listeria spp isolates, two were identified as L. welshimeri by amplification of a 281 bp region of the scrA gene while three were identified as L. innocua by amplification of a 749 bp region of the Lin0464 gene. The rest of the isolates, (22/27) were unidentified Listeria spp. The overall prevalence of L. monocytogenes was 3.86% (22/570). Molecular serotyping of the 22 L. monocytogenes isolates showed that 95.45% of the isolates carried both the ORF 2110 and the ORF 2819 genes characteristic of serotypes 4b,4d and 4e. A majority of these isolates (68.18%) were from milk collected from dispensing machines, two isolates from polony and an isolate each (4.55%) from long life milk, short life milk, brawn and ham. The remaining isolate (4.55%) carried the ORF2819 gene only, characteristic of serotype 1/2b, 3b, 4b, 4d, 4e and 7 and was isolated from brawn. All the isolates possessed hlyA, inlA, inlC, iap and actA virulence genes. Almost all the isolates (21/22) had the inlJ gene while inlB was only detected in 10/22 (45.45%) of the isolates. All L. monocytogenes were resistant to penicillin, 9.09% resistant to erythromycin and 4.54% resistant to sulfamethoxazole trimethoprim. All isolates were susceptible to gentamycin, chloramphenicol and tetracycline. The study concluded that processed ready to eat meat and milk products available to consumers were contaminated with the virulent form of L. monocytogenes that is responsible for up to 95% of Listeriosis cases reported worldwide. It is recommended that strict regulation of the processing and storage conditions of ready to eat foods be done to ensure they reach consumers pathogen free.

STRUCTURE-ACTIVITY STUDIES AND ON-HOST EVALUATION OF CONTROLLED-RELEASE FORMULATIONS OF OPTIMISED POTENT REPELLENTS AGAINST RHIPICEPHALUS APPENDICULATUS

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East Coast Fever (ECF), commonly known as theileriosis, is a tick-borne disease caused by a protozoan organism known as Theileria parva. It has been a major limitation in livestock production and food security in several developing countries. ECF is transmitted predominantly by the brown ear tick, Rhipicephalus appendiculatus. In Africa, it is estimated that about 1.1 million cattle suffer from ECF resulting to losses of about US dollars 168 million. In Kenya, approximately 50-80% of the national cattle population of about 10 million animals is vulnerable to tick infestations, and out of this number, 1% die of
ECF each year. Use of semiochemicals represents a prospective eco-friendly strategy for the control and management of the vector. Previously, on-host behavioral observations showed preference of R. appendiculatus adults to feed primarily inside and around the ear of their hosts. Combination of a repulsive blend from the anal region and an attractive blend at the ear was revealed to play natural “push” and “pull” roles, respectively, to guide the ticks to their predilection feeding sites. In a preliminary study, use of a crude repulsive blend obtained from the anal region at the ears was found to confuse the ticks, most of which dropped off the cattle. In a follow up study, 4-methylguaiacol was found to be the major component of cattle anal odour, and also most repellent to R. appendiculatus. Three sets of studies were then carried out. First, structure-activity of 10 analogues of 4-methylguaiacol and that of selected blends was performed at different doses in a dual-choice climbing assay set up. Each analogue showed either higher or lower repellency compared with 4-methylguaiacol. The structural feature that was associated with the highest repellency was 4-propyl moiety in the guaiacol unit (RD75 = 0.031 for 4-propylguaiacol; that of 4-methylguaiacol, RD75 = 0.564). However, blending selected analogues with high repellency showed no incremental increases in repellency compared with that of 4-propyl-2-methoxyphenol. Second, encapsulation of 4-propylguaiacol in β-cyclodextrin, ethyl cellulose and PVP, respectively, was carried out, and the inclusion of 4-propylguaiacol in the resulting complexes was confirmed by FT-IR, XRD and SEM. The rates and duration of release of the repellent from 0.2 g of each inclusion complex were then compared at 38-40 °C every 3 hours for 24 hrs. The β-cyclodextrin complex was found to last longer than the others with a release rate of 0.396 mg per hr. Third, on-host behavior effects of individual ticks (male or female) placed at one of six different body locations (i.e. forehead, shoulders, dewlap, escutcheon, hind leg and front leg) of Friesian steers, with no prior exposure to ticks, and tagged with β-cyclodextrin, ethyl cellulose or PVP inclusion complexes at one or both ears, were monitored. Tagging the treatment on one ear and both ears showed that β-cyclodextrin complex gave the best repellency with Mean ± SE of 0.64 ± 0.05 for tagging the treatment on one ear and Mean ± SE 0.35 ± 0.05 for tagging on both ears for ten days. Tagging the treatment on both ears gave 100% protection for seven days. This makes the complex a superior means of delivering the repellent and on-host use than the other complexes. The tagging on both ears was more effective than tagging on one ear. The most appropriate dosage was 0.5 mg with Mean ± SE 0.35 ± 0.05 when the treatment was on both ears. The β-cyclodextrin complex was found to repel the ticks for a longer time. This push approach exhibited by the β-cyclodextrin complex in small doses for a long time provides a potential tool to protect the cattle against the brown ear tick.

FACILE REMEDIATION OF FLUORIDE IN AQUATIC MEDIA USING MODIFIED POLYETHYLENE CONTAINER

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Development of environmentally friendly and economically viable water treatment techniques for remediation of fluoride ions in drinking water has gained a huge research interest. Fluoridated water is associated with dental and skeletal disorders disorders. Previously used water treatment methods encountered several limitations such as operational problems and are not regeneratable. Adsorption technique is easy to use and is regeneratable. Adsorbents used include activated carbon and bone char. However, activated carbon is expensive while bone char is not acceptable to some religions. Therefore there is need to search for cheaper and widely acceptable adsorbents. This research studied the use of polyethylene wastes from the environment as a green water treatment technique. Polyethylene wastes were separately dispersed in 1, 2-dichloroethane or liquid vegetable oil. The dispersed wastes were each divided into two where one portion was chemically modified with ethylamine, diethylamine and triethylamine separately. Both modified and unmodified adsorbents were characterized using fourier transform infra red spectroscopy (FTIR), nuclear magnetic resonance (NMR) and scanning electron microscopy (SEM). The characterized materials were subjected to removal of
fluoride ions and optimal parameters were applied. Liquid vegetable oil dispersed and activated with trimethylamine adsorbent gave an adsorption capacity of 10.30 mg/g at pH 7.0 fitting well in Langmuir model (R² = 0.864) and was a pseudo first order (R² = 0.726). When 1, 2 dichloroethane dispersed and activated with triethylamine adsorbent was used, removal capacity of 0.17 mg/g at pH 4.0 was recorded. Using fabricated container, Lake Baringo water sample having a fluoride ion concentration of 2.5 mg/L had its fluoride concentration reduced to 1.5 mg/L. Thermodynamic parameter proved that fluoride ions removal was a spontaneous and exothermic process. This study presents an ecofriendly and cheaper method for water treatment and helps to curb polyethylene waste menace in the environment.

DERIVATION OF CYCLE INDEX FORMULAS OF SEMIDIRECT PRODUCT GROUPS

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The concept of the cycle index formulas of a permutation group was discovered in the year 1937. Since then cycle index formulas of several groups have been studied by different scholars. For instance the cycle index of the dihedral group Dn acting on the set of vertices of a regular n-gon is known and has been applied in enumeration of different mathematical structures. In this study the relationship between the cycle index formula of a semidirect product group and the cycle index formulas of the two subgroups which the group is a semidirect product of was established. In particular the cycle index formula of the dihedral group Dn of order 2n is expressed in terms of the cycle index formula of a cyclic group of order two C2 and the cycle index formula of the cyclic group of order n, Cn; the cycle index formula of the symmetric group Sn is expressed in terms of the cycle index formula of the alternating group An and the cycle index formula of a group generated by a cycle of length two, h(ab)i. The cycle index formula of an a ne(p) group has been derived by considering the different cycle types of elements of the group and expressed in terms of the cycle index formula of Cp = fx + b; where b Zp and the cycle index formula of Cp;1 = fax; where 0 6= a Zp. We further extend this to a ne(q) where q is a power of a prime p and to the a ne square(p) and a ne square(q) groups. Finally, the cycle index formula of a Frobenius group is expressed in terms of the cycle index formula of the Frobenius complement H and the cycle index formula of the Frobenius kernel M. The cycle index formulas which are known such as that of the dihedral group and the symmetric group were used and the groups whose cycle index formulas are not known such as the a ne(p), a ne square(p); a ne(q) and a ne square(q) group were first derived as part of the research. It was noted that for semidirect groups which are Frobenius such as the dihedral group Dn with an odd value of n, the a ne groups and the a ne square groups, we can fully express the cycle index of the group in terms of the cycle index formulas of the subgroups which the group is a semidirect of. However, for semidirect product groups which are not Frobenius such as the dihedral group Dn with an even value of n and the symmetric group Sn, the cycle index formula of the group cannot be expressed fully in terms of the cycle index formulas of the subgroups the group is a semidirect product of.
As climate change continues to threaten ecosystems’ functions, agriculture remains one of the major source of greenhouse gas (GHG) emissions that are responsible for global warming. The major GHG in agriculture are; carbon dioxide (CO2), nitrous oxide (N2O) and methane (CH4). Unfortunately, agriculture is also one of the most affected sectors by climate change. There is therefore need to reduce emissions by adopting agricultural practices with mitigation potential. This is by enhancing soil carbon sequestration to offset emissions, or reducing emissions while safeguarding crop yields. However, little is still known about GHG quantities and intensities that major cropping systems in Kenya emit. Site specific studies on GHG emissions to establish interventions for mitigation of climate change and enhanced crop production is therefore of essence. The objective of this study was to examine the effect of reduced tillage, crop residue retention and use of controlled release urea (CRU) in maize-soybean cropping systems on GHG emissions, soil N mineralization, organic carbon stocks and yields. Field measurements were carried out in a 13 year old researcher-managed trial in Siaya county, Kenya between March 2016 and January 2017. Four treatment combinations: ZT M-S NU (reduced tillage+maize soybean rotation+normal urea), ZT M-S CRU (reduced tillage+maize soybean rotation+controlled release urea), ZT M/S (reduced tillage+maize soybean intercrop without urea), CT M-S NU (Conventional tillage+maize soybean rotation+normal urea) were tested. The treatments were laid out in a randomized complete block design. DAYCENT model was used to simulate soil carbon, N2O emissions and maize yields. Results showed that daily fluxes of N2O ranged between 0.5-26 g ha-1 d-1 and 2-10 g ha-1 d-1 in the long and short rainy seasons respectively. Cumulatively, N2O emissions were between 0.2 - 0.7 kg ha-1 and 0.2 - 0.4 kg ha-1 in the long and short rainy seasons respectively. In the short rainy season, ZT M-S CRU had significantly higher N2O fluxes than the other treatments (P=0.05). In the short rainy season there were no significant effects of treatment on N2O emissions. In the long rainy season, CO2 daily fluxes were between 9 to 42 kg ha-1 while the cumulative emissions ranged between 2.5 to 2.8 t ha-1. In the short rainy season daily CO2 fluxes ranged between 6 to 30 kg ha-1 while cumulative emissions were 1.8 - 2.5 t ha-1. There was no significant effect of treatment on CO2 emissions. Methane emissions were largely negative, and did not differ significantly among treatments. Yield was significantly low for ZT M/S but N2O emission intensities were not significantly different among treatments. DAYCENT simulated soil carbon and maize yield within the same ranges observed by measurement. N2O emissions by DAYCENT were higher during the peak of the seasons, but were comparable with observed measurements later in the seasons. Even though the long rainy season had higher N2O and CO2 emissions, the difference was not significant. These results indicate that emissions in the study area were low. These results further indicate that the current soil management practices in Siaya County influence GHG emissions, and the higher emissions observed with ZT M-S CRU in the long rainy season calls for further investigations of the effect of CRU on N2O emissions. The lower emission intensity shown by ZT M/S despite having lower yield points to the need of evaluating cropping systems for climate change mitigation and adaptation. These results indicated that DAYCENT model can be used to simulate soil carbon and yield but not N2O emissions in the study area.
Evidence abounds in literature that people are the preeminent resource that is key to the attainment of an organisational goal, and therefore performance of an organisation is contingent on the performance of its employees. To this end, the design and implementation of human resource management interventions has become a pivotal tool to provoke positive employees’ attitudinal and behavioural outcomes that, will in turn, occasion desired organisational performance outcomes. While empirical evidence of both significant and insignificant relationships between human resource management interventions, employee attitudinal outcomes, and performance has been registered in different contexts, however, evidence of such relationships has remained anecdotal in a Nigeria’s context where some institutions have undergone reforms to mitigate the crisis of underperformance. It is against this backdrop that this study sought to empirically investigate the relationship between human resource management interventions and performance of police force in Ondo State, Nigeria. The specific objectives sought by the study include: to determine the relationship between ability-enhancing interventions and performance of police force; to determine the relationship between motivation-enhancing interventions and performance of police force; to determine the relationship between opportunity-enhancing interventions and performance of police force; to establish the mediating effects of organisational commitment on the relationship between human resource interventions and performance of police force; and to establish the moderating effects of organisational justice on the relationship between human resource management interventions and performance of police force in Ondo State, Nigeria. The theories anchoring this study included Ability, Motivation, and Opportunity, Social Exchange, Affective Events, Self-Determination, and Resource-Based View theories. This study was guided by positivist approach, and both descriptive and explanatory research designs were employed. The study population comprised the entire 6,588 police personnel operating in all the 18 Local Government Areas in Ondo State, and employing Yamane’s formula a sample size of 377 respondents was determined. The respondents were selected using multi-stage sampling technique, and data were collected using self-administered questionnaire. The validity of the study’s instruments was ascertained using principal component analysis, and reliability of the study’s variables was achieved above the threshold of 0.7 for Cronbach Alpha value, in a pilot study conducted. Data collected from 321 respondents were analysed using both descriptive and inferential statistical methods. The descriptive statistics was employed to explain and summarise the characteristics of the survey data, and the inferential statistics through multiple regression method, having carried out the necessary diagnostic tests, was employed to test the various hypothesised relationships at 95 per cent level of significance. The study established that human resource management interventions positively and significantly influence performance of police force. Moreover, ability, motivation, and opportunity-enhancing interventions were statistically significant and positively influence performance of police force. Organisational commitment was found to partially mediate the relationship between human resource management interventions and performance of police force. Furthermore, the Administration of other agencies of Criminal
Justice System in Nigeria can use the recommendations offered in this study to design and develop Human Resource policies towards managing people to attain desired institutional goals.

**WELNESS PROGRAMS AND EMPLOYEE PERFORMANCE IN COMMERCIAL BANKS, KENYA**

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The objective of the study was to analyse the effect of wellness programs on the performance of employees in commercial banks in Kenya. Specifically, the study sought to determine the extent to which employee counselling programmes, drug and substance abuse cessation programmes and provision of recreational facilities affected employee performance within the commercial banks in Kenya. The study was guided by 3 theories namely, social comparison, social exchange and hierarchy of needs theories. The study was guided by a positivist philosophy and used descriptive research design targeting 30,903 employees of the 43 commercial banks in Kenya. Proportionate stratified sampling combined with purposive sampling was used to identify 395 respondents for the study. Pilot study was done to check on the reliability and validity of the instrument using Cronbach alpha (α) and expert opinion respectively. Structured questionnaires was used to source for primary data while other studies, libraries, worldwide web and organizational reports provided secondary data. Descriptive statistics and regression model was used to analyse quantitative data while content analysis was utilized to analyse qualitative data. A response rate of 71% was achieved and employee performance was found to be affected positively by the wellness programs provided by the banks. Recreational facilities had the highest effect (76.9%), employee counselling programmes (61.8%) while drug and substance abuse cessation programs (46%). The findings also found that employee performance was mediated by employee job satisfaction while employee characteristics also moderated the relationship between employee performance and wellness programs. The employees who would be satisfied with utilizing wellness programs would perform better evidenced by the reduced absenteeism levels, enhanced punctuality, enhanced morale, and reduced stress and anxiety among the employees. The moderating variable of employee characteristics affected employee punctuality, influence the speed at which the employees performed their assignments, helped in reducing employee stress, enhanced teamwork and ultimately improved the productivity and output levels. The study recommends that the employee counselling programmes should be enhanced, recreational facilities play a critical role in enhancing performance among employees and should be provided for the employees. The facilities should be accessible to most of the employees and appropriately flexible. The study also recommends that the commercial banks should endeavour to make employees be satisfied with their work so that they can enhance output, which can be done through job enlargement, enrichment and even rotation which ultimately enhances employee engagement. There is also need for commercial banks to consider the characteristics of the individual employees in its human resource practice. On policy level, commercial banks should consider policy changes on how wellness programs are considered in workplaces, either public or private and that there would be need to incorporate wellness programs and utilization as a measure to manage medical costs through the incorporation of the same in the Employment Law of Kenya. The study suggest that further studies be conducted on the cost benefit analysis of the wellness programs so as to demystify the “high” costs implication of the wellness programs regardless of the benefits out of it; on the impact of employee attitude on successful implementation of the wellness programs with the organizations and on the impact of employee counselling on employee performance.
MACRO ENVIRONMENT AND PERFORMANCE OF DONOR FUNDED HEALTH PROJECTS IN KENYA

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Projects have become an integral part of organizations’ strategy. Health projects in particular, have been found to carry out a critical function in enhancing the well-being of society. In Kenya, many health projects are funded by donors. Although the amounts of funding from donors have been rising over the years, most donor-funded health projects in Kenya are not performing well. According to the World Health Organization, almost 50 percent of health projects in Kenya do not achieve the performance measures of cost, time and quality. Recent studies have demonstrated that the macro environment comprising of the economic, social-cultural, political, technological, legal and the physical environment has a significant effect on the performance of government funded projects. However, there is scanty information on the effect of the macro environment on the performance of donor financed health projects in Kenya. This study specifically sought to determine the effect of social-cultural, economic, technological and political environments on the performance of donor funded health projects in Kenya. The moderating effect of top management support and the mediating effect of project risk management on the relationship between the macro environment, and the performance of donor funded health projects in Kenya were also investigated. The research was anchored on The Theory of Constraints and supported by Hofstede’s Cultural Dimensions Theory and The Goal Setting Theory. The study was guided by the positivism philosophy and it adopted an explanatory and descriptive research designs. A census of all the sixty-nine donor funded health projects initiated between 2008 and 2018, and were ongoing was conducted. Six section heads for the donor financed health projects at the Ministry of Health were also included in the study. Primary data was gathered by administering semi-structured questionnaires to identified respondents after seeking official authorization from relevant entities. Both descriptive and inferential statistics were applied in the analysis and presentation of data. Quantifiable data was examined using the Statistical Package for Social Sciences (SPSS) software while qualitative data was examined by content analysis based on patterns and themes. A multiple regression model was used to explain how the macro environment affects the performance of donor funded health projects in Kenya and to test hypothesis. The study found out that social-cultural, economic and political environment had a significant effect on the performance of donor funded health projects. The study further established that top management support moderated the relation between the macro environment and the performance of donor funded health projects. The research also determined that project risk management had a partial mediation on the relationship between the macroenvironment and the performance of donor funded health projects. Consequently, the study recommended that the government of Kenya should develop policies and frameworks that will minimize the negative effects of the economic environment and maximize the positive effects of the social-cultural and political environments on the performance of donor funded health projects. The study also recommended that all decision makers and other donor funded health project stakeholders should devise strategies for enhancing the performance of their projects within their macro environment. It is also imperative for the government and other stakeholders in the donor funded health projects to embrace project risk management practices to ensure the projects are successful. Furthermore, the donor funded health projects top management should provide the needed support in the initiation, planning, and execution of the projects to enhance the performance of the projects.

FOREIGN FINANCIAL INFLOWS AND STOCK MARKET DEVELOPMENT AT THE NAIROBI SECURITIES EXCHANGE, KENYA

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Despite the stock markets’ pivotal role towards economic growth, stock market development in Kenya and its contribution to economic growth is still an issue of great concern to policy makers and scholars. The Kenyan stock market is characterized by a small number of listing, lack of sophisticated infrastructure, narrow range of tradable instruments and very low liquidity. Moreover, the market is highly volatile as evidenced by high volatility in key market indicators during the period under study. Foreign investors play a significant role towards stock market development by enhancing the value of stocks and their liquidity. Hence, the study sought to establish the effect of foreign financial inflows on stock market development at the Nairobi Securities Exchange, Kenya. The Specific objectives of the study were to assess the effects of Foreign Direct Investment, Foreign Equity Portfolio, Foreign Debt Portfolio and Diaspora Remittances on stock market development at the Nairobi Securities Exchange, Kenya. The study further assessed the mediating effect of foreign investor participation on the relationship between foreign financial inflows and stock market development as well as the moderating effect of political risk on the relationship between foreign financial inflows and stock market development. The study was anchored on the Base Broadening theory, Foreign Direct Investment Dependence theory, Neoclassical Theory of Investment, Trade Off theory and the Pure Self Interest theory. The study adopted a positivism philosophy as well as causal research design methodology. The study adopted a census approach and time series data for the period 2008-2018 was obtained from Capital Markets Authority quarterly statistical bulletins, Central Bank of Kenya monthly reports, Nairobi Securities Exchange annual reports and the United Nations Conference on Trade and Development website, using a secondary data collection schedule. To ensure non-violation of the assumptions of classical linear regression, the following diagnostic tests were conducted; Normality, Heteroskedasticity, Autocorrelation, Stationarity and Multicollinearity and Model Stability test. The data was then analysed using correlation analysis, Modified Least Square Regression analysis and the Autoregressive Distributed Lag Model. The Modified Least Squares regression analysis was used in testing the direct effects of foreign financial inflows on stock market development while the autoregressive distributed lag model was used to test for existence of long run and short run cointegration with the aid of E-views 9.5 and SPSS 23 statistical software. The direct effect test indicates that diaspora remittances and foreign debt portfolio had positive and significant effect on stock market development whereas foreign direct investment had a negative and significant effect on stock market development. Foreign equity portfolio inflows however had negative but insignificant effect on stock market development at the Nairobi Securities Exchange, Kenya. The mediating effect of foreign investor participation on the relationship between foreign financial inflows and stock market development was not statistically significant. However, foreign investor participation was positive and significant as a predictor of stock market development. Political risk was not significant both as a predictor of stock market development and as a moderator in the relationship between foreign financial inflows and stock market development at the Nairobi Securities Exchange. The autoregressive distributed lag test results support the existence a significant short run positive effects of all foreign financial inflows on stock market development as evidenced by the negative and significant coefficient of the Error Correction Term (ECT). However, in the long run only diaspora remittances and foreign debt portfolio had a significant positive effect on stock market development while foreign direct investment had a significant negative effect on stock market development. The effect of foreign equity portfolio on stock market development was equally negative but insignificant in the long run. In view of the foregoing findings, the study recommends that the Kenyan government needs to devise measures that would boost foreign investor confidence and thus attract increased diaspora remittances and foreign debt portfolio investment. Additionally, the Capital Markets Authority needs to implement policy measures that will attract active participation of the local investors to invest at the Nairobi Securities Exchange. This will give the bourse more stability, liquidity and subsequently lead to increased value of stocks listed at the market.
DYNAMIC CAPABILITIES AND PERFORMANCE OF SELECTED MANUFACTURING FIRMS IN KENYA

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Dr. Ann Muchemi

Performance of food manufacturing firms has been on a declining trend leading to the relocation of some firms to other countries. As a result, the country has been experiencing frequent food deficits. The search for how performance can be enhanced has led scholars and managers to consider dynamic capability to be at the heart of firm strategy. This study, therefore, sought to examine how dynamic capabilities influence the performance of selected manufacturing firms in Kenya. The specific objectives were to assess the effect of adaptive capabilities on performance of food manufacturing firms in Kenya, to determine the effect of marketing capabilities on performance of food manufacturing firms in Kenya, to establish the effect of alliancing capabilities on performance of food manufacturing firms in Kenya, to examine the effect of managerial capabilities on performance of food manufacturing firms in Kenya, to establish the moderating effect of firm size on the relationship between dynamic capabilities and performance of food manufacturing firms in Kenya and to assess the mediating effect of firm competence on the relationship between dynamic capabilities and performance of food manufacturing firms in Kenya. Adaptive capability, marketing capability, alliancing capability and managerial capability were the dependent variables of the study. Firm competence and firm size were the mediating and moderating variables, respectively. The study was grounded on the dynamic capability theory supported by the competence-based theory, the upper echelons theory, the resource-based theory, the stakeholder theory and the BSC framework. The study was founded on a positivist research philosophy and utilized a descriptive and explanatory research design. The population consisted of 70 food manufacturing listed in the Kenya Association of Manufacturer’s directory. Primary data was collected from 190 respondents using self-administered semi-structured questionnaires selected using a proportional stratified sampling technique. Descriptive statistics were computed to describe the characteristics of the study variables and multiple regression analysis was conducted to determine the nature and magnitude of the relationships between the independent and dependent variables. The findings show that there is a significant direct and positive effect of adaptive capabilities, marketing capabilities, alliancing capabilities and managerial capabilities on performance of food manufacturing firms in Kenya. The findings also show that firm competence partially mediates the relationship between dynamic capabilities and performance of food manufacturing firms in Kenya. Firm size was found not to have a moderating effect on the relationship between dynamic capabilities and performance. The findings supported the theoretical foundation of the dynamic capabilities theory that firm performance and sustainable competitive advantage depends on its ability to react rapidly and flexibly to changing market environments. The study recommends that the management of food manufacturing firms should set aside budgets to build dynamic capabilities. Food manufacturing firms should also build alliances with producers of raw materials to stabilize the supply of inputs and customers to stabilize the market for processed food. They should also cooperate with peers to solve industry problems and engage government agencies for a favorable regulatory framework. The firms should also build technological competences through sponsoring employees for technical training and invest in the development of capabilities that increase their ability to reconfigure themselves to cope and thrive even during times of unexpected adversities.

INFORMATION TECHNOLOGY INTEGRATION AND PERFORMANCE OF SELECTED PUBLIC HOSPITALS IN KENYA

Iloka Kenneth Malongo-PHD

Department: Business Administration

Supervisors: Dr. Stephen Muathe
Kenya’s health sector is faced by inefficiencies and ineffectiveness that deter the achievement of its citizens’ goals of universal health, fairness, cost effectiveness, acceptance and sustainable development. Kenya’s Vision 2030 outlines provision of healthcare as key to improving the quality of life for all Kenyans while public hospitals guarantee improved citizens’ wellbeing. Universal health coverage is one of the pillars in the Big Four Agenda to be achieved by the Government of Kenya by the year 2022. The Ministry of Health has underlined Information Technology Integration as one of its reform strategies to ensure public health institutions perform better. Despite the increasing demand and need for healthcare, performance of public hospitals has been crippling. Therefore, this study investigated the effect of information technology integration on performance of selected public hospitals in Kenya. The specific objectives were to: establish the effect of human information technology integration on performance of selected public hospitals; determine the effect of organizational information technology integration on performance of selected public hospitals; analyze the effect of information technology infrastructure integration on performance of public hospitals; analyze the moderating effect of organizational characteristics on the relationship between information technological integration and performance of selected public hospitals; analyze the mediating effect of user perception on the relationship between information technological integration and performance of selected public hospitals in Kenya. This study was anchored on Technology-Organization-Environment Model, Technology Acceptance Model, Diffusion of Innovations Theory as well as Dynamic Capabilities Theory. The study was guided by positivism research. An explanatory and cross-sectional survey research design were utilized. The target population of the study included ninety-eight, public hospitals in Kenya which have integrated managed equipment services, comprising ninety-four from the forty-seven counties and four national referral hospitals. A sample size of 294 respondents was drawn using proportionate stratified random sampling. The study used primary data collected using self-administered structured questionnaire. To analyze the features of the surveyed public hospitals and the respondents, descriptive statistics were used. Multiple regression analysis was carried out to determine the effect of information technology integration, organizational characteristics and user perception on performance. Results from the study showed that integration of human-information technology, organizational information technology integration and infrastructure flexibility had a significant positive impact on the performance of public hospitals in Kenya. The study further found that the characteristics of the organization and the perception of the users respectively moderated and mediated the relationship between the integration of information technology and the performance of public hospitals in Kenya. The study concluded that the integration of information technology in public hospitals plays an important role in increasing hospital efficiency, relevance, effectiveness and financial viability. The study recommends enhanced use of integrated information technology by public hospitals in Kenya for improved performance hence better service delivery.

TOP MANAGEMENT TEAM CHARACTERISTICS AND PERFORMANCE OF INDEPENDENT REGULATORY AGENCIES IN KENYA

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There has been great variation in organizational performance of independent regulatory agencies in Kenya, with some exhibiting exceptional outcomes in delivering on their mandates, while others are performing dismally. Previous researches have demonstrated that top management team characteristics affect organizational performance. This study purposed to investigate the effect of strategy execution and legal environment on the relationship between top management team characteristics and performance of the independent regulatory agencies in Kenya. The specific objectives of the study were; to determine the effect of top management team demographic characteristics, to examine the effect of top management team psychological characteristics and to assess the effect of top management team
cognitive characteristics on the performance of the independent regulatory agencies in Kenya. The study also aimed to establish the mediating effect of strategy execution on the relationship between top management team characteristics and performance, and lastly to evaluate the moderating effect of legal environment on the relationship between top management team characteristics and performance of the independent regulatory agencies in Kenya. The study was anchored on upper echelons theory, resource based view theory, the contingency theory, open systems theory and stakeholder theory. To achieve these objectives, the study adopted descriptive cross-sectional research design. The target population of the study was the twenty-three independent regulatory agencies currently existing in Kenya. The study adopted a census survey of the top management team members in the twenty three independent regulatory agencies in order to capture the required information. Primary data was gathered using structured questionnaire administered through drop and pick later method. Descriptive statistics were then used to summarize the survey data into percentages, frequencies, means and standard deviations. Inferential statistics employed regression analysis to test hypotheses and draw conclusions. Baron and Kenny, and Whisman and McClelland models were used to test for mediating and moderating effects respectively. The results of the study showed that there is no significant effect of top management team demographic characteristics on performance of the independent regulatory agencies. The results further showed that top management team psychological characteristics significantly affect performance of the independent regulatory agencies. Further, it was established that top management team cognitive characteristics significantly affect performance, strategy execution partially mediates the relationship between TMT characteristics and performance and lastly, that legal environment moderates the effect of TMT characteristics on performance of the independent regulatory agencies in Kenya. The study recommends that the recruitment process of TMTs should include psychological and cognitive characteristics as requirements apart from the demographic characteristics requirements mostly in use. The study further recommends that independent regulatory agencies need to develop a reward system for their TMTs who excel in executing their organizational strategies so that they can be motivated and to provide an opportunity for the managers to compete amongst themselves in order to achieve superior organizational performance. The study also recommends that the judicial system should recognize and support the work of the independent regulatory agency in enforcing regulations for their sectors or subsectors. Lastly the study recommends that the independent regulatory agencies should have stable funding mechanism to enable them to execute their mandates and to be operationally autonomous.

RESULTS-BASED MANAGEMENT AND SUSTAINABILITY OF WATER SUPPLY PROJECTS IN INFORMAL SETTLEMENT AREAS IN NAIROBI CITY COUNTY, KENYA

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Sustainability of water supply continues to be a global priority due to water stress and scarcity attributable to climate change and other anthropogenic factors. The situation is especially dire in informal settlement urban areas which are beleaguered by a strain on extant water supply infrastructure due to population increase resulting from rural-urban migration. Collaboratively, stakeholders in this space have implemented water supply projects in these areas. However data collected from Nairobi City County informal settlement areas reveal that these water supply projects have registered soaring failure rates with the existing water supply systems running below the intended operational capacity. Further, the current regulatory policy is not explicit on water supply management in informal settlement areas. Considering that water is a human right and key resource for economic development, ensuring sustainability is imperative. This research was premised on the argument sustainability is under the project manager’s purview and should be intrinsic to project management approaches and activities. The main objective of this study was therefore to investigate the effect of Results-Based Management on sustainability of water supply projects in the informal settlement areas in Nairobi City County,
Kenya. The specific objectives were to establish the effect of Results-Based Management principles namely: accountability, national ownership and inclusiveness on sustainability of water supply projects. The study further investigated the moderating effect of regulatory policy on the relationship between Results-Based Management and sustainability of water supply projects. The main theory underpinning this study was the Four-Capital Model, supported by other theories: Public Value Theory, Stakeholder Theory and Agency Theory. The study was guided by the positivism philosophy and employed an explanatory, non-experimental research design. The target population of this study comprised 741 leaders of projects implemented by the Nairobi City Water & Sewerage Company in informal settlement areas in Nairobi City County. A sample of 260 project leaders obtained through stratified random sampling was considered and 194 respondents participated in the study. Data was collected through semi-structured questionnaires. Quantitative data was analyzed through descriptive and multiple linear regression analysis using SPSS while qualitative data was analyzed using content analysis. The study established that the combined effect of Results-Based Management accounted for seventy-five per cent of the variation in sustainability of water supply projects in informal settlement areas of Nairobi City County. Separately, the independent variables (accountability, national ownership and inclusiveness) showed a positive and statistically significant effect on sustainability. The study also established that the moderator, regulatory policy had a positive and significant effect on the relationship between Results-Based Management and sustainability. The study concluded that water supply projects should strive to strengthen accountability and inclusiveness mechanisms. The project implementers should also ensure that the projects address local community priorities. The study recommended that the projects enhance participatory evaluation, conduct regular assessment of the project managers’ performance, improve the existing policy framework to meet the needs of informal settlement areas and develop sustainability plans with which they can monitor and evaluate specifically for sustainability.

LAGGED DISTURBANCES AND VOLATILITY OF SECTORAL RETURNS IN THE NAIROBI SECURITIES EXCHANGE, KENYA

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The securities market plays an integral role in any well-functioning economy. In particular, it helps in raising of equity capital, provision of investment opportunities, and transfer of funds from surplus agents to deficit agents. In order to attain Vision 2030, the Nairobi Securities Exchange (NSE) is expected to play a key role in the economic pillar of this blueprint by perpetuating the mobilization of resources for implementation of envisaged flagship programs and projects. However, despite the key importance of the NSE in the local and regional economy, this market has exhibited high levels of volatility of returns. This is inferred by the huge responses to sectoral and systematic shocks that have been observed in the NSE, as well as extant empirical evidence of high levels of volatility persistence in its sectors. Therefore, it is vital to understand the NSE sectors’ shock and volatility transmission linkages since this can enhance portfolio selection processes, help in forecasting of future sectoral volatility, and guide market regulators in mitigating the adverse effects of shock and volatility transmission. The main objective of this study was to establish the extent to which volatility of sectoral returns in the NSE, as at any specified time period, is influenced by lagged disturbances. In particular, the study investigated the influence of own past shocks; cross past shocks; own past volatility; and cross past volatilities on the volatility of each NSE sector. Further, the study also investigated the moderating effect of liquidity on the relationship between own past volatility & shocks and volatility of each NSE market sector. Weekly secondary time series data for the 6th June 2008 to 8th February 2019 period was used for all analysis processes. The study utilized a VAR(1)BEKK MGARCH(1,1) model to investigate the influence of lagged disturbances on sectoral volatility in the NSE. The moderating effect of liquidity on own shock and volatility transmission effects was appraised using the Irwin and McClelland (2001) two step process and estimation of GARCH(1,1) models with exogenous variance regressors.
All empirical analysis was undertaken using the WinRATS Version 10 software package. Results indicated that own past shocks influence volatility of all NSE sectors. In addition, volatility of each sector of the NSE in any given week was found to be responsive to cross shocks from the previous week, although the prevalence of these effects wasn’t uniform across all sectors. Moreover, the study found evidence of significant own volatility transmission effects in six NSE sectors. Further, there was evidence of cross volatility transmission linkages in all sectors, though these linkages were more prevalent in some sectors than others. The study also found out that liquidity moderates own shock and volatility transmission effects in the Agricultural, Automobiles & Accessories, Commercial & Services, and Energy & Petroleum sectors only. On the basis of these results, several policy implications of the study are outlined: When sectoral shocks are detected, investors and portfolio managers should prepare for an elevation of idiosyncratic volatility in the near future and undertake mitigation measures in advance, depending on the shock transmission linkages of the affected sector(s). Regulatory authorities should also monitor markets proactively and be ready to enforce administrative measures to prevent speculative gains and dramatic losses that can lead to a spike in volatility immediately after a major sectoral shock. Moreover, portfolio managers and investors should use the unveiled shock transmission patterns in tandem with their respective portfolio allocation strategies when choosing the sectors to invest in. Additionally, investors should avoid forming portfolios with stocks of sectors that are linked by shock and volatility transmission linkages. Finally, since the study found out that liquidity moderates the transmission of own shocks and own volatility in four NSE sectors, it is suggested that volatility management measures for portfolios that include stocks from these four sectors should be robust enough to take into account the extant moderating effect on liquidity.

FIRM CHARACTERISTICS AND FINANCIAL STABILITY OF COMMERCIAL BANKS IN KENYA

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A stable banking sector is significant in ensuring economic growth as well as sound, efficient and stable financial system. However, the banking sector has been considered fragile and this is evident from the increasing trend of non-performing loans, fluctuating deposit trend of some commercial banks and increasing trend of foreign liabilities held by commercial banks in Kenya which is associated with financial stability. Furthermore the collapsing of commercial banks and some being put under receivership is of great concern to the financial stability of the commercial banks in Kenya. The Central Bank of Kenya (CBK) uses the CAMEL model whose firm characteristics namely, capital adequacy, asset quality, management efficiency, earnings/profitability and liquidity are used as measures of ascertaining the financial stability of commercial banks in Kenya. Despite the CBK’s adoption of the CAMEL model, the banking sector in Kenya has been considered fragile. It is the need to investigate the link between firm characteristics and financial stability of commercial banks in Kenya, which triggered the desire to undertake this study. The general objective of the study was to establish the effect of firm characteristics on financial stability in commercial banks, Kenya. The specific objectives of the study were to determine the effect of operational efficiency, capital adequacy, bank liquidity, profitability and asset quality on financial stability of commercial banks in Kenya. Exchange rate was utilized to ascertain the moderating effect between firm characteristics and financial stability of commercial banks in Kenya. The study has been underpinned on Agency Theory and supported by Efficiency Structure Theory, Buffer Capital Theory, Liquidity Shiftability Theory and Information Asymmetry Theory. Causal research design was employed. The study was carried out in 17 fragile commercial banks in Kenya, between years 2011 to 2018. The study carried out normality test, panel unit root test, autocorrelation, heteroscedasticity test and multicollinearity test. Generalized Method of Moments (GMM) model guided by dynamic panel regression results revealed that operating efficiency had a statistically significant positive effect on financial stability of commercial banks in Kenya. Capital adequacy had a statistically significant negative effect on financial stability of
commercial banks in Kenya. The study further revealed that bank liquidity had a statistically insignificant negative effect on financial stability of commercial bank in Kenya. In addition, profitability had a statistically significant negative effect on financial stability. Asset quality had a statistically significant positive effect on financial stability. Exchange rate had a statistically significant negative effect on the relationship between firm characteristics and financial stability of commercial banks in Kenya. The study concludes that firm characteristics namely operating efficiency, capital adequacy, profitability and asset quality are strongly linked to financial stability of commercial banks in Kenya. The study recommends for mergers and acquisition among the fragile commercial banks as per the fragility index, adoption of internal economics of scale, limits on insider loans to be established, credit to borrowers should not exceed 15% of the capital and adoption of unified exchange rate. This would ensure a sound and vibrant economy towards achieving the Vision 2030 that advocates for well-functioning, efficient and stable financial system.

**BUSINESS SPECIFIC FACTORS AND CREDIT RATIONING AMONG REGISTERED SMALL AND MEDIUM ENTERPRISES IN KIAMBU COUNTY, KENYA**

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Dr. Job Omagwa

The economic potential of Small and Medium-sized Enterprises (SMEs) have been recognized worldwide. However, the existence of credit rationing has hampered realization of the same. The prevalence of credit rationing has been evidenced by the documented SMEs financing gap which is within the range of 2.1 to 2.6 trillion British pounds and the proportion of SMEs financing to total lending in the world, which averages 23.4 percent in any financial year. A similar credit rationing situation is being experienced in Kenyan, such that, on average SMEs are awarded at most 17.4 percent share of amount of loans available in the credit market. Hence, the study sought to establish the effect of business specific factors on credit rationing among registered SMEs in Kiambu County, Kenya. The specific objectives were: to determine the effect of business credit history, business repayment capacity, collateral and business size on credit rationing among SMEs in Kiambu County, Kenya. The study adopted positivism research philosophy and utilized explanatory study design. The target population was 41,115 registered and active SMEs located within Kiambu County, Kenya. A sample size of 397 SMEs was randomly selected based on inclusion and exclusion criteria: that is having applied for credit once during the period of study (2013-2017) and denied or awarded less amounts than the amount applied. Structured questionnaire was used to collect data relating to business specific factors and credit rationing, while data on inflation was collected from Central Bank website by use of data collection sheet. The data were analyzed using descriptive statistics and inferential statistics got by undertaking logistic regression analysis. The results of correlation analysis indicated that the business specific factors were sufficiently different measures of separate variables, and consequently, this study utilized all the variables in undertaking logit regression analysis. In regard to logit regression analysis, the study found that: credit history, repayment capacity and size of business have statistical significance effect on credit rationing. However, collateral have statistical insignificance effect on credit rationing. The findings from the testing of moderating effect of inflation on the relationship between business specific factors and credit rationing indicated that there exists statistically significant moderating effect of inflation on the relationship between business specific factors and credit rationing. Guided by the findings, a number of recommendations were made. First, SMEs should comply on timely credit repayment as well as repayment of the required credit installment in order to improve their future credit evaluation. Secondly, SMEs should improve on their repayment capacity by managing their sales and expenses in a manner to improve on their net profits. In addition, the proprietors of SMEs should diversify on other sources of income which may increase the repayment capacity. Thirdly, the SMEs should improve on their sizes as reflected by capital employed and sales turnover. With regards to capital employed, the proprietors can enhance the policy of maintaining retained earnings, while the government can introduce seed capital to
any new coming proprietors. Lastly, the existence of moderating effect of inflation implies that the government should institute monetary policies geared to maintaining inflation to a levels which should not adversely affect the borrower and the lender.

**STRATEGIC CAPABILITIES AND ORGANIZATIONAL PERFORMANCE: A CASE OF PRIVATE UNIVERSITIES IN KENYA**

King’oo Ruth Ndanu-PHD

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Dr. Godfrey Kinyua

Private Universities in Kenya have continuously faced a number of challenges such as declining quality of educational programs, quality of research, authenticity of degrees granted, flexibility of the university programs, innovations created and efficient utilization of resources at their disposal. Despite the increasing number of students seeking higher education, these numbers have not translated to better performance in these Universities. Modern business environment calls for organizations, including private Universities to identify and exploit strategic capabilities for them to effectively compete and boost their performance. These universities need to harness their resources, and exploit their competences in order to gain competitive advantage. This study sought to establish the effect of strategic capabilities on performance of private Universities in Kenya. Specifically, it sought to determine the effect of information technology capability, human capital capability, networking capability, and intellectual capability on performance of private Universities in Kenya. The study also sought to determine the mediating effect of competitive advantage and the moderating effect of organizational culture on the relationship between strategic capabilities and performance of private Universities in Kenya. The study was anchored on Resource-based view theory, organizational learning theory, intellectual capital theory, human capital theory, balanced scorecard model and the institutional theory. Further, the study was founded on positivism philosophy and adopted a descriptive survey research design. The target population for the study was the 31 private universities in Kenya while a sample size of 153 respondents was selected using stratified random sampling technique. The respondents included the faculty deans, registrar administration and finance, human resources managers and ICT managers. Primary data was collected using semi structured questionnaire. Quantitative data was analysed using descriptive and inferential statistics and presented using figures and tables. Qualitative data collected through open ended questions was analysed using common themes and presented in narrative form. In testing the significance of the model, the coefficient of determination and F-statistic was computed at 95% confidence level, while hypothesis testing was done using p values at 5% significance level. The study found that information technology capability, human capital capability, networking capability, intellectual capability, and competitive advantage were adopted to a moderate extent. However, organizational culture was emphasised to a large extent. The study concluded that information technology capability, human capital capability, networking capability and intellectual capability had a significant positive effect on performance of private universities in Kenya. Competitive advantage had a partial mediating effect while organizational culture had a significant moderating effect on the relationship between strategic capabilities and performance of private Universities in Kenya. The study contributes to the body of knowledge by filling contextual, empirical, and conceptual gaps earlier identified in literature. The study recommends that private universities should seek to acquire and maximise information technology capability, human capital capability, networking capability and intellectual capability, in order to boost their performance. Private universities should also differentiate their programmes, manage their cost, and develop market-oriented programmes and specialisations to generate competitive advantage. Finally, private universities should promote learning culture, employee involvement, be customer centric, innovative, and supportive culture. The study suggested that other studies should be conducted in public universities in Kenya and other countries and in other institutions of higher learning to establish if similar conclusions will be reached.

**FUNDAMENTAL RISK FACTORS AND PROFITABILITY OF COMMERCIAL BANKS IN NIGERIA**
Commercial banks undertake significant roles in the economic resource allocation of countries. The financial intermediation roles performed by banks are however largely dependent on profitability. The fluctuating profitability trend of commercial banks in Nigeria is bringing about high concerns among various stakeholders. The study sought to assess the effect fundamental risk factors on profitability of commercial banks in Nigeria. The specific objectives were to establish the effect of price level fluctuation, exchange rate fluctuation and interest rate fluctuation on profitability of commercial banks in Nigeria. The study further sought to assess the moderating effect of bank competitiveness on the relationship between fundamental risk factors and profitability of commercial banks in Nigeria. The study was anchored on Agency Theory, Deflation Theory, Expectations Theory of Exchange Rates, Liquidity Theory of Interest Rates, Market Power theory, Agency Theory and Financial Intermediation Theory. The study adopted positivism research philosophy and causal research design. The target population of the study comprised of the twenty one commercial banks in Nigeria with the sample comprising of the seventeen commercial banks which were fully operational within the study period. The study therefore was based on purposive sampling design. The study applied annual panel data for the period 2010 to 2017 which was sourced from the published audited financial statements of commercial banks and the Nigeria National Bureau of Statistics. Data was analyzed based on descriptive, correlation and panel regression analyses. Hypotheses of the study were tested at 0.05 significance level. Correlation analysis indicates that fundamental risk factors and bank competitiveness had significant correlation with profitability of commercial banks in Nigeria. Based on the panel regression analysis, the study found that price level fluctuation had a significant effect on profitability of commercial banks in Nigeria based on return on assets ($\beta=0.003$, $p=0.0170$) and net interest margin ($\beta=0.0028$, $p=0.0380$) and no significant effect based on return on equity ($\beta=0.0027$, $p=0.0660$). The study findings indicate that exchange rate fluctuation had a significant effect on return on assets ($\beta=-0.0002$, $p=0.0440$) and insignificant effect on return on equity ($\beta=-0.0002$, $p=0.0510$) and net interest margin ($\beta=-0.0002$, $p=0.0560$). Interest rate fluctuation had a significant effect on return on assets ($\beta=0.0136$, $p=0.0090$), return on equity ($\beta=0.0139$, $p=0.0110$) and net interest margin ($\beta=0.0155$, $p=0.0010$) of commercial banks in Nigeria. Bank competitiveness had a significant moderating effect on the relationship between price level fluctuation and return on assets ($\beta=0.0414$, $p=0.0400$), return on equity ($\beta=0.0484$, $p=0.0130$) and net interest margin ($\beta=0.0415$, $p=0.0390$). Bank competitiveness had no significant moderating effect on the relationship between exchange rate fluctuation and profitability. Bank competitiveness had no significant moderating effect on the relationship between interest rate fluctuation and profitability of commercial banks in Nigeria. The study recommends that managers of commercial banks should fully anticipate price level fluctuation in the country and that of other countries which they also operate in. In periods of severe exchange rate fluctuation, bank management should hedge against this by increasing their divestment options and switching trading options to less volatile currencies. Bank managers can take advantage of periods of high loan demand and moderately charge higher loan rates accordingly. Price discrimination can also be employed by the managers of commercial banks by attaching different interest rates on loans for different customers which can be guided by their credit history.

VENTURE CAPITAL FINANCING AND GROWTH OF SMALL AND MEDIUM ENTERPRISES IN NAIROBI CITY COUNTY, KENYA

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The usage of venture capital is fundamental for the growth of Small and Medium Enterprises (SMEs) for economic and political development of a nation. SMEs in emerging economies do experience growth constraints compared to those in developed countries, in terms of institutional longevity, asset base, employment and revenue generation. Growth of registered SMEs in Kenya declined from 204 SMEs in the year 1999 to 47 in the year 2015 representing 77% drop in SMEs. Subsequently, over 50% of SMEs closed their businesses at the age of 4 years in Nairobi, yet Nairobi City County contributes over 50% of the national GDP. Main reasons for stagnation and closures are poor usage, cost and lack of finance. Realizing the difficulties of accessing credit from financial institutions, SMEs in Kenya seek alternatives sources of financing such as borrowings from relatives and friends which are unreliable and unsustainable. In retrospect, venture capital financing provides an alternative credit, a fundamental financial leverage which comes along with a simple and structured financing methods, cost and management support towards the SMEs. It has remained unclear, however, whether the usage of these critical financial leverages in venture capital financing do contribute to the growth of small and medium enterprises in developing countries as desired. Therefore, the general objective of the study was to investigate the effect of venture capital financing on the growth of small and medium enterprises in Nairobi City County, Kenya. The County has a higher concentration of both venture capital firms and small and medium enterprises. This study adopted positivist research philosophy. Descriptive research design was used to study the target population of 97 small and medium enterprises which had received venture capital financing over the last five-year period from 2013 to 2017. Using a stratified simple random sampling design technique, a sample of 79 venture capital backed SMEs was selected and questionnaires administered to obtain both primary and secondary data. The response rate of 64.56% was adequate for analysis and drawing inferences. The study used multiple regression analysis. To address various research biases common in multiple regression analysis, diagnostic tests were undertaken namely: Test for normality, homoscedasticity, multicollinearity and autocorrelation. The study found out that 48.4% of variation in SMEs growth was due to venture capital financing. The unexpected finding was that cost of venture capital financing is positively related to the growth of venture capital. The study found that the more the cost of venture capital was used the higher the growth realized by SMEs. This was because cost of venture capital was found to be responsible for the development of technical and management skills critical for the internal operation of the business, development of customer focused strategies and this immensely contributed to growth of the SMEs. The study further found that financing method has a positive effect on the relationship between venture capital financing and SMEs growth. It was also found that management support has a positive effect on growth of SMEs. Financial performance was found to be a significant partial mediator while regulatory framework was not found to be a moderator in the relationship between venture capital financing and SMEs growth. Given that cost of venture capital positively influences SMEs growth, the study recommends that a cost containment-revenue growth trade off strategy be embraced by both venture capitalists and SMEs and due consideration given to cost during the budgeting process. Venture capital-backed SMEs should embrace management boards for professional advice as this is a fundamental management support. Further research should be undertaken to establish other factors that explain the 51.6% variation in SMEs growth.
Computer Aided Design (CAD) and Computer Aided Manufacturing (CAM) is the use of technology to design and produce textile goods with greater productivity at low cost. It’s usage demands some level of training and competency. The purpose of the study was to assess CAD CAM training, competency and usage in textile industries of Northern Nigeria in order to develop a CAD CAM training model. The objectives of study were to identify the level of CAD-CAM training received, to examine the competencies of textile staff, to determine the relationship between work experience and CAD-CAM usage, to establish the relationship between the availability of CAD-CAM program and CAD-CAM usage, to determine the organizational leadership and financial influence on CAD-CAM usage, and to develop a CAD-CAM training model. Purposive sampling was used in selecting the states and industries. Stratified sampling was used to divide the unit of analysis into strata such as CEOs, designers, and technologists. Census sampling was used in selecting eight CEOs. A sample size of 152 was selected from a population of 196. Self-administered questionnaires were shared to CEOs, designers, and technologists. This study used a cross-sectional descriptive survey to collect quantitatively data with a response rate of 96.1% (146), then analyzed it, using statistical package for social science (SPSS) 20. Descriptive statistics were used to generate, group and summarize the data in terms of tables, percentages, means and standard deviation. Pearson’s correlation was also used to determine associations between availability of CAD-CAM program, work experience, CAD-CAM training, staff CAD-CAM, staff competency, leadership style, financial status, and CAD-CAM usage. The study findings revealed a low level (44.2%) of CAD CAM training; this was significantly related with CAD-CAM usage. Similarly, 76.0% of the staff lack competency in CAD-CAM technology, this was significantly related with CAD-CAM usage. Lack of leadership support and financial investment in CAD-CAM technology are some of the key issues impeding CAD-CAM usage. Leadership style in textile industries is weak, and does not have any mediating effect on CAD-CAM usage in the industries. Additionally, financial status has no significant influence on CAD-CAM usage. Multiple linear regressions were performed in determining the independent variables that were related to the dependent variables and to infer the correlational relationship. Six hypotheses were tested at p<0.05 alpha index, four out of the six were statistically significant; (availability of CAD-CAM program, t=2.508, p< 0.014; work experience, t=4.524, p< 0.010; CAD-CAM training, t=13.179, p< 0.020; and staff competency, t=2.145, p< 0.039), hence the study rejected them, while the two, leadership style (t=0.083, p< 0.934) and financial status (t=0.249, p< 0.804) were retained because they were not statistically significant. Finally, a CAD CAM training model was developed from the result of the findings for the textile industries. The study recommends that textile industries, stakeholders and government should use the developed training model to improve workers’ training and retraining capacity in CAD-CAM through Public Private Partnerships, (PPPs), with software developers through promotion and after-sale training. Industries leaders and government should invest in CAD-CAM technology to make it available for use.
This study investigated the influence of opinion leadership communication strategies on Exclusive Breastfeeding in Meru County, Kenya in order to improve the Exclusive Breastfeeding practices for better maternal and infant health. To enable an effective appraisal, the study was carried out in Igembe North Sub County of Meru County. The study was guided by four specific objectives as follows: to establish which opinion leaders are engaged in Exclusive Breastfeeding campaigns in Igembe North Sub County; to examine which opinion leadership communication tactics are used in influencing Exclusive Breastfeeding in Igembe North Sub County; to evaluate the communicative attributes of opinion leaders influencing Exclusive Breastfeeding practices in Igembe North Sub County and to determine what socio-cultural factors influence the effectiveness of opinion leadership communication strategies for Exclusive Breastfeeding practices in Igembe North Sub County. The Two Step Flow and the Uncertainty Reduction theories of communication were used to guide the collection and interpretation of data. The study adopted the mixed research design: qualitative and quantitative. Multistage sampling technique was used to select a quantitative sample of 384 breastfeeding respondents that was determined using Fischer and Krejcie and Morgan’s standard sample size calculation formulae. Ultimately, 372 respondents were surveyed, which was 96.8% response rate. Purposive sampling was used to select 32 respondents for the qualitative sample: 24 FGD participants and 8 Key Informants. A total of 31 qualitative data respondents were available for interviews and Focus Group Discussions. The survey method was used to collect quantitative data from four purposively sampled sub-locations of Igembe North Sub County. Interviews with all eight Key Informants were used to collect qualitative data. In addition, four focus group discussions were held comprising a total of 23 male and female participants. Quantitative data was analyzed using descriptive statistics (mainly percentages) with the aid of Statistical Package for Social Scientists (SPSS) and the results presented using tables. Qualitative data was analyzed using emerging themes and presented as narratives that were triangulated with the quantitative data. Study findings indicated that fellow mothers, mothers-in-law and healthcare workers were the most influential EBF opinion leaders. Secondly, the study concluded that Breastfeeding mothers in Igembe North Sub County rated EBF opinion leaders as more influential if they were highly knowledgeable on EBF, social and friendly, trustworthy and if they were their role models. Thirdly, although EBF opinion leaders in Igembe North Sub County had used the highly rated face-to-face communication methods and proper (local) language to communicate EBF information, the rate of EBF information adoption still remained low due to inapplicability of the message to the physical and social-cultural environments of the breastfeeding mothers. The study concluded that socio-cultural factors such as maternal occupation and workload, cultural infant feeding practices and pressure from relatives led to early EBF cessation. The study recommended that expert EBF opinion leaders should be supported to identify and empower many lay opinion leaders in order to ensure more frequent communication of positively influential EBF information at the community and household levels.

TECHNIQUES OF ASSESSING STUDENTS’ VOCAL MUSIC PERFORMANCE BY SELECTED UNIVERSITIES IN KENYA: INVESTIGATING CONFORMITY WITH PROCEDURAL EVALUATION FRAMEWORKS

Everline Kwamboka Ogari-PHD

Vocal music performance occupies a dominant position in the musical landscape of Kenya yet scholars have had numerous debates as to how music should be assessed and evaluated. Instructional refinement and related matters of liability have
provided a domain for the widespread need for diverse assessment and evaluation grading systems. The title of the study was on “Techniques of assessing students’ vocal music performance by selected universities in Kenya: Investigating conformity with procedural evaluation frameworks”. Based on the absence of defined frameworks and standardized criterion for assessment and evaluation that offer a common language across universities in Kenya, the main purpose of this study was to establish tools used for assessment and evaluation of vocal music by selected Kenyan universities; determine the availability of the techniques used in assessing cognitive, affective and psychomotor domains in music; Develop a vocal music assessment scoring guide that synchronizes the currently utilized grading schemes in Kenyan universities and analyze vocal music grading schemes and music scores from selected Kenyan universities based on the developed scoring guide. Guided by the objectives the study examined the intricacies of vocal music performance assessment laying out the significance of these instructional tools such as scoring guides in the evaluation process. It was noted that in all tiers of vocal music performance, there is a need for instructors to provide a thorough documentation of student performance and implementation of certain assessment and evaluation tools that layout students progresses. Purposive sampling was used to select 12 universities that offer music where 3 private and 3 public universities were randomly selected. Students of music were selected using stratified random sampling to acquire gender representation before simple random sampling technique was used to acquire the actual sample size n=30%. This study aimed at the enlightenment and improvement with regard to assessment and evaluation of vocal music in Kenyan universities. The study was guided by Constructive Alignment model as the theoretical underpinning of the research. Data were collected using opinionnaires, questionnaires, focus group discussion, and observation schedule. For purpose of classification, summarization and tabulations of data, the used descriptive analysis technique through pie charts, tables, percentages, frequencies and narration. The study findings established that activities of vocal warm ups such as vocal slides were the most used instructional activity in the universities for the voice instrument while non-verbal communication principals were least used; It was also observed that evaluation tools such as goal setting forms, templates for practice guidelines and lesson journals were inadequate ; the students’ vocal training varied in the sampled universities; as well as the capacity of music instructors to assess rhythmic accuracy, tempo, sight singing, tone, intonation, melodic accuracy, vocal technique, musicianship and synthesis analysis, historical and cultural context. The study concludes that tools for assessment and evaluation of vocal music are of great significance to the growth of students’ vocals; findings of the study showed that although there are music departments in all universities of study, some of them conform to a few of the strategies, techniques and tools needed for collecting information that determine desired outcomes. Some of the recommendations made after the study were that administration of the assessment scoring guide across different universities should exercise a common language and goals; institutions especially in Kenya to establish a more appropriate concentration on vocal music performance so as to enhance a more elaborate research on assessment and evaluation criteria on the instrument; trainers to consider the learners needs in and outside class and the vocal instrument to be assessed on its own since it involves a lot more compared to other music instruments.
EFFECT OF EXCHANGE RATE MISALIGNMENT ON BILateral TRADE BETWEEN KENYA AND EUROPEAN UNION

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The exchange rate is an important variable in international trade due to the expectations that trade reacts to its movements and therefore determines a country’s international competitiveness. Prudent management of trade and exchange rate policies has been associated with faster growth in developing countries. In order to orient the economy outwards, Kenya has pursued various measures from 1990s to 2000s. Despite these export oriented efforts, Kenya’s trade has remained skewed towards imports and a widening trade deficit which seems to follow the weakening of the Kenya shilling. The main policy dilemma is therefore how imports accelerated in an environment of unhindered European Union market access, and hence the motivation of this study. The key objective of this study was to investigate the effect of exchange rate misalignment on Kenya’s bilateral trade with the European Union. Secondary data was used on variables considered instrumental in influencing trade between Kenya and EU for the period between 2000 and 2016. Data was collected from Kenya National Bureau of Statistics, Central Bank of Kenya, EuroSTAT and IMF financial statistics. The study adopted a dynamic modelling approach since exchange rate and trade are affected by previous as well as present values. The study results show that the real exchange rate is driven by the economic fundamentals and in terms of misalignment the exchange rate is overvalued to maximum of 5.9 percent and undervalued up to 5.2 percent. The estimated misalignment has a negative effect on imports but positive statistically insignificant for exports. Finally, the exchange rate has a positive effect on trade balance. The results of this study suggest that the monetary authority should ensure the exchange rate remains stable and within the 6 percent range while monitoring all the underlying determinants. Coupled with this, hedging instruments should be made available and affordable.

FISCAL POLICY AND EMPLOYMENT ELASTICITIES IN KENYA

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Creation of productive and sustainable employment opportunities remains a key policy priority of most countries including Kenya. Employment creation in Kenya has been based on the premise that high economic growth should translate to more employment opportunities. Kenya has experienced varying rates of economic growth. Despite the increase in growth rates, Kenya’s employment elasticity declined from 1.28 in 1992-1996 to 0.5 and 0.38 in 2004-2008 and 2009-2016 respectively. The decline in employment elasticity meant that the growth in employment grew by less than the proportionate rate of growth in gross domestic product. Since political independence in 1963, the Kenya government has implemented various fiscal policies that focus on employment creation. Despite all these interventions, creation of adequate, productive and sustainable employment opportunities continues to be one of the greatest economic challenges in the country. The general purpose of the study was to analyze the relationship between fiscal policy and employment elasticities in Kenya. The study estimated the magnitude of employment elasticities in priority sectors in Kenya by
employing a log linear regression model. Drivers of employment elasticities were also determined through an auto regressive distributed lag model. The study further analyzed the response of employment elasticities to changes in fiscal policy variables in Kenya by adopting a structural vector auto regressive model. Time series secondary data for the period 1970 to 2016 was used. Empirical findings revealed that employment elasticities within priority sectors ranged from 0.115 to 0.412. The study further found that the drivers of employment elasticity were the first lag of employment elasticity, average wage, inflation rate, labour force participation rate, population density, foreign direct investment and exchange rate. Finally, the study established that taxation, debt, recurrent expenditure and development expenditure had positive effects on employment elasticity while budget deficit had mixed effects on employment elasticity. From the foregoing, it can be concluded that the employment elasticity’s response to fiscal policies varied among the priority sectors. The study recommends that government should give more attention to service sectors as a means of enhancing employment creation. Policies pursued by the government to boost employment should also be sector specific. This could be achieved by ensuring that growth targets on employment under the Kenya Vision 2030, or any programme are employment-intensive. The study further recommends that policy measures to control inflation should be tightened and more efforts to attract foreign direct investment to be undertaken. Finally, the government ought to pursue prudent expansionary policies that will boost expenditure. This could be realized by eliminating unproductive expenditures and focus on projects and programme that are more productive capable of generating more employment opportunities.

**EFFECT OF THE SIZE OF THE INFORMAL SECTOR ON ECONOMIC GROWTH, TOTAL FACTOR PRODUCTIVITY AND POVERTY ALLEVIATION IN KENYA**

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The Kenyan economy is predominantly informal. The informal sector employed 132,100 workers in 1974; and 13,442,200 workers in 2016, which translate to 19 percent and 84 percent of the total workforce in the respective time periods. The government has from 1986 put in place policy measures to develop the sector for employment creation, economic growth, and poverty alleviation. Among the country’s Big Four Agenda as contained in the Medium Term Plan (2018-2022), is the development of the manufacturing sector for economic growth and improved welfare. The manufacturing sector in the country is largely informal with 80 percent of firms and 84.3 percent of the total workforce being informal. The development of the sector is therefore central in the achievement of the country’s macroeconomic targets of 10 percent annual economic growth rate and a reduction in poverty rates to 28 percent of the total population by the year 2030. However, theoretical and empirical literature point at a sector that has low productivity with some studies attributing poor economic performance to the existence of a large informal sector. This study aimed at establishing the effect of the size of the informal sector on economic performance in Kenya. The study objectives were; to analyze the contribution of the informal sector to output growth in Kenya, to determine the effect of the informal sector on total factor productivity in Kenya; and to examine the effect of the informal sector on poverty alleviation in Kenya. The study used secondary time series data for the period 1974 to 2016 and employed Ordinary Least Squares in analysis. Data was sourced from the country economic surveys and statistical abstracts, the Central Bank of Kenya website, the World Development Indicators and the Global Financial Development database. A growth accounting exercise was conducted using the standard Cobb-Douglas production function to address the first objective. The study used the residual from the growth accounting exercise, commonly referred to as total factor productivity as the dependent variable to address the second objective based on endogenous growth models with the growth in the average annual wage in the informal sector as an indicator of the size of the sector following efficiency-wage theories. The third objective was based on the Marxist and Liberal theories of poverty. The poverty headcount index was used as the dependent variable with the depth of
informality as an indicator of the size of the informal sector. From the study findings, the informal sector is the lowest contributor to output growth in the country; the sector has a negative and statistically significant effect on total factor productivity; and significantly increases poverty in the country. Based on the findings, and given the size of the informal sector, the study concludes that there is a need to target increased productivity in the sector for increased output growth, increased total factor productivity and poverty alleviation in the country.

**EFFECTS OF VALUE ADDED TAX REFORMS ON HOUSEHOLD WELFARE AND COLLECTION EFFICIENCY AND THE DETERMINANTS OF ITS COMPLIANCE GAP IN KENYA**

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The study evaluated the Value Added Tax reform process in Kenya, and established its effect on welfare of households and collection efficiency of Value Added Tax. In addition, the study estimated the Value Added Tax gap in Kenya and evaluated its determinants. The study made use of the Quadratic Almost Ideal Demand System model to assess the effects of Value Added Tax reforms on household welfare. Value Added Tax efficiency was measured using the Collection-Efficiency model and Value Added Tax gap was estimated using the International Monetary Fund Revenue Administration-GAP model. Secondary data was used from the year 2015/16 Kenya Integrated Household Budget Survey, whereas data on value added tax revenue, final consumption, Gross Domestic Product, was obtained from Statistical Abstracts, Economic Surveys, Kenya Revenue Authority and World Bank Data base. The study found the VAT reforms in Kenya to have led to decline in welfare of households, since the uncompensated price elasticities for all the selected ten food items were found to be negative; tea leaves, sugar, beans, salad, white-bread, rice, cooking fat, spices, soda, maize, which was an indication that consumers would respond to increase in prices of the commodities by cutting down their expenditure on them. Further, coefficients of eight out of the ten food items exhibited positive expenditure elasticities; sugar, beans, salad, white-bread, rice, cooking fat, soda, and maize. The results demonstrated that households were under consuming these commodities and required either a reduction in their prices or income compensation to consume more, this was another pointer of decline in welfare of households as a result of VAT reforms in Kenya whose net effect was general increase in price levels. The tax reforms were found to have significantly improved VAT collection efficiency but also contributed to widening of VAT compliance gap in Kenya. The ARDL model run to estimate the determinants of VAT compliance gap obtained the following results; standard VAT rate (0.097), VAT reforms (0.150), number of VAT rates (-0.022), manufacture value added growth (0.032), population growth (-4.91), import as a percentage of GDP (0.066), final consumption as a percentage of GDP (-0.122), and export as a percentage of GDP (-0.087), all significant at one, five and ten percent levels. These results revealed that tax evasion and avoidance were quite rampant in Kenya and also laxity on the part of Kenya Revenue Authority to effectively collect VAT revenue. This study will be useful for future policy formulation in Kenya and in designing more effective tax reforms with consideration to welfare of households by the National Treasury, Kenya Revenue Authority and Scholars.

**ANALYSIS OF TAX REVENUE PRODUCTIVITY FOR SELECTED COUNTRIES IN THE EAST AFRICAN COMMUNITY MANYANZA**

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The East African Community member states face challenges in mobilizing tax revenues to the required level which is suitable for economic growth enhancement and attaining fiscal sustainability. Tax reforms have been implemented in the region with the main objective of mobilizing more tax revenues. However, the tax revenue collections have been inadequate leading to persistent budget deficits which shows the inability of the tax system to generate sufficient revenues to finance public expenditure. Moreover, the member states have not been able to attain the target of Sub Saharan Africa average tax to gross domestic product of 26 per cent. Therefore, this study sought to establish the determinants of tax revenue, analyse the trends of tax effort indices and examine the effect of integration on productivity of tax revenue, for selected taxes for countries in the East African Community. The study employed no n-experimental research design using time series data for the period 1984 to 2016. Appropriate tests for time series data were carried out whereby unit root test was done to determine the stationarity of the data and variance inflation factor to test for multicollinearity. Various diagnostics tests were conducted to determine the suitability of each econometric model. Regression analysis was carried out using ordinary least square. The study findings showed that the political risk factors, which included bureaucracy quality, democratic accountability and internal conflict, were key determinants of tax revenue. Gross domestic product per capita and inflation were determinants of tax revenue in all the countries; trade openness and manufacturing share in gross domestic product were key determinants of tax revenue in Kenya and Tanzania; while dependency ratio was a determinant of tax revenue in Kenya only. The efficiency of institutions was a key determinant of tax revenues in Kenya. Analysis of tax effort trends the study findings showed that, tax reforms, economic reforms and stabilization programmes, increase in agricultural output, political stability and reconstruction programmes increase tax effort. On the other hand, drought, financial crises, tax reductions and exemptions, low agricultural output, political instability and foreign aid embargo and high petroleum prices decrease tax effort. The study results showed that, formation of East African Community led to direct increase of all selected taxes in Kenya, while in Uganda it led to increase in total tax revenue, excise tax and direct tax. In terms of productivity, integration increased productivity of total tax revenue, value added tax and direct tax in Kenya, while in Uganda it led to increase in productivity of excise tax and direct tax. Integration also led to decline in productivity of total tax revenue in Tanzania, excise taxes and import taxes in Uganda and excise taxes in Kenya. The study recommends that East African Community governments should strengthen quality and efficiency of institutions through employment of qualified personnel, re-training and review of existing policies. Measures need to be put in place to control acts of civil war, civil disorder and terrorism. The East African Community governments should embrace policies that broaden tax base, improve tax administration, increase economic activities and stabilization policies to increase tax effort. Moreover, the thriving of East African Community need to be encouraged through policies such as labour mobility, improved infrastructure and simplification of regulatory framework coupled with research and development. Measures need to be put in place to control smuggled goods across borders and reduce tax fraud in custom authorities.

EFFECTS OF PRUDENTIAL CAPITAL REGULATIONS ON SYSTEMIC RISK AND FINANCIAL STABILITY IN THE BANKING SECTOR IN KENYA

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The prudential regulation's main objective is to mitigate financial instability's threat and macroeconomic costs. In the last decade (2007 to 2018), the banking sector in Kenya has expanded rapidly, making some banks operate within thin capital margins, while others have begun regional operations exposing themselves to cross-border country risks. The country needs to be cautious about risks to the financial system and spillovers of these risks to the economy. The aim of this research was to analyse the effect of the implemented prudential capital regulations policies on systemic risk and financial
stability in Kenya. The first objective of the study was to analyse how prudential capital regulations policies can effectively curb financial risks in Kenyan banks. To achieve this objective, the dynamic Generalized Method of Moments model was estimated. The results suggest that banks with capital adequacy ratios, either above or below the applicable regulatory minimum limits, have reduced portfolio risk of assets in response to stringent risk-based capital requirements. It may be impossible to implement effective capital regulations where transparency, deterrence and accountability are very weak. Therefore, the Kenyan government must fix the vulnerabilities that remain in the institutional environment in order to ensure the effectiveness of regulatory capital requirements. In addition, bank capital is a required but insufficient prerequisite to stab a bank. The second objective was to investigate the impact on financial stability in Kenya of the existence of foreign banks. The analysis found a double result, i.e. the lower or higher financial strength for international capital-owned banks than for all the country's banks. The analysis used the regression of binary logits. The findings indicate that there is no substantial direct link between the share of foreign banks and stability in the banking sector in Kenya; rather, financial stability depends on the credit policy of banks and their balance sheet structures, regardless of ownership form. Positive macroeconomic development drives Kenya's financial stability, increase foreign banks penetration, and encourages them to expand through aggressive credit policies. The findings suggest that it is the conditions of the host country that affect the stability of foreign-owned banks, which implies that they have to react to local conditions. The success of foreign banks is same as the success of the host country. The study analysed objective three by investigating the effectiveness of prudential capital regulations on Financial Stability using panel vector autoregression model. The research results indicate the importance of capitalization of the banking system in ensuring financial stability that can be used to shape and size the policies being applied. To increase transparency, regulatory and supervisory authorities need specific guidelines to maintain financial stability. Including mitigation of systemic risks should be viewed as an explicit goal for the concerned central banks and regulators. The purpose of the study was to shed some more light on the effectiveness of the implemented prudential capital regulations policies.
Rapid population growth, increasing demand for land, over-exploitation and the degradation of local natural resources have led to serious socio-ecological challenges in Matungulu Sub-county. This situation, compounded by the effects of climate change, has impacted negatively on the livelihood resilience of the local people. The specific objectives of this study were to: analyze tree cover trends in Matungulu Sub-county between 1987 and 2017; examine major socio-economic factors that influence tree cover; assess farmers’ perceptions of the effects of climate change on tree cover; examine the role of tree cover in community resilience against poverty and effects of climate change; and identify specific constraints that have hampered improvement of tree cover in the Subcounty. Systematic random sampling was used to collect data from 412 farmers in the study area. A structured questionnaire, FDGs, key informants and direct observations were used to collect household socio-economic data. Landsat maps for historical analysis of land cover change and climate data in Matungulu Sub-county were used to study changes in tree cover and climate parameters over the three-decade period. Descriptive and inferential statistics were used in the data analysis. Results showed that forest cover reduced by 64% over the 30-year period (from 17,044 ha to 6,136 ha) while all other land uses increased (farming by 34%, shrubs by 9%, water by 245% and urban settlements by 600%) in the same period. A logistic regression model with R statistics was used to test for relationships between tree cover (dependent variable) and the socio-economic parameters. Socio-economic variables that significantly influenced tree management included gender (p=0.011), household size (p=0.030), and title deed ownership (p=0.023). Majority (84%) of respondents perceived climate change to have occurred over the 1987-2017 period. Farmer-perceived climatic patterns in the area over the same period were corroborated by data from the Kenya Meteorological Department. Farmers used trees to enhance their resilience against effects of climate change and poverty. Respondents had 58 different types of tree species, all for different roles and uses. Major tree species included Eucalyptus saligna, Grevillea robusta, Mangifera indica, Persea americana, Croton megalocarpus, and Terminalia brownie. Tree uses included firewood, timber, charcoal, poles, shade, utensils, fodder, food and medicine besides others. Environmental benefits of trees included soil erosion control (27%), mulch (15%), soil fertility (13%), aesthetics (10%) and pest control (3%). 79% of the respondents had experienced lack of information (24%), lack of capital (24%) and lack of water for seedlings (20%) as constraints to tree cover. The study concluded that there was overall tree cover loss over the three decades and recommends afforestation and reforestation programmes and incorporation of local participation and use of indigenous knowledge in climate change adaptation and mitigation interventions in Matungulu Sub-county.
Commercial oil and gas was discovered in Kenya in 2012. Few academic studies have been done on the effects of the mentioned discovery to the environment. The oil and gas resources are expected to transform the economic wellbeing of the locals and the nation at large. However, land degradation, environmental pollution and socio-economic problems have always ensued oil and gas exploration ventures globally. This study aimed at determining the effects of oil and gas exploration on biophysical and socio-economic environments in Oil Block 13T South Lokichar Basin, Turkana South-subcounty and come up with sustainable environmental management strategies in the oil fields. The specific objectives were to review, constitutional, policy, legal and institutional framework governing environmental management in the backdrop of oil and gas exploration in Kenya and determination of oil and gas exploration effects on biophysical and socio-economic environments in the study area. The study adopted an exploratory mixed method research design. Purposeful non-probability sampling was applied in determining the study area, sampling the boreholes, sampling the drill cutting samples and sampling the key informants. Probability sampling was used in identifying the manyattas, households and the villages for conducting focused group discussions. Questionnaires, documents review, photography, observation, Landsat satellite imagery acquisition and analysis, laboratory analysis using XRF and AAS machines, for drill cuttings and water samples respectively to determine the levels of physicochemical properties were the data collection methods used. The questionnaires were coded into the Statistical Package for Social Sciences version 20.0 software and Excel 10.0. Descriptive and inferential statistics were used in data analysis. The study identified several gaps in the existing environmental policy and legal framework in relation to the oil fields environmental management coupled with poor enforcement of the laws by the relevant agencies. In addition, the study observed a decline in NDVI from 1 to 0.4329 for the rainy season and 0.4107 to 0.1217 for the dry season between 2006 and 2017 with a p-value of 0.0091 < 0.05 on paired T-test implying a significant change on vegetation cover. The area under forest, shrubland and grassland had significantly reduced at 90% confidence interval with a value of, 0.0718, 0.0738 and 0.0609. The drill cuttings whose levels of detected heavy metals concentration for manganese (Mn), copper (Cu), nickel (Ni), iron (Fe), calcium (Ca), lead (Pb), were 1.58, 0.21, 0.05, 70.4, 62.57, 4.58 respectively were incorrectly being managed onsite. Mn, Fe and Pb concentration levels in the drill cuttings were above the WHO and USEPA recommended standards for the reserve pit. The levels of Fe, Ni, Turbidity and Total Dissolved Solids of the sampled water from the study area, were all above the prescribed WHO standards. The study noted improved socio-economic characteristics, physical and social infrastructures in the study area. 70% of the respondents felt that water provision, health facilities, education facilities, employment opportunities had improved since oil and gas exploration began with a Cohen kappa coefficient of agreement of 0.608. However, challenges such as population influx, land displacement, lack of adequate engagement of the locals, gender inequalities with a Cronbach’s Alpha of reliability of 0.735, health challenges of the locals and increased number of conflicts cases since 2012 with a statistical p-value of 0.005 < 0.05 were noted. The study recommends enforcement of the existing environmental legislations and development of oil specific environmental laws, adoption of advanced oil drilling and drill waste management technologies, as well as participatory environmental management approach in the oil fields.

ENVIRONMENTAL SUSTAINABILITY IN INFORMAL SETTLEMENT UPGRADING PROJECTS IN NAIROBI, MOMBASA AND KISUMU CITIES IN KENYA

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The phenomenal growth of urban centres in developing countries makes cities important sites for engaging with environmental issues. The prevalence of informal settlements in cities and its implication on environmental sustainability has become a growing concern. Metabolic processes of these spatial units significantly shape the urban ecological system and define quality of life in cities. However, the significance of this space in the environmental sustainability function has
not been adequately considered. Policy makers and urban planners have often failed to recognize informal settlement upgrading projects as conduits for integration of environmental sustainability in cities. As a result, the upgraded settlements do not sufficiently contribute to improved urban environmental quality. In this regard, this study sought to establish the environmental sustainability performance of government led informal settlement upgrading projects in Kenyan cities so as to recommend measures that can be taken to improve environmental quality in the upgraded settlements. It assessed the environmental performance of 11 upgraded informal settlements, the existing environmental sustainability integration pathways and analysed the impact of institutional arrangements on environmental sustainability integration in informal settlement upgrading programs in Kenya. A list of 16 environmental sustainability indicators was developed based on the theoretical and empirical frameworks. The indicators were grouped into four categories: resource consumption, waste management, environmental quality and community organization. The study adopted a case study research design. Household and key informant interviews, observations and focused group discussions were used to collect data. A total of 600 households were sampled from the eleven settlements through multistage method involving cluster and systematic sampling. These households were distributed equally between Nairobi, Kisumu and Mombasa. The 200 households in each city were distributed proportionately among the selected settlements. A scoring system was devised to help determine significant differences in performance between the three cities. The highest environmental sustainability score in the upgraded settlements is 61.4% while the lowest score is 37%. The scores vary significantly between cities. Upgraded settlements in Nairobi have higher scores than those in Kisumu and Mombasa. Environmental quality indicators have the highest predictive ratio for environmental sustainability performance of an upgraded settlement. Government led informal settlement upgrading programs indicate significant achievement in the use of green enterprises, clean technologies, community based institutions and environmental education to integrate environmental sustainability in upgraded settlements. Environmental infrastructure and environmental impact assessment have achieved minimal environmental outcomes. Housing tenure is not a significant environmental integration pathway in informal settlement upgrading. Institutional structure and functional reconstruction poses both challenges and opportunities for environmental integration in informal settlement upgrading processes. Informal settlement upgrading programs have not been adequately utilized to diffuse environmental sustainability in the urban space. The study recommends improved actor coordination; broader stakeholder engagement, institutionalizing an environmental unit in the ministry in charge of informal settlement upgrading and multi levelled environmental education in the implementation of upgrading programs.

MODELLING THE SPATIAL RELATIONSHIP BETWEEN BUILT-UP VOLUMES AND SURFACE URBAN HEAT ISLANDS IN UPPER HILL, NAIROBI CITY COUNTY, KENYA

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Urban heat island refers to the thermal temperature differences between rural and urban areas. The factor that has been attributed to this phenomenon is urbanization, where natural land cover is replaced by concrete and other man-made impervious surfaces. Causes and effects of heat islands and urban climates are varied. The urbanization process dislocates the natural solar and hydrologic balances by transforming the radiative, thermal, moisture and aerodynamic characteristics of a region. Lack of indicators and frameworks on three dimensional development in urban environment possess a challenge to urban authorities when formulating policies on thermal comfort, pollution, assessing health-related risks such as heat stress, respiratory diseases and vector-borne diseases. Therefore, this study aims at modelling the relationship between built-up morphology and topographical features with land surface temperatures using time series data in Upper Hill, Nairobi. Upper Hill, Nairobi, Kenya has rapidly developed over the years, transforming to commercial,
office blocks and high-rise flats from low density residential area. Changes in zoning regulations is informed by businesses choosing to locate their offices away from the Central Business District because of traffic jams, inadequate parking space and high costs of renting office space. The research uses case study and correlational research design. Random sampling is used to collect ground control points and verify analysed data. Land surface temperature, land cover, NDVI and albedo is analysed for the years 1986, 1995, 2000, 2005, 2011 and 2017. Road and building information is extracted from stereo-aerial photographs for the period 1978, 1998 and 2017, which is utilized to obtain building height, ground coverage ratio and built-up volume density index. The spatial relationship of land surface temperature with built-up morphology is modelled using geographically weighted regression and ordinary linear regression. Findings show that land surface temperature is influenced by type of land cover and albedo; with sparse grassland having an albedo of 0.18 and mean surface temperature of 28°C while water has an albedo of 0.09 and mean surface temperature of 25°C during the day. At night, water and sparse grassland have mean surface temperatures of 18.62°C and 18°C respectively. Contribution index of built-up and forest areas has reduced with increased impervious surfaces. Mean built-up volume density and ground coverage ratio in Upper Hill in 1978, 1998 and 2017 is low density while mean building heights are low-rise. Geographically weighted regression model findings indicate that building height in 1978 has an r² of 70% and built-up volume density in 1998 and 2017 have r² of 72% therefore having a great relationship with land surface temperature. Combined modelling tools capture the physical dynamics and interaction built-up forms have with land surface temperature. Built-up volume densities should be integrated in the development control frameworks, with building heights being an important variable in urban development. It further recommends that green design strategies be made an integral part of urban development with percentage vegetation cover specified in the zoning policy as surface urban heat islands is a spatial temporal

ANTHROPOGENIC IMPACTS OF LAND USE AND LAND COVER CHANGES ON MAI MAHIU ECOSYSTEM, NAKURU COUNTY, KENYA

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Land-use changes are the main cause of human and environmental problems especially in many developing countries in Africa and Asia. Study was conducted in Mai Mahiu, Nakuru County, Kenya whose aim was to assess the impacts of land-use and cover changes on the ecosystem functioning and human environment. Specific objectives were: (i) to understand the nature of land use practices (ii) to monitor impacts on soil quality; (iii) impacts on vegetation composition and structure; (iv) to examine the level of variation in the physico-chemical parameters of rivers; and (v) to assess the effect of land-use change on climatic variability. GIS technology was used to establish land-use/cover changes from 1985 to 2015. Soil samples were collected for physical and chemical analyses from five land-use practice namely; undisturbed forest, disturbed forest dominated by Croton spp., disturbed forest dominated by Tarchonanthus camphoranthus, cropland and severely grazed grassland while Transect method was used for vegetation survey. Water was sampled at four sampling stations (A, B, C and D) which are sites where the river passes through the above mentioned land-use practices and analyzed for physico-chemical parameters while climate data was used in climatic variability analysis. Analysis of variance, regressions and mean separation at 0.05 significance level were executed on the data using GenStat 14th edition. Results showed a remarkable land-use and land-cover change between 1985 and 2015. Cropland significantly increased by 135% from 27.3 km² in 1985 to 64.2 km² 2015 at the expense natural forest. Built-up area and roads coverage had increased by almost three times from 9.8 to 29.9 km². Soil quality deteriorated significantly with land conversions. There were significant changes in soil bulk density (p<0.001) that ranged from 0.93 g/cm³ in undisturbed forest to 1.27 g/cm³ in severely grazed grassland, soil pH (p=0.002), soil organic carbon (p=0.008) with losses of up to 63%, and total nitrogen (p=0.005) that ranged from 0.15 to 034%. Vegetation was stratified into three layers with shrub stratum being dominant
replacing the tree layer that was dominant in 1985. Physico-chemical characteristics of river water deteriorated along sampling stations, A to D in both dry and wet seasons. Water pH, temperature, turbidity and conductivity increased along sampling stations A to D (p<0.001) while flow velocity and dissolved oxygen decreased significantly (p<0.001). Chlorides, sulphates, nitrates, phosphates calcium, iron, magnesium, potassium and sodium were significantly higher (p<0.001) at stations C and D compared to stations A and B. There was no significant difference in long-term annual rainfall variability (p=0.685). Intra-annual rainfall variability was noticed in the months of March, April, May and November (p>0.001). The study concluded that land use change and modifications in Mai Mahiu have negatively affected the state of the Mai Mahiu ecosystem. For the sake of the present and future generation in the region, the study recommends restoration and rehabilitation through landscape based land-use practices, enforcement of laws and implementation of policies relevant this type of ecosystem.
SCHOOL OF MEDICINE

Streptococcus pneumoniae SEROTYPE PREVALENCE, ANTIBIOTIC SUSCEPTIBILITY AND ASSOCIATED RISK FACTORS AMONG CHILDREN ATTENDING GERTRUDES CHILDREN’S HOSPITAL IN NAIROBI CITY COUNTY-KENYA

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Pneumococcal disease remains the biggest killer of children living in Kenya. This is true despite inclusion of the 10-valent pneumococcal conjugate vaccine in the Kenya Expanded Program on Immunization. Serotype replacement, emergence of antibiotic resistance, inaccurate laboratory diagnosis due to optochin resistant bacterial types and a range of environmental and host related risk factors have been touted to be the cause of these statistics elsewhere. This study sought to establish prevalence of Streptococcus pneumoniae serotypes, antibiotic susceptibility patterns and associated risk factors among PCV-10 vaccinated and unvaccinated children attending Gertrude’s Childrens Hospital. A total of 206 children were recruited for this study. Nasopharyngeal swabs were the main specimen used. Culturing and isolation of the bacteria was done on blood agar with gentamicin and plain blood agar plates respectively. Optochin and bile solubility (where necessary) tests were done as confirmatory assays for the bacteria. Pneumococci se rotyping was done using the Gold Standard Quellung Reaction test while the disk diffusion method was used to assess antibiotic susceptibility profiles. Out of the 206 subjects sampled, 20.39% (n=42) were found to be carriers of the bacteria. About 52% (n=22) of the carriers had received the recommended dose of PCV-10, while 48% (n=20) had not. Almost all (n=41; 19.90% of subjects) isolates contained non-vaccine type serotypes, while n=1 of the isolates (0.49% of subjects) were both optochin resistant and untypeable. Serotypes 28F, 6A, 11A, 3 and 7C were prevalent in both vaccinated and unvaccinated children, whereas serotypes 23A, 17F, 35F, 48, 13 and 35B, and 23B, 20, 19B, 21, untypeable, 15B and 39 were found among unvaccinated and vaccinated cohorts, respectively. Thirty nine (92.86%) of pneumococci isolates were susceptible to erythromycin, 39 (92.86%) were susceptible to vancomycin, 8 (19.86%) were susceptible to oxacillin; 40 (95.24%) were susceptible to clindamycin, 24 (57.86%) were susceptible to ceftriaxone while 18 (42.86%) were non-susceptible. The risk of nasopharyngeal carriage decreased insignificantly when the subject was female (odds ratio [OR]: 0.766, 95% CI: 0.388, 1.511, p-value=0.442). Children between the age of 25-36 months (OR: 1.147 (95% I: 483, 2.722) and 37-48 months (OR: 1, 95% CI: 0.286, 3.501) had an insignificant elevated risk of nasopharyngeal carriage of the bacteria. Children whose mothers were non-cigarrate smokers exhibited low odds of carriage (OR: 0.764 (95% CI: 0.077, 7.537; p=0.818). Serotype replacement, resistance to penicillins and exposure to smoke were correlated with increased risk of nasopharyngeal carriage. Continuous and broader epidemiological surveys should be carried out in the entire country to accurately determine the degree of serotype replacement and; people should be sensitised on judicious use and/or consumption of antibiotics. Optochin test should be introduced as a routine assay in diagnosis of Streptococcus pneumoniae in hospitals.

SPATIAL AND TEMPORAL DISTRIBUTION OF AEDES MOSQUITOES, DENGUE AND CHIKUNGUNYA VIRUSES AND THEIR PHYLOGENY ALONG THE COASTLINE OF KENYA

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There are arthropod-borne disease outbreaks as a result of pathogen influx including arboviruses which are transmitted by strains of Aedes species that occur periodically in varying spots in Kenya. However, there has been paucity of documented information on the epidemiology of Aedes mosquitoes involved in transmission of different strains of viruses. This cross sectional study determined spatial and temporal distribution of Aedes mosquitoes, Dengue and Chikungunya viruses, and their phylogeny and vector-virus co-infections during dry and wet seasons. Indoor and outdoor sampling of adults Aedes mosquitoes was done using Biogent Sentinel trap baited with solid carbon dioxide and Prokopack aspiration technique. Aedes mosquitoes were identified and sorted according to collection site, sex, physiological status and species using their morphological features and molecular techniques. Sentinel sites coordinates were recorded by Global Positioning System receiver with spatial and temporal maps generated using ArcGeographical information system. RNA was extracted from Aedes mosquitoes using Trizol®. Identification of Aedes species, Dengue and Chikungunya was done using Polymerase Chain Reaction. Sequencing of amplicons was done using Sanger high-throughput technique and their proportions analysed by R-statistics. Phylogeny tree files were generated using Randomised Accelerated Maximum Likelihood and trees plotted using interactive tree of life. A total of 37,220 Aedes mosquitoes belonging to eight species were collected and grouped in pools of 20 mosquitoes. Aedes aegypti formosus was dominant at 62.5%. Aedes aegypti aegypti was identified for the first time along the Coastline of Kenya. There was no effect of season on the distribution and proportion of Aedes species along the Coastline. Aedes mosquitoes belonged to the upper clade of the phylogenetic tree. Four serotypes of Dengue virus were identified with DENV-4 identified for the first time in Aedes mosquitoes in the region. Only the East/Central/South African (ECSA) genotype of Chikungunya virus was isolated and seasons did not influence the distribution of both viruses along the Coastline (p>0.001). Aedes mosquitoes were closely related to previous isolates and to those from Uganda, Senegal and Thailand. DENV-1 isolates were closely related to those from India, DENV-2 isolates were closely related to those from Pakistan, and DENV-3 isolates were closely related to those from Brazil while DENV-4 isolates were closely related to those from Haiti. Chikungunya ECSA genotype isolates were closely related to previous Kenyan isolates and to those from South Africa and Tanzania. There were co-infections of Dengue and Chikungunya viruses in Aedes mosquitoes. Aedes aegypti s.l and Aedes pembaensis had co-infections of all viruses. Prevalence of Dengue virus was at 7.9% while Chikungunya was at 2.1%. These results are important as they give information on areas of high risk for the virus outbreaks. Surveillance of entomological infection by viruses and implementation of their appropriate control measures should be taken by the Ministry of Health.

EVALUATION OF ANTIBREAST AND ANTIPROSTATE CANCER ACTIVITIES OF SELECTED MEDICINAL PLANTS FROM SOME PARTS OF KENYA

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Cancer is a group of diseases characterised by uncontrolled proliferation of cells. Of all the types of cancers worldwide, breast cancer is the most commonly diagnosed in women while prostate cancer is the second in men. The current cancer management methods have challenges including unpleasant side effects, high cost and even not effective. As the number of patients is on the rise, physicians look forward with hope to the discovery and development of safe, effective and less toxic anticancer drugs. More than 67 % of prescribed anticancer drugs have been developed based on natural products. The objective of this study was to evaluate anticancer activities of extracts obtained from Fagaropsis angolensis, Hydnora abyssinica, Launaea cornuta, Spermacoce princeae, Combretum tanaense, Uvariiodendron anisatum, Marsdenia schimperi
and Prunus africana against breast and prostate cancer cells. Methanol and water extracts from the seven plants were evaluated for anticancer activities using methyl thiazole tetrazolium cell viability (MTT) assay and microtiter 96 well plate s. Breast cancer (HCC 1395 and 4T1) and prostate cancer (DU-145 and 22RV1) cell lines were used in this study. The controls that were used in this study were cyclophosphamide and fluorouracil for positive chemotherapeutic agent and African green monkey kidney epithelia normal cell (vero) for for cancer cells. Enzyme linked immunosorbent assay (ELISA) scanning multiwell spectrophotometer was used to measure optical densities to calculate cell viability. Analysis of concentrations that inhibited 50% of cell growth (IC50) was done using Prism Graphpad version 8.0. Remarkable activities of extracts (IC50 < 50 μg/ml) were demonstrated by the methanol extracts of C. tanaense root, U. anisatum root, H. abyssinica rhizome, M. schimperi husks, M. schimperi leaves and F. angolensis stem bark. High selectivity indices were revealed F. angolensis extracts. Bioassay-guided isolation of these extracts resulted to isolation of seven compounds. The active fractions were those F. angolensis and C. tanaense extracts, dichloromethane and ethyl acetate fractions, respectively, the two fractions exhibited anticancer activities with moderate (1 ≤ SI ≤3) to high (SI > 3) selectivity indices. The isolated compounds were coded as FC1, FC2, FC3, CC1, CC2, UC1 and UC2. The FC1-3 compounds were active against cancer cell lines, CC1-2 revealed moderate activities and UC1-2 were not active. FC1 revealed high selectivity indices against the cancer cell lines. All extracts that demonstrated remarkable anticancer activities revealed no toxic effects upon cute oral toxicity studies on swiss mice. It was therefore established that plants that were selected on the basis of thnopharmacological approach had potential anticancer activities and were also relatively safe. Moreover, the compounds that were isolated were remarkably active and less toxic. This study therefore provided scientific basis for validating the use of extracts from Fagaropsis angolensis stem bark and Hydnora abyssinica rhizome in the management and treatment of breast and prostate cancers.
A culturally competent health workforce is recognized as a priority reform area in health management as well as in improving maternal healthcare indicators in vulnerable and marginalized settings. Yet modalities of integrating and reorienting healthcare services to meet the cultural needs of patients are rare. This study aimed at investigating the effect of training health workers in cultural competence towards satisfaction with maternity services among women of Elgeyo-Marakwet County. This was a cluster randomized controlled trial (CRT) blended with qualitative and quantitative data collection approaches. Clusters were randomized into intervention and control arms. Health workers in the intervention arm were sensitized on patient-centered maternal health care needs. Baseline and end line assessment (after six months) were carried with 758 women of reproductive age, 379 in each arm. Simple random sampling was applied. Data was collected using exit and mystery client surveys. Statistical Package for Social Science (SPSS) was used to analyze the data.

The effect of the interventions was measured using standard mean difference (Cohen’s d) and t-test. An alpha cut of 0.05 tested the hypothesis. Qualitative data was analyzed through a process of data reduction, organization, and interpretation. Known companion, continued support, and naming critically influenced pregnancy and childbirth with a mean of 4.1, 3.9 and 3.2 respectively. Other important considerations are the choice of birthing position and placenta management with a mean of 3.1 and 2.9. The study revealed diverse and multiple women’s maternity needs and requirements. Cultural needs included the choice of delivery methods, placenta interpretation, placenta disposal, naming, and celebration. Esteem needs included value, respect, and friendliness. Physiological needs were labor room cleanliness, staff grooming, hygiene, and comfort. Psychological needs ranged from encouragement, assurance, empathy, and emotional support. Information and communication are also paramount. Before the intervention, there was no statistically significant difference (t (741) = 0.106, p = 0.916) between the control and intervention group on the mean scores of quality of delivery room settings. The mean for intervention arm however improved to 4.41 ±0.673 from 4.13±0.738 while that of control remained steady. The mean change tinkered the differences between the two groups to significant t (756) = -1.1959, p = 0.002. The mean scores quality of prompt provision of maternity services between the two groups were indifferent prior to intervening t (749) = -0.380, p = 0.704 but significant thereafter t (756) = -5.214, p < 0.001. The intervention effect size was (F (1, 756) = 10.142, p = .001, ηp2 = 0.036). The difference between the groups in the scores of trust in provider was insignificant before t (692) = -9.57, p = 0.339 but significant later t (690) = -6.137, p = 0.001. The mean of the intervention improved to 4.26±0.698 from 4.05±0.727. The effect size was significant (F (1, 756) = 6.395, p = 0.012, ηp2 = .018) on trust scores. ANOVA showed that there was significant effect (F (1, 756) = 11.493, p < 0.001, ηp2 = .049) on satisfaction with provided information on delivery methods. With a mean of intervention group increasing from 3.55 ±1.056 to 3.94, ±0.894 following training of the health workers. The mean of control changed somewhat from 3.57±1.187 to 3.62 ± 1.149. The mean changes tweaked the group variance from insignificant t (725) =0.290, p = 0.771 to significant t (713) =4.336 p <0.001 after intervention. Results conclude that cultural competence training improved perceived quality and satisfaction with maternity services among women of reproductive age. Consequently, there is a need to integrate cultural knowledge and skills into existing maternal policies and training. This would elicit a broad-based impact on maternal and child health services. Similar research but biased to treatment or health outcome is advanced.
IMPACT OF MATERNAL DIETARY INTAKE ON BREAST MILK COMPOSITION AND INFANT NUTRITION STATUS AMONG LACTATING WOMEN IN NYERI COUNTY, KENYA

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Exclusive breastfeeding for the first six months of life, with continued breastfeeding up to 2 years after the introduction of complementary feeds, is considered as the standard norm for infant feeding. Although the benefits of breastfeeding have long been known, studies on the composition of human milk are still ongoing. Considering that breast milk is the sole source of the nutrition for the infant in the first six months of life, it is essential to have accurate and up to date data on its composition. The composition of human milk could vary according to many maternal factors such as diet, nutritional status, genetics and environmental exposures, among other factors. The amount of variability in human milk composition that could be attributed to maternal dietary intake remains largely unknown. In Africa, particularly in Kenya, there is scanty information available on the nutrient composition of breast milk and the factors that affect its composition. This study therefore investigated the association between maternal dietary intake with breast milk nutrient composition and their effect on the nutrition status of the infant (under six months). The longitudinal study was conducted in Nyeri County, Kenya. Participants included lactating mothers with infants under six months. The lactating mothers’ dietary intake, nutrition status (BMI, MUAC and serum micronutrients) and that of their infants (recumbent length and weight) were assessed. Additionally, breast milk samples were collected and analyzed for selected nutrient content and correlated with both maternal dietary intake and the infant’s nutritional status. The breast milk samples were analysed for energy, macronutrients and selected micronutrients (vitamin A, calcium, magnesium, zinc and iron). All the measurements were done at two time points (first and the fifth month of lactation) among a comprehensive sample of 104 mother-child dyads. Significant changes in the mean nutrient composition were noted between the first and fifth month of lactation (protein -0.96 g/dL and 0.85 g/dL, p = 0.03; vitamin A-22.48 and 31.61 μg/dL, p value, p < 0.001; iron-0.39 mg/L and 0.47 mg/L, p = 0.02). There was statistically significant (p < 0.05) relationship between mother energy intake with milk lactose (r = 0.30); carbohydrate intake with milk true proteins (r = 0.24); protein intake with milk true protein (r = 0.44) and milk iron (r = 0.31); fat intake with milk energy (r = 0.29), milk true protein (r = 0.40) and milk fat (r = 0.35); percent of energy from fat with milk energy (r = 0.39) and milk fat (r = 0.45). Furthermore, vitamin A intake with milk retinol (r = 0.56), calcium intake with milk zinc (r = -0.32) and iron (r = -0.27), zinc and iron (r = -0.26). For maternal nutrition status, hemoglobin (Hb) was correlated with both milk energy (r = 0.30) and true protein (r = 0.44). Serum retinol, magnesium and iron were correlated with milk retinol (r = 0.34), magnesium (r = 0.29) and iron (r = 0.33), respectively. Association between breast milk nutrient composition and infant nutrition status revealed that the milk true protein (r = 0.58) and retinol (r = 0.32) were positively correlated with weight for age and MUAC (r = 0.31) of the infant. Weight for length was also positively correlated with milk lactose (r = 0.47). No relationship was found between other maternal factors (age, parity, child sex and mode of delivery) and any of the selected breast milk nutrient content (p > 0.05). The study observes that breast milk nutrient composition is variable over the course of lactation. Further, both maternal dietary intake and nutrition status (serum micronutrient status) are associated with the nutrient composition of human milk. Moreover, breast milk nutrient composition is related to the infant nutrition status. Promoting adequate nutrient intake and optimal maternal nutritional status during lactation is essential to ensure adequate child growth and development.

RELATIONSHIP BETWEEN BEHAVIOURAL PROFILES AND DEMOGRAPHIC CHARACTERISTICS OF ELITE DISTANCE RUNNERS AT HIGH ALTITUDE TRAINING CENTRES IN NANDI COUNTY, KENYA

Mse, Elizabeth-PHD
Behavioural profiling (DISC) is a new invention which has recently began to be used in sporting contexts. However, there is scanty information on quantitative data to support conclusions and recommendations. The purpose of this study was to assess the relationship between behavioural profiles and demographic characteristics of Kenyan elite middle and long-distance runners. The study hypothesized that there is no significant difference in behavioural profiles and demographic characteristics of age, gender, type of race and marital status of elite distance runners. The study adopted a descriptive survey research design. The study targeted a population of 600 elite middle- and long-distance Kenyan runners ranging from 800m to 10,000m races. Stratified random sampling placed athletes in respective races while simple random sampling was used to obtain the representative sample of 235 study participants with a return rate of 98.7%. A validated DiSC® Classic instrument that consisted of a five-point Likert scale was used to collect data. Results revealed that majority of the athletes were aged between 22-30 years. The male distance runners were more than their female counterparts. The type of race recorded more athletes during training for 10,000m. Majority of the participants were single. Participants scored higher mean values in the dominance behavioural profile than the other influence, steadiness and compliance. A paired sample t-test examined behavioural profiles in relation to gender and marital status, results indicated a statistically significant difference in behavioural profiles of male and female distance runners as well as marital status. One-Way Analysis of Variance (ANOVA) examined behavioural profiles in relation to age categories and type of race. Results showed no statistically significant difference in behavioural profiles across age categories and the type of race. In conclusion, gender and marital status are likely to have an impact on the DISC. However, age and type of race are not likely to have an impact on the DISC. Overall, this study recommends that AK should put strategies in place for potential athletes based on age categories, female, type of races and marital status to enrol and train for elite distance running. The study also recommends that athletic coaches, trainers and administrators need to incorporate behavioural profiling in order to help predict psychological orientations in relation to their demographic characteristics.

**EFFECTIVENESS OF ALBENDAZOLE ON SOIL TRANSMITTED NEMATODES AMONG SCHOOL GOING CHILDREN IN KAKAMEGA COUNTY, KENYA**

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Soil-Transmitted Nematodes (STNs) are roundworms transmitted through faecally contaminated soil. Globally, major STNs include Ascaris lumbricoides, Trichuris trichiura and hookworm (Necator americanus and Ancylostoma duodenale). School going children are mostly affected by STN infections. STNs cause malnutrition, intellectual retardation and cognitive deficits. They are distributed worldwide, Kenya included and they are of public health importance. Kenya has embarked on mass deworming programs since 2012. The study is entrenched in school mass deworming programs. Kakamega county has high endemicity of STNs and treatment using albendazole has been going on since 2009. The main objective of the study was to determine the effectiveness of a single 400 milligram dose of albendazole against STNs infections. A longitudinal study was conducted in selected public primary schools selected through random sampling from three randomly selected sub counties, Kakamega East, Kakamega Central and Kakamega South in Kakamega County, in Kenya. A
structured checklist was used to establish demographics of the school pupils and schools’ WASH conditions. Kato Katz technique examined STN infections both at baseline and follow up survey. The prevalence of infection was determined as the percentage of children that tested positive for each STNs species to the total number of children examined. Intensity of infection was determined using Arithmetic mean of the number of eggs per gram of faeces. A total of 731 children in baseline from seven primary schools provided stools and were examined for STN infections. A post treatment survey was conducted after two weeks where total of 665 children were examined. Effectiveness of albendazole was analyzed using prevalence reduction and the fecal egg reduction rate (ERR). Data was analyzed using STATA version 12.0. Associations were assessed between WASH predictors and STNs; Infection prevalence of either gender or age group was analysed using Pearson chi-square test. Infection mean intensity was assessed using two sample independent t-test and significance for age group was assessed using ANOVA test. Prevalence of infections based on 95% CIs was calculated using binomial logistic regression. Arithmetic mean expressed mean egg counts and negative binomial regression model estimated mean intensity. At baseline, STNs prevalence was 44.0% (95% CI: 35.8 – 54.2). Common STN was Ascaris lumbricoides. 43.5%. The baseline STN mean intensity was 3674 eggs per gram. There was significant prevalence reduction of combined STN prevalence infection to 2.3% (PR=94.9%, P=0.001). STNs mean intensity was significantly reduced from 3674 epg to 59 epg (ERR=98.4%, P=0.001). Prevalence of T. trichiura significantly reduced, 0.8% to 0 (100%, P<0.001). Pupil latrine ratio was significantly associate with STN infection intensity ($\chi^2 = 3.7333$, df=1, p=0.047). Improved water source was not significantly associated with both lower infection prevalence ($\chi^2 = 0.875$, df = 1, p=0.350) or intensity ($\chi^2 = 0.1944$, df = 1, p=0.659). Hand-wash facility with water and soap did not associate with both lower infection prevalence ($\chi^2 = 0.4667$, p=0.495). In this study, mass treatment with Albendazole was highly effective on the STNs. These findings are important to Ministry of Health and Ministry of Education in assessing the national deworming guidelines and policies. Mass Deworming programmes be extended to communities to ensure all possible transmission focal points are covered.

EFFECT OF TARGETED-COUNSELING ON RETENTION TO HIV PRE- EXPOSURE PROPHYLAXIS AMONG MEN WHO HAVE SEX WITH MEN WITHIN NAIROBI CITY COUNTY, KENYA

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This study looked at effect of targeted Counseling intervention on retention to Pre Exposure Prophylaxis (PrEP) among Men who have Sex with Men (MSM) within Nairobi City county Kenya. In Sub Saharan African countries, MSMs have 19.3 folds higher odds of being HIV infected compared with the general population. Kenya MSM have a HIV prevalence of 18.2%. This community has benefitted from HIV Pre exposure prophylaxis (PrEP). PrEP protects up to 90% of HIV infection in those who adhere well. The only three African countries who have rolled out PrEP among Key population are South Africa, Zimbabwe and Kenya. However adherence and retention of MSM on PrEP in Kenya has proved to be a challenge. Experimental design was used with mixed method of data collection. The two facilities within Nairobi serving Men having sex with Men were purposively selected. Eligible Men who have Sex with Men and had just enrolled into PrEP within one week were selected through simple random sampling and randomized to either arm using computer generated randomization table. MSM in the intervention arm received Targeted counseling sessions three times for six months this included PrEP health education, depression assessment, alcohol consumption assessment, substance abuse assessment and adherence to clinic appointments. Their retention was analyzed and compared to the control arm. Control arm participants received PrEP services as prescribed by the government without any intervention. Qualitative method was used in exploring drivers to PrEP retention among MSM, including knowledge and challenges before intervention whereby two focused group discussions (FGD) each having 6-12 participants were conducted. MSM peer leaders and site staff were approached for a Key Informant interview (KII). Quantitative data was collected through questionnaires, qualitative data
was tape recorded. Data was cleaned and analyzed. Quantitative data was entered into SPSS version 24.0. Univariate, bivariate and multivariate data was analyzed. Descriptive data was analyzed using frequencies, proportions and mean. Chi square was used to test for associations between two categorical variables. T test was used to test for differences between the groups. A total of 168 MSM were enrolled into the study 84 on each arm. Retention at month one was 97.6% among the intervention group while 81% in the control group. At month three retention was 91.7% and 31% respectively. At month six the retention for Intervention arm was 69% while control 19%. PrEP knowledge for Intervention arm increased from 37.7% to 83%, while control arm dropped from 44% to 37.5%. Data was presented in graphs and tables to Kenyatta University department of Community Health, graduate school, both local and international conferences as well as through publication.

CONTRACEPTIVE UPTAKE AND ADHERENCE AMONGST POST ABORTION WOMEN FOLLOWING CONTRACEPTIVE COUNSELLING BY PHYSICIANS AND MIDWIVES IN KISUMU COUNTY, KENYA

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Complications of unsafe abortion and those of incomplete abortion, led to 120,000 Kenyan women receiving Post Abortion Care (PAC) in 2012, and of these women, 70% had not used contraception before pregnancy and repeat abortion is common. The aim of the research was to explore contraceptive uptake, adherence to contraceptive use, associated factors and satisfaction with care among women seeking post abortion-care (PAC) in Kisumu, Kenya and to determine the technical competence of midwives as compared to physicians in terms of contraceptive counselling. The study (included 128 women in the quantitative study and 20 in the qualitative study) nested in a larger randomized controlled trial, where women sought PAC at two public hospitals in Kisumu, in October 2015–September 2017. The 128 women randomly assigned to a midwife or a physician for PAC, including contraceptive counselling, and followed-up after 7–10 days and three months. Associated factors for contraceptive uptake analyzed with binary logistic regression, and contraceptive method choice, adherence and satisfaction level examined by descriptive statistics, using IBM SPSS Statistics for Windows, Version 22.0 while framework analysis was used to analyze qualitative data. The results showed that of the 128 randomly selected PAC-seeking women, 95.3% accepted the use of contraception. The women were between the age of 15 and 40 years. Methods chosen after contraceptive counselling were hormonal injections (39%), contraceptive pills (33.3%) condoms (22.8%), hormonal implant (4.1%) and fertility (0.8%). None chose intrauterine device (IUD) or a permanent contraceptive method. After 3-months, follow-up 79.7% retained the chosen contraceptive method while 20.3% had changed the chosen type of contraception to another method. Women (96.1%) still used contraception, and were satisfied with the chosen contraceptive method (x²= 1.0112, df = 3, p =0.799). The twenty (20) women in the qualitative study selected from the 128 who had participated in the quantitative study, to determine their experiences of contraceptive counselling that was provided during counselling and provision of contraceptive methods. Women generally had positive experiences with contraceptive counselling from service providers and it helped them in making informed choice of contraceptives and were able to discuss the contraceptives in general and more in detail on the method of choice. Follow up visits well planned and women could visit facilities anytime they had a problem following post abortion care, before planned visits women were given a call a day before to remind them of visits. The counselling they received was effective in supporting contraceptive uptake and adherence. In conclusion, the study shows that there were no statistical difference in contraceptive uptake and adherence provided by midwives (98.5%) as compared to physicians (93.5%) in providing contraceptive methods to post abortion women effectively. Women have good experiences during interaction with midwives and physicians during counselling. Since the post abortion women were satisfied with the contraceptives
counselling provided and services dispensed, meaning both physicians and midwives can provide services effectively therefore recommend the midwives to counsel and provide contraceptives to post abortion women.

**INFLUENCE OF SCHOOL-BASED SEXUAL RISK AVOIDANCE EDUCATION ON SEXUAL BEHAVIOR AMONG ADOLESCENT GIRLS IN HOMABAY COUNTY, KENYA**

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Adolescent sexual and reproductive health is a priority in the global agenda because of its associated negative reproductive health outcomes. It is estimated that Homabay County contributes 11.5% of adolescents aged 10-19 years living with HIV in Kenya. The fertility rate among girls aged 15-19 is also high in Homabay with a reported teenage pregnancy rate of 33% and the age-specific fertility rate of 178 births per 1000 girls. This study aimed to determine the influence of school based sexual risk avoidance education on sexual behavior in Homabay County. Using a cluster randomized control trial study design 28 schools were randomly selected from a sampling frame of 94 schools and randomly allocated to intervention and control arm of the study at a ratio of 1:1 for a period of 12 months. Using a repeat cross-sectional study design a total of 491 and 489 participants were proportionately and randomly selected from a sampling frame of 2085 participated in the baseline and evaluation surveys respectively. The data collection tools were a self-administered questionnaire, a focused group discussion guide, and key informant interview guide. For intervention, school-based sexual risk avoidance manual, self-assessment evaluation checklist, and videos were used. Quantitative data was managed in SPSS while qualitative was analyzed by thematic content analysis. Descriptive statistics was used to determine the prevalence of high-risk sexual behavior, teenage pregnancy, level knowledge, perception of risk and sexual self-efficacy. Logistic regression analysis was used to determine factors associated with sexual behavior and effect of intervention. The study found overall high-risk sexual behavior, sexual activity, early sexual debut, inconsistent utilization of condom and multiple sexual to be 62.3%, 61.7%, 37.5%, 33%, and 23.1% respectively among girls. Proportion of participants with a good level of knowledge on risky sexual behavior, pregnancy and HIV/AIDS were found to be 39.4%, 40.4%, and 82.9% respectively while those with high perceptions of risk on pregnancy and HIV/AIDS were found to be 54.3% and 41.9% respectively and 60% had high self-sexual efficacy. Multiple sexual partner was associated with current guardians (OR 0.327, CI 0.126-0.844, P 0.021) and perception of risk on pregnancy (OR 0.327, CI 0.115-0.929, P 0.036) while inconsistent utilization of condom was associated with current guardian (OR 0.477, CI 0.242-0.940, P 0.033), position of birth (OR 0.355 CI 0.157-0.805, P 0.013) and sexual self-efficacy (OR 0.389, CI 0.188-0.806, P 0.011). Early sexual debut was associated with knowledge on pregnancy (OR 0.353, CI 0.169-0.737, P 0.006) and perception of risk on pregnancy (OR 0.316, CI 0.147-0.676, P 0.003). School-based sexual risk avoidance education significantly increased knowledge on risky sexual behavior (OR 1.525, CI 1.059-2.195, P 0.023) and strength of sexual self-efficacy (OR 1.506, CI 1.021-2.221, P 0.039). The SRAE has a protective effect on knowledge on risky sexual behavior and sexual self-efficacy which directly influences sexual behavior. Therefore, Ministry of education and the stakeholders should upscale a progressive sexual risk avoidance education from primary to secondary schools.