



**29<sup>TH</sup> -31<sup>ST</sup> MARCH 2023**

**THEME: LEVERAGING SCIENCE AND TECHNOLOGY FOR DEVELOPMENT**

**VENUE: GREAT HALL & ISSER CONFERENCE CENTRE,  
UNIVERSITY OF GHANA**

**BOOK OF ABSTRACTS**



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# CONFERENCE PROGRAMME

PROGRAMME 29 - 31 March, 2023				UG COLLEGE OF BASIC AND APPLIED SCIENCES	3 <sup>RD</sup> BIENNIAL SCIENCE AND DEVELOPMENT CONFERENCE
DAY 1 (Wednesday, 29th March 2023)					
TIME	ACTIVITIES	PERSON RESPONSIBLE	Venue		
8:00 am - 8:45 am	Arrival and Registration with Abibigromma	Mr. Mawusi Glozah / Dr. Ezekiel Acquah	Great Hall		
9:00am - 9: 05 am	Introductory Remarks	Prof. Elvis Tiburu - Chair, Conference Planning Committee			
9:05 am - 9: 10 am	Introduction of Chairperson and Other Dignitaries	Prof. Matilda Steiner-Asiedu - Co-Chair, Conference Planning Committee			
9:10 am - 9: 15 am	Chairperson's Remarks	Prof. Felix A. Asante, ProVC-RID, UG			
9:15 am - 9: 25 am	Welcome Address	Prof. Boateng Onwona-Agyeman - Provost, CBAS, UG			
9:25 am - 9: 30 am	Brief Performance	Abibigromma			
9:30 am - 9: 40 am	Vice Chancellor's Remarks/ Conference Opening	Prof. Nana Aba Appiah Amfo - VC, UG			
9:40 am -10:00 am	Address by Guest of Honour	Dr. Eugene Owusu - Special Advisor on SDGs, Office of the President			
10:00 am -10:30 am	Address by Keynote Speaker	Dr. Tsepo L. Tsekoa, Council for Scientific and Industrial Research (CSIR), South Africa			
10:30 am -10:35 am	Closing Remarks	Prof. Felix A. Asante, ProVC-RID, UG			
10:35 am -11:00 am	Group Photo & Refreshment	Mr. Mawusi Glozah / Dr. Ezekiel Acquah			
11:10 am -11:20 am	Opening of Exhibition	Ing. David Osei Amankwah, Chairman-CBAS Advisory Board	Recreational Quadrangle		
DAY 1 (Wednesday, 29th March 2023)	Facilitator	Prof. Matilda Steiner-Asiedu	ISSER Conference Centre		
	<b>ROOM 1 (parallel session 1)</b>	<b>ROOM 2 (parallel session 1)</b>	<b>ROOM 3 (parallel session 1)</b>		
	<b>Agriculture and Food Security</b>	<b>Emerging Technologies</b>	<b>Planetary Health and Pandemic Preparedness</b>		
	Chair: Prof. Daniel Asiedu	Chair: Prof. Robert Kingsford-Adabo	Chair: Prof. Augustine Ocloo		
11:30 am -11:45 am	<b>Cedric Kpakpo Parker-Allotey:</b> Decision support system for sizing drying bins, fan selection and drying parameters determination for selected Grains	<b>Sheila Opoku Adjei:</b> Quantifying the carbon footprint of a multi-specialist hospital in Ghana and opportunities to go green	<b>Jamiyu Ayodeji SALIU :</b> Effects of Ylang Ylang ( <i>Cananga odorata</i> ) leaf extract on blood glucose level and biochemicals related to diabetes nephropathy		
11:45 am -12 noon	<b>Eunice Berko Nartey:</b> The early stages of the covid-19 pandemic were associated with household food insecurity among adolescents with sickle cell disease in the Greater Accra region, Ghana	<b>O.Y. Adeniran:</b> Sensory evaluation and hematopoietic potential of fermented sorghum fortified with <i>Sorghum bicolor</i> leaf powder in phenylhydrazine-induced anaemic rats	<b>Heckel Amoabeng Abban:</b> Predictors and pathways associated with of potentially high risk for preeclampsia among pregnant women attending ante natal clinic in selected hospitals in Ghana		
12 noon -12:15 pm	<b>Francis Z. Taabia:</b> A Systematic review of factors associated with household food insecurity in sub Saharan Africa during covid-19 pandemic	<b>Michelle Oti-Bronya:</b> Investigating the adsorption rate of uremic toxins using zeolite for a potential application as a dialysis membrane	<b>Alberta Serwaa:</b> Effects of SARS-CoV-2 spike protein and ACE2 interaction on cancer properties and cytokine expression in cancer lines		
12:15 pm -12:30 pm	<b>Etriakor K. Gbordzoe:</b> Assessment of the market for poultry by-products and their contribution to poultry farmers' revenue in Ghana.	<b>Akofa Bart-Plange:</b> Biomedical engineering and the innovation landscape in West Africa: A case study of Ghana	<b>Akindele Fakoya:</b> Terpenoid compounds from <i>Buchholzia coriacea</i> seed exhibited inhibitory potential against SARS spike protein receptor binding domain		
12:30 pm -12:45 pm	<b>Nutrition Education....</b> VIRTUAL PRESENTATION		<b>Winfred Seth K. Gbewonyo:</b> Kombucha is a safe health drink		
12:45 pm -1:00 pm	All Poster Presentations				
DAY 1 (Wednesday, 29th March 2023)	<b>Agriculture and Food Security</b> Chair: Prof. Daniel Asiedu	<b>Emerging Technologies</b> Chair: Prof. Robert Kingsford-Adabo	<b>Planetary Health and Pandemic Preparedness</b> Chair: Prof. Augustine Ocloo		

1:00 pm -1:15 pm	<b>Mathieu Koue Bi:</b> Food interest of rural populations in the management of natural resources: Case of consumed birds by the Gourou people, Marahoué region, Côte d'Ivoire (VIRTUAL)	<b>Oluwafemi Oriola:</b> An ICT-based control and security model for implementation and evaluation of sustainable development goals at subnational levels in Nigeria	<b>Elmer N. Ametefe:</b> African fermented seeds as probiotic carriers for poultry feed and alternative to antibiotic growth promoters
1:15 pm -1:30 pm	<b>Gifty-Maria Sangber-Dery:</b> Do farm operation injuries have an influence on household welfare of cocoa farmers? Empirical evidence from Ghana	<b>Bernice Okrah:</b> Investigating the applicability of a mathematical module for prediction of individual-specific fetal growth trajectory using ultrasound	<b>Francisca Mawulawoe Akoto:</b> Antimicrobial dispensing practices in medicine outlets in Ghana: A maximum difference experiment design
1:30 pm -1:45 pm	<b>Ibidun Comfort Adene:</b> Studies on hematological profile and behaviour of juvenile <i>Oreochromis niloticus</i> exposed to metalaxyl fungicide	<b>Felix Ola Aranuwu:</b> Optimized bids responsiveness evaluation model for improved performance in the public procurement sector and construction projects	<b>Bright Akomea Aboagye:</b> Kombucha drinks possess potential anti-diabetic property
1:45 pm -2:00 pm	<b>Olojede Ayoyinka:</b> Evaluation of selected natural preservatives on the sensory and storage properties of fermented locust bean (Iru) powder	<b>Richmond Tackie:</b> Monitoring patients' oxygen saturation and heart rate using wearable devices	<b>Emelia Awude:</b> Existing insights into micronutrient insufficiency among older adults in Africa
2:00 pm - 3:00 pm	<b>Lunch break</b>		

	ROOM 1 (parallel session 2)	ROOM 2 (parallel session 2)	ROOM 3 (parallel session 2)
	<b>Planetary Health and Pandemic Preparedness</b> Chair: Dr. Theresa Mantful Gwira	<b>Emerging Technologies</b> Chair: Prof. Firibu Kwesi Saalia	<b>Agriculture and Food Security</b> Chair: Prof. Kwadwo Ofori
3:00 pm - 3:15 pm	<b>Daniel Oduro:</b> Gastrointestinal helminths of the Ethiopian rock hyrax ( <i>Procavia capensis</i> ; Pallas, 1760) in the North-East region of Ghana	<b>Joanna Aha Modupeh Hodasi:</b> Femtosecond all-fiber amplifier similariton erbium doped fiber laser	<b>David A Sepenoo Modzakah:</b> Perception of agribusiness firms about benefits and preferences for credit guarantee system
3:15 pm - 3:30 pm	<b>Obed Harrison:</b> Knowledge, awareness, and use of folate-rich foods and supplements among pregnant and lactating women in a peri-urban community in Ghana	<b>Isaac Wiafe:</b> Training machine learning models for natural language processing in Ghana: An audio description dataset of five Ghanaian languages	<b>Yao Sedufia Agbenyefia:</b> Achieving rice self-sufficiency through enhanced profitability and effective constraint management
3:30 pm - 3:45 pm	<b>Peace Korshiwor Amoatey:</b> Water consumption changes during and after COVID-19 in Ghana	<b>Adwoa Adubea Onomah:</b> Automated detection and labeling of lanes in gel electrophoresis images	<b>Knutsford Asiamah:</b> Time intensity evaluation of sensory attributes of flavoured skimmed milk yoghurt
3:45 pm - 4:00 pm	<b>Akofa Bart-Plange:</b> Assessing the responsiveness of emergency medical services and the availability of diagnostic radiology equipment for injury management in health facilities in the Ashanti region of Ghana	<b>Josephine Cudjoe:</b> Machine learning models for predicting half maximal inhibitory concentrations of compounds against Vascular Endothelial Growth Factor Receptor-2 (VEGFR-2)	<b>Oluwatoyin Sunday Osekita:</b> Genotypic variability and plant character correlation among the wheat ( <i>Triticum aestivum</i> L.) genotypes
4:00 pm - 4:15 pm	<b>Eric Gaba:</b> The use of pineapple leaf fiber for prosthetic socket application	<b>Savannah Nyarko:</b> LTA zeolites synthesized at different temperatures and evaluating the drug loading capability	<b>Abiola T. Ajayi:</b> Genetic variation, genotype × environment interaction, and correlation among drought tolerance indices in cowpea
4:15 pm - 4:30 pm	<b>Christabel Ampong Domfe:</b> Objective assessment of shared plate eating in urban and rural households in Ghana using a wearable camera (VIRTUAL)	<b>Richard Minkah:</b> Estimating bivariate tail coefficient: An exponential regression approach	<b>Samuel Asah Akyeampong:</b> Irrigation technology enhances vegetable productivity in peri-urban areas of Ghana
6:00 pm	<b>Networking at "The Loggia" (Sarbah Hall Senior Common Room)</b>		

<b>DAY 2 (Thursday: 30th March, 2023)</b>			
8:30 am - 9:00 am	Arrival and Registration	Mr. Mawusi Glozah / Dr. Ezekiel Acquah	<b>ISSER Conference Centre</b>
DAY 2 (Thursday: 30th March, 2023)	Facilitator	Prof. Matilda Steiner-Asiedu	
<b>Plenary Session 1</b>			
9:00 am - 9:10 am	Chairperson	Prof. Mark Sandow Yidana	
9:10 am - 9:40 am	Invited Speaker	Dr. Stephen Ayisi-Addo -National AIDS/STI Control Programme	
9:40 am -10:15 am	Group Photo & Refreshment	Mr. Mawusi Glozah / Dr. Ezekiel Acquah	

DAY 2 (Thursday: 30th March, 2023)	Plenary Session 2		ISSER Conference Centre
	ROOM 1 (parallel session 2)	ROOM 2 (parallel session 2)	ROOM 3 (parallel session 2)
	<b>Policy, Culture and Society</b> Chair: Prof. Kwadwo Owusu	<b>Emerging Technologies.</b> Chair: Prof. Esther Sakyi-Dawson	<b>Agriculture and Food Security</b> Chair: Dr. Nicole Sharon Affrifah
10:15 am - 10:30 am	<b>Edwin Williams-Gadabor:</b> Influence of extension methods used under the planting for food and jobs programme on adoption of improved technologies	<b>Emmanuel Annor:</b> Revisiting the application of extreme value theory to the management of a hydroelectric dam	<b>David Ntuu:</b> Combining ability studies and root-knot nematodes resistance in tomato genotypes in Ghana in open and protected conditions
10:30 am - 10:45 am	<b>Sandra Ayisi Addo:</b> Predictors of weight loss maintenance success among previous participants of a commercial weight loss programme in Accra, Ghana	<b>Bernard Asimeng:</b> pH-sensitive biogenic silica-chitosan composite for targeted folic acid delivery	<b>Joseph Okani Honger:</b> Importance, etiology and control of styelar-end-rot disease of guava in Ghana
10:45 am - 11:00 am	<b>Sylvia Hagan:</b> Climate change adaptation and organisational sustainability: Insights from industrial and organisational psychology	<b>Joseph Asamoah-Asare:</b> Carboxymethyl chitosan- $\beta$ -cyclodextrin nanoparticles as a drug delivery system: Evaluation against MCF-7 breast cancer cells	<b>Thomas Buxton:</b> Insecticidal activities of cinnamic acid esters isolated from <i>Ocimum gratissimum</i> and <i>Vitellaria paradoxa</i> leaves against <i>Tribolium castaneum</i>
11:00 am - 11:15 am	<b>Mawusi Mattah:</b> Assessment of social factors that promote the susceptibility of communities to coastal hazards in the Volta estuary, Ghana	<b>Felix O. Aranwuwa:</b> Deep Learning Technique for Efficient Iris Image Classification	<b>Clement Akotsen - Mensah:</b> Role of invasive species in global food security: The case of <i>Drosophila suzukii</i> and <i>Halyomorpha halys</i> in tree fruit and berry crop production in the U.S.
11:15 am - 11:30 am	<b>Rejart Adomah:</b> The influence of storage temperature and humidity on chocolate retained in hot climate using phase change material	<b>Samuel. A. Atarah:</b> A first-principle study of the electronic properties and mechanical stability of lead-free halide inorganic double perovskite Cs <sub>2</sub> InAgX <sub>6</sub> (X = F, Br, Cl, I)	<b>Salome Heymann:</b> The role of micronutrients in the prevention and management of neurodevelopmental disorders: A systematic review
11:30 am - 11:45 am	<b>All Poster Presentations</b>		
	<b>Climate Change &amp; Environmental Sustainability</b> Chair: Prof. Kwadwo Owusu	<b>Emerging Technologies</b> Chair: Prof. Esther Sakyi-Dawson	<b>Agriculture and Food Security</b> Chair: Dr. Nicole Sharon Affrifah
11:45 am - 12:00 noon	<b>Omowumi Ademila:</b> Engineering and environmental radiation performance of geomaterials in Southwestern Nigeria	<b>Desmond Asante Karikari:</b> Exposure assessment of some heavy metals (Arsenic, Lead, Cadmium, Mercury, Copper and Zinc) in locally produced rice sold in Accra Metropolis	<b>Ken Okwae Fening:</b> Bioecology and management of some insect pests of quarantine importance and their implication for the export of vegetables
12:00 noon - 12:15 pm	<b>Ezekiel Acquah:</b> Monitoring and evaluating climate change adaptation programmes using adaptation frameworks of interaction and outcomes	<b>Ebenezer Annan:</b> Green synthesized magnetite from <i>Tetrapleura tetraptera</i> for fluoride mitigation in aqueous media	<b>Joshua Baffoe-Ansah:</b> Susceptibility of five cowpea varieties to field insect pests
12:15 pm - 12:30 pm	<b>Benjamin Osei Botwe:</b> Assessment of benthic macroinvertebrates and heavy metal content of sediments, fish and shellfish in the Pra Estuary, Ghana	<b>Famous Sosah:</b> Formulation of plantain-based snack ('kaklo') from orange fleshed sweet potato and bambara groundnut flour blend	<b>Vincent Tamakloe:</b> Performance of some selected eggplant ( <i>Solanum</i> spp.) accessions to the eggplant fruit and shoot borer under field and screenhouse conditions
12:30 pm - 12:45 pm	<b>Abdallah Dawood:</b> Sustainable development and climate change in Ghana – The nuclear power factor	<b>John Bright Amoah Nyasapoh:</b> Oil palm empty fruit bunch and irrigation effects on growth, dry matter yield, and radiation use efficiency of eggplant cultivated in Ghana	<b>Ama Asantewah Ahene-Codjoe:</b> Planting for Food and Jobs (PFJ) participation and smallholder farmers' technical efficiency: Evidence from rice farmers in Northern Ghana
12:45 pm - 1:00 pm	<b>Delia Akosua Bandoh:</b> Climate resilience of water sources in coastal communities in the eastern coast of Ghana, 2021	<b>Maxwell Awinikagise Nsoh:</b> Factors influencing the adoption of improved industrial cassava varieties among farmers in the Yilo Krobo district of the Eastern Region, Ghana	<b>Nyagortey Nene Kofi:</b> Review of the effects of the threats of ticks infestation on cattle in the coastal savanna, Ghana
1:00 pm - 2:00 pm	<b>Lunch break</b>		

Plenary Session 3				
	ROOM 1 (parallel session 3)	ROOM 2 (parallel session 3)	ROOM 3 (parallel session 3)	
Day 2 (Thursday: 30th March, 2023)	<b>Emerging Technologies</b> Chair: Prof. Osbourne Quaye	<b>Climate Change &amp; Environmental Sustainability</b> Chair: Prof. Francis Nunoo	<b>Agriculture and Food Security</b> Chair: Dr. Frederick Vuvor	
2:00 pm - 2:15 pm	<b>Dora Duah-Bisiw:</b> Antioxidant activity and phenolic content of selected dehydrated vegetables with different drying methods	<b>Francis Taabia:</b> Mineral concentrations and heavy metal contamination of mangrove oysters ( <i>Crassostrea gasar</i> ) from selected estuarine sites in Ghana	<b>Benifram Tagmar:</b> Zinc sorption characteristics of biochar and biochar-compost	
2:15 pm - 2:30 pm	<b>Adjoa Kesewaa Sarfo:</b> Particle size distribution and emulsion ability of cocoa shells processed with different methods	<b>Olaoluwa Yaya:</b> Long memory cointegration in the analysis of maximum, minimum and range temperatures in Africa: Implications for climate change	<b>Ephraim Semordzi:</b> Aging and phosphorus availability in biochar and biochar compost	
2:30 pm - 2:45 pm	<b>George Enninful:</b> Non-canonical amino homoarginine as a potential substituent to improve antimicrobial peptide trypsinolytic stability	<b>Danley Colecraft Aidoo:</b> Influence of climate change adaptation strategies on maize productivity in two agro ecological zones in Ghana	<b>Reuben Acheampong:</b> Physicochemical, functional and sensory characteristics of a breakfast cereal made from sprouted finger millet-maize composite flour	
2:45 pm - 3:00 pm	<b>Andrew Nii Nortey Dowuona:</b> Preparation of Ag@Metal oxide (ZnO/CuO) core-shell nanoparticles as non-cytotoxic inorganic bactericides	<b>Yaa Serwaa Gyan:</b> Facies, depositional environment and provenance studies of the Yabraso and Bimbila formations of the Voltaian basin	<b>Timothy Dzadze:</b> Current status, challenges and prospects of quail farming in Ghana	
3:00 pm - 3:15 pm	<b>George K. Acquaaah-Mensah:</b> Cactin, MID2, and prognosis of breast cancer in African women (VIRTUAL)	<b>Kate Ackon:</b> Activity budget, diet, and habitat use of the Gambian sun squirrel in urban landscape	<b>Marian Ewura-Esi Adjeiwa Adjei:</b> Drivers of increasing cost of poultry production in Ghana: Trend analysis of input prices from 2010-2021	
3:15 pm - 3:30 pm	<b>Azurae Yaa Akanya:</b> The effect of multi-sized Pt <sub>3</sub> Ni@TiO <sub>2</sub> electrocatalyst core-shell nanoparticle for stable proton exchange membrane fuel cell	<b>Daniel Kwayisi:</b> Exhumed residual mantle peridotite in an ancient oceanic basin at the Southeastern margin of the West African Craton, Ghana	<b>Cephas Glavee:</b> Agricultural labour availability, food production and food security: Perspectives of non-migrant agricultural households in Southern Ghana	
3:30 pm - 3:45 pm	<b>Bismark K. Sam:</b> Computational modelling and inhibition of <i>Echis ocellatus</i> venom acidic phospholipase A <sub>2</sub> by ethnopharmacologically derived compounds: Structure-activity relationship	<b>Edinam Cita Amekudee:</b> Preparation of uniform size and shape Pt <sub>3</sub> Ni@TiO <sub>2</sub> core-shell electrocatalyst NPs for stable PEM-fuel cell for sustainable renewable energy	<b>Patience Attisogbey:</b> Nutrition education improves knowledge and consumer behaviour towards the usage of green leafy vegetables and legumes in households in the Greater Accra metropolis, Ghana	
4:00 pm - 5:00 pm & All day	Exhibition Sessions	IAST / Dr. Henry O. Sintim	Recreational Quadrangle	
6:00 pm	Networking at "The Loggia" (Sarbah Hall Senior Common Room)			
DAY 3 (Friday: 31st March, 2023)				
8:30 am - 9:00 am	Arrival and Registration	Mr. Mawusi Glozah / Dr. Ezekiel Acquaaah	ISSER Conference Centre	
	Facilitator	Prof. Matilda Steiner-Asiedu		
<b>Plenary Session 1</b>				
9:00 am - 9:10 am	Chairperson	Prof. Langbong Bimi		
9:10 am - 9:40 am	Invited Speaker	Dr. Foster Ansong-Bridjan - Ghana Ambulance Service		
9:40 am-10:00 am	Group Photo & Refreshment	Mr. Mawusi Glozah / Dr. Ezekiel Acquaaah		
<b>Plenary Session 2</b>				
<b>IAST Symposium</b>				
10:00 am - 12:00 noon	Chairperson	Prof. Sammy T. Sackey	ISSER Conference Centre	
	<b>Theme-</b> "Leveraging Science and Technology for Development: The Role of Industry and Society"	<b>Speakers:</b> Nana Osei Bonsu (Private Enterprise Federation) Ing. Dr. Kenneth Ashigbey (Ghana Chamber of Telecommunications) Dr. Mercy Gardiner Tenkorang (DevAPPS Ltd)		
<b>Closing Ceremony</b>				
12:00 noon - 1:00 pm	Closing Ceremony and Lunch	Prof. Boateng Onwona-Agyeman, Provost, CBAS, UG	ISSER Conference Centre	

All day: 29-31 March

DAY 3 (Friday: 31st March, 2023)	Plenary Session 3		ISSER Conference Centre
<b>All Poster Presentations</b>			
	<b>001 Alice Koryo-Dabrah:</b> Physical activity, screen time and barriers to exercise among adolescents in the La Nkwatanag public Junior High Schools, Accra	<b>002 Justina Chiamaka Oguikpo:</b> The association between maternal socio-economic status, time available for care and the nutritional status of children from 0 to 2 years	<b>003 Miriam Semefa Mantey:</b> Preliminary studies on the presence of the eggplant fruit and shoot borer, <i>Leucinodes laisalis</i> in <i>Solanum</i> spp. in Ghana
	<b>004 Grace Nnmai Adorkor:</b> Antibiotic resistance profile and efficacy of sanitizer treatments on <i>E. coli</i> O157:H7 isolated from leafy green vegetables	<b>005 Susanna Bassaw:</b> Effect of essential oil (Clove and Thyme) coating on the quality and shelf life of eggs	<b>006 Benjamin Senyo Aćkah:</b> Determinants of cocoa farm rehabilitation in the Volta Cocoa Region, Ghana
	<b>007 Cecille Wendy Aboagye:</b> Sensory qualities of indigenous green leafy vegetables	<b>008 Beatrice Tagoe:</b> Exploring the role of carrot juice in enhancing the sensory properties of Bissap juice extract	<b>009 Josephine Ansa Larbi:</b> Baseline lipid profile of pregnant women enrolled in an interventional study
	<b>010 Phyllis Akua Amamoo:</b> Automating phytoplankton identification in Ghanaian estuaries: A machine learning approach	<b>011 Godsway Asamoah:</b> Maize seed production in Ghana can benefit from Internet of Things (IoT)	<b>012 Emmanuel Anokye Mensah:</b> Robots in higher educational learning: Prospects and concerns
	<b>013 Nana Ekua Awotwe Vandyck:</b> Food security and dietary diversity: A phenomenological study of smallholder farmers in rural communities, Central Region, Ghana	<b>014 Ruth-Ann Y. Frimpong:</b> The Effect of wet milling on the physical and rheological characteristics of slurry made from Moringa oleifera seeds	<b>015 Benjamin Eyram Agamah:</b> Evaluation of <i>Trichoderma harzianum</i> as a bio-control agent against root-knot nematode in okra
	<b>016 Selina Acheampong:</b> Assessment of microbial quality of table eggs sold in selected markets in the Abuakwa South Municipality of the Eastern Region, Ghana	<b>017 Christiana Bansah Atsupe:</b> Determination of physiochemical, proximate and mineral composition of fresh tomatoes and tomato paste on the Madina market	<b>018: Stella Asuming-Brempong:</b> Determination of nitrogen mineralization potential for Ferric Lixisol under both upland and lowland condition in the incubated study
	<b>019 Nana Yaw Aboagye:</b> Microbiological quality of lettuce irrigated with treated wastewater	<b>020 Millicent Tetteh:</b> Quality of sachet and bottled water in Ayawaso West Municipality	<b>021 Emmanuel Kosi Apetsi:</b> Insect fauna of cashew and mango at the University of Ghana farm, Legon
	<b>022 Ernest Emmanuel Obeng:</b> Investigating the antibacterial activity of drug loaded bacterial cellulose zeolite composite for wound dressing application	<b>023 Erica Akanko:</b> Prediction of Aromatase inhibitors as potential breast cancer therapy in postmenopausal women using machine learning	<b>024 Kwabena Owusu Ansah:</b> Effects graded levels of biochar inclusion on nutritive value and gas production characteristics of <i>Brachiaria mulatto</i> II
	<b>025 Anthonia H. Andoh-Odoom:</b> Bacterial diversity of wild and farmed African Nile tilapia ( <i>Oreochromis niloticus</i> ) from the Eastern and Greater Accra Regions	<b>026 Derick Ekow Ellis:</b> Learning from and leaning on nature for resilience to climate change hazards: opportunities and challenges for nature-based solutions in Ghana's coastal communities	<b>027 Seth Akagla:</b> Understanding drivers of non-compliance of guidelines for urban tree planting and green spaces in Ghana's building regulations: Perspectives from Residential House Owners
	<b>028 Abubakar Ibrahim:</b> Adoption and impact of sustainable land and water management practices on maize yield in West Mamprusi District, Ghana	<b>029 Sonia O. Sintim:</b> Defining sesame, and the lignan profile of its seeds prospected from Kpembe in Northern Ghana	<b>030 Edith-Casely Nndidi Fordjoe:</b> Ghanaian consumers: Considerations for environmental sustainability in purchase decisions
	<b>031 Priscilla Agyemang :</b> Viability and market potential of coconut briquette as an alternative sustainable energy: Evidence from Ghana	<b>032 Akwasi Akomeah Agyekum:</b> A dendritic reusable nanostructured substrate for the detection of volatile organic compounds in air	<b>033 Leticia Donkor:</b> An optimisation approach to planning a 3-course meal for an adult male
	<b>034 Musah Bukari:</b> The emerging greenhouse technology: A reliable controlled growing environment to achieve improved yields and profits	<b>035 Collins Tutu Boahen:</b> Farmers' preference for agricultural technology transfer modes and its implication for inorganic fertilizer use and maize yield: Evidence from Guinea Savannah and Transitional Zones of Ghana	<b>036 Sheila Priscilla Kyeremeh:</b> Investigating the antibacterial activity of hydroxyapatite / cellulose nano crystal composites for water treatment
	<b>037 Benjamin Osei Botwe:</b> Assessment of water quality of the Pra estuary (Ghana)	<b>038 Priscilla Agyemang:</b> Perception and willingness to pay for coconut briquette	<b>039 J. O. Ademila:</b> Climate change and environmental sustainability
<b>All day</b>	Exhibition Sessions	IAST/ Dr. Henry O. Sintim	Recreational Quadrangle

**Acknowledgement: Conference Planning Committee**

Prof. Elvis Kwason Tiburu Chair	Prof Langbong Bimi Member	Prof. Christian P. K. Dagadu Member	Dr. Robert O. Manteaw Member
	Dr. Jerry Joe Harrison Member	Dr. Henry Ofosuhene Sintim Member	Dr. John Saviour Yaw Eleblu Member
Prof. Matilda Abakai Steiner-Asiedu Co-Chair	Dr. Richard Dery Suu-Ire Member	Dr. Daniel Dzidzienyo Member	Dr. Jesse Sey Ayivor Member
Mr. Mawusi Kofi Glozah Member-Secretary	Dr. Nii Longdon Sowah Member	Dr. Jaqueline Naalamle Amisah Member	Dr. Ezekiel Kojo Acquaaah Member



# MESSAGE FROM CHAIRMAN OF THE CONFERENCE PLANNING COMMITTEE



**PROF. ELVIS K. TIBURU**  
**CHAIRMAN**

Welcome to the 3rd Biennial Conference of the College of Basic and Applied Sciences. This is a biennial event that brings scientists together to showcase their research work and share ideas for future collaborations. The maiden conference was organized in 2016, followed by another in 2018, however due to the global pandemic the third biennial conference was postponed to 2023. The theme for this year Conference is ***“leveraging science and technology for national development.”*** We are privileged to have our Keynote Speaker from the Council for Scientific and Industrial Research, South Africa, in the person of Prof. Tsepo Tsekoa and we thank Prof very much for agreeing to support us. We also thank our Guest of Honour, Dr. Eugene Owusu, Special Advisor on SDGs, Office of the President, for honoring our invitation. We are also grateful to our invited guest speakers who were carefully selected based on their expertise in their respective fields. They are;

- Dr. Stephen Ayisi-Addo, National AIDS /STI Control Program
- Nana Osei Bonsu, Private Enterprise Federation
- Dr. Forster Ansong-Bridjan, the Ghana Ambulance Service

Thank you for accepting to participate in the conference and also to share your expertise to strengthen academia-industry-government collaboration.

Five thematic areas were chosen for this year's conference. These are;

- Agriculture and food security
- Climate change and environmental sustainability
- Emerging technologies

- Planetary health and pandemic preparedness
- Policy, culture and society

We received over 300 abstracts, quite a number of those abstracts came from our international participants. We have organized the oral presentations in parallel sessions at ISSER Conference Center after the opening of the conference in the Great Hall. There are also exhibitions and poster sessions happening concurrently at the Recreational Quadrangle (behind the Balme library) as well as on the premises of the ISSER Conference Center respectively. You may find the details of the programs of events in the booklet. For those of you who are attending virtually, we encourage you to assess our website for additional information. We are also encouraging participants to consider submitting manuscripts for publication in the CBAS Science and Development journal.

Let me take this opportunity to thank the Conference Planning Committee and the sub-committee members for their dedication and hard work that made this conference possible;

### Conference Planning Committee

Prof. Matilda Steiner-Asiedu	Co-Chairperson
Dr. Jerry Joe Harrison	Member
Dr. Jacqueline Naalamle Amisah	Member
Dr. Daniel K. Dzidzienyo	Member
Dr. Robert Manteaw	Member
Prof. C. P. K. Dagadu	Member
Dr. Henry Ofosuhene Sintim	Member
Dr. Richard Dery Suu-Ire	Member
Dr. Nii Longdon Sowah	Member
Prof. Langbong Bimi	Member
Dr. Jesse Ayivor	Member
Dr. John Saviour Eleblu	Member
Dr. Ezekiel Acquah	Member
Mr. Mawusi K. Glozah	Secretary

### Conference Planning Sub-Committee

Sub-committee	Members
<b>Publicity &amp; Publications</b>	Dr. Robert Manteaw – Chair Dr. Henry Ofosuhene Sintim Dr. Longdon Sowah Dr. Daniel Dzidzienyo

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**Fundraising & Stakeholder Engagement**

Prof. Matilda Steiner-Asiedu – Chair  
Prof. C. P. K Dagadu  
Dr. Henry Ofosuhene Sintim  
Dr. Sharon Affrifah  
Dr. Joycelyn Quansah  
Dr. Bennett Atta Dzandu  
Dr. Angela Parry-Hanson Konadu  
Mr. Obed Akwaa Harrison

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**Scientific/Abstract Review**

Dr. John Eleblu – Chair  
Prof. Langbong Bimi  
Dr. Richard Suu-Ire  
Dr. Naalamle Amissah  
Dr. Jerry Joe Harrison  
Dr. Jesse Sey Ayivor

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**Event, Logistics & Hospitality**

Mr. Mawusi K. Glozah – Chair  
Dr. Ezekiel Acquah  
Mr. Bright Avuglah  
Ms. Ernestina Melomey  
Mr. John Adenaa Bawa  
Mr. Hanson Tamatey Tweneboanah  
Mr. Joseph Dikenou  
Ms. Rosemary Okai  
Mr. Ernest Obeng  
Mr. Richard Asiamah  
Ms. Michelle Oti-Bronya  
Ms. Sheila Kyeremeh

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**IT Support**

Prof. Elvis Tiburu – Chair  
Mr. Daniel Anafo  
Mr. Theophilus Dugah  
Mr. Michael Philips  
Mr. Chris Andrew Yebuah

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We urge you to attend presentations of your choosing and try to identify key persons in your area of research for future collaborations.

Thank you

**Prof. Elvis K. Tiburu**  
Chair, CBAS Conference Planning Committee

# ABOUT THE COLLEGE OF BASIC AND APPLIED SCIENCES

The College of Basic and Applied Sciences (CBAS) is one of the four colleges established by the University when it adopted the collegiate system of governance in 2013. It became operational during the 2013-2014 academic year. The College is home to more than 10,000 undergraduate and 800 graduate students. The College offers a valuable journey of learning and discovery across a broad range of Biological, Physical and Mathematical, Engineering, Nuclear and Allied Sciences, Agriculture and Veterinary Sciences.

The College is a community of dedicated faculty whose teaching and research transforms the boundaries of our knowledge and imagination. The Constituent units of the College are the School of Agriculture, School of Biological Sciences, School of Engineering Sciences, School of Nuclear and Allied Sciences, School of Physical and Mathematical Sciences, School of Veterinary Medicine, Institute for Environmental and Sanitation Studies (IESS), Institute of Applied Science and Technology (IAST), Biotechnology Centre, the West African Centre of Crop Improvement (WACCI), the West African Centre for Cell Biology of Infectious Pathogens (WACCBIP) and the Centre for Climate Change and Sustainability Studies

The Objectives of the College are to:

- Develop world-class scientists to meet national and global development needs through quality teaching, learning, research, innovation and extension;
- Enhance staff capacity through systematic staff development programmes;
- Enhance research capabilities of staff for increased output in teaching and publications;
- Develop effective processes for public engagement; and,
- Create congenial environment for teaching research and student learning experiences.

The College of Basic and Applied Sciences offers unparalleled opportunity for students to engage in scholarship spanning agriculture, biological sciences, engineering sciences, nuclear and allied sciences, physical and mathematical sciences and veterinary medicine.

# PROFILE OF SPEAKERS

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**DR EUGENE OWUSU**

**GUEST OF HONOUR**

DR EUGENE OWUSU is an International Policy and Development Management expert with over 25 years of experience in strategic leadership and advocacy with the United Nations throughout Africa, managing complex political, development and humanitarian challenges. He has been a facilitator of institutional partnerships between the UN, Governments, private sector and civil society entities, and is adept in negotiations and policy-driven solutions.

Presently, Eugene is the Special Advisor to the President of Ghana on the Sustainable Development Goals and Sherpa to the President in his role as Co-Chair of the Eminent Group of SDGs Advocates and as a member of the High Level Panel on the Ocean Economy. He is the substantive lead on the President's advocacy and engagement team for mobilizing support for the accelerated implementation of the SDGs at both the sub-regional and international levels.

As the Senior Advisor (Strategic Africa Partnerships) at UNDP Brussels from 2007-2010, he facilitated institutional partnerships with the European Union and its institutions in support of Africa's development agenda in countries like Uganda, Sierra Leone and Tanzania.

From 2015-2017, Eugene has served in various capacities at the UN. Among these are UN Assistant Secretary General and Deputy Special Representative of the UN Secretary General in South Sudan, UN Secretary-General and Humanitarian Coordinator and UNDP Resident Representative in Ethiopia where he performed many roles including providing leadership role in the implementation of UN's system and operational activities.

Prior to joining UNDP, Eugene worked with the world-renowned private sector entity, Dun and Bradstreet Ltd in the United Kingdom as Senior Country Risk Analyst, and then as Head of Economic Research where his functions included managing Dun and Bradstreet's macroeconomic and strategic research and the company's portfolio of director-level sovereign risk reports for international trade, investment and business decision-making. From 1989 -91, Eugene was an Economist/Market Analyst at the British Sulphur Corporation/CRU International in London where he had responsibility for Strategic and Market Studies, Economic Forecasting, Investment Analysis, and Analysis of Industry and Economic Trends.

Eugene Owusu holds a PhD in Agricultural Economics from the Pennsylvania State University. His passion for the humanitarian agenda cannot be underestimated considering his contribution to UN in the area of humanitarianism. He also has keen interest in conflict mediation and peace maintenance.



**DR TSEPO TSEKOA**

**KEYNOTE SPEAKER**

DR TSEPO TSEKOA is a biochemist focusing on the production and characterisation of biologics.

Dr Tsekhoa received his training from University College London, the University of Cape Town and the University of the Western Cape and has gone on to become a Chief Researcher at South Africa's Council for Scientific and Industrial Research (CSIR), where he drives the advancement of local production of vaccines, biopharmaceuticals, and diagnostic reagents through research and development. His work has resulted in the establishment of a successful Biotechnology startup, as well as the transfer of four technologies to industry partners. Dr Tsekhoa is currently assisting several African companies in localising and developing biomanufacturing technologies for commercialisation.

With his experience and knowledge in biomanufacturing, Dr Tsekhoa leads a thriving and productive unit at the CSIR, which has published about 30 papers in the past five years. Tsekhoa is frequently invited to lecture and act as an examiner at universities worldwide. He also participates in various professional activities, including committees, advisory boards, and working groups at an international level.

Dr Tsekhoa's keynote address at our conference will focus on his research in developing production processes for biologics manufacturing towards achieving local self-sufficiency and equitable access to vaccines and biopharmaceuticals in Africa. He will showcase the translation of his research from basic knowledge creation towards real-world implementation and impact on sustainable development.



**DR. STEPHEN AYISI ADDO**

**GUEST SPEAKER**

Our guest speaker is a Medical doctor and Public Health Specialist: an alumnus of the University of Ghana Medical School and School of Public Health- University of Ghana, Legon respectively. He also holds two postgraduate diplomas in HIV innovation and management from the Galilee International management Institute of Israel and theological studies from the Maranatha University College respectively. He is An academic mentor and facilitator in occupational health, HIV epidemiology, policy, planning and implementation at the school of public health, college of Physicians and Surgeons and Ensign School of Public Health. He is also a Public health consultant for some private hospitals and quasi-government institutions. Prior to his current position in the Ghana Health Service, he was a WHO TDR Clinical trial monitor for the moxidectin study and country advisor on Monitoring and Evaluation for the WHO Ghana Country HIV Treatment Acceleration Programme. He is currently the Principal Investigator for the cooperative agreement between the Ghana Health Service and CDC Atlanta-USA to strengthen laboratory and Health Management Information systems. He leads in the implementation of the comprehensive package of Treatment Care and Support for PLHIV and has extensive HIV/TB research experience with several publications to his credit. He is chairperson of very important technical working groups (TWG) responsible for the decentralized response to HIV in Ghana, notably the Antiretroviral Therapy TWG, Paediatric HIV Task Team, HIV Drug resistance TWG and Community Systems Strengthening steering Committee of Christian Health Association of Ghana (CHAG). He is also a member of the National Tuberculosis Advisory Board, national health commodity & procurement supply chain committee of the Ministry of health, Schistosomiasis and soil helminthes expert committee and former commissioner of the Ghana AIDS Commission, to mention a few. He rose through the ranks after clinical practice as a Programme officer, deputy Programme Manager, acting Programme Manager and then became the substantive Programme Manager for the National AIDS/STI Control Programme of the Ghana Health Service from 2015 till date. Aside all these, he is a family man with many hobbies and talents ranging from fine art to music and dancing. He is in the Person of **Dr. Stephen Ayisi Addo, a.k.a Rabbi S!**





**NANA OSEI-BONSU**

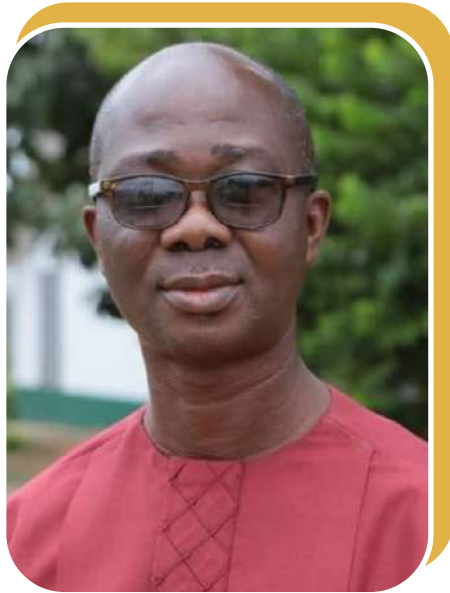
**GUEST SPEAKER**

Nana Osei-Bonsu is the CEO of the Private Enterprises Federation, a position he's held since June 2011. As an expert in Economics and Finance, he pursued his first degree in Economics at Saint Francis College in Brooklyn, USA in 1977, and graduate studies in International Finance at the Fordham University Graduate Arts and Sciences. Nana Osei-Bonsu has over forty (40) years' experience in the private and public sectors. He's had an extensive banking career in the USA, which includes: working with the Federal Reserve Bank of New York; New York State Banking

Department; the Federal Home Loan Bank of New York; Manoff Associates of New York as a Managing Partner; and JP Morgan Chase, investment banking division. On his return to Ghana, Nana Osei-Bonsu served as a Technical Assistant to the Economic Management Team at the Senior Minister's Office and a Technical Advisor to the Minister of State for Economic Planning from 2003 -2005. Nana was the architect for the enactment and establishment of the Venture Capital Trust Fund Act and the Long-Term Savings Act in 2004. The Long-Term Savings Act was later adopted in its entirety as the Third Tier of Ghana's current 3-Tier Pension Scheme. Nana was appointed the first Chief Executive Officer of the Venture Capital Trust Fund (VCTF) in 2005, where he leveraged Government's endowment to partner private sector investors, including some

European Equity firms, to create five Venture Capital Funds with private partners. Nana serves on many boards and committees in the private and public sectors, and local and foreign research organizations. These include: Ghana EximBank; Ghana Enterprise Agency (GEA); Food Research(FRI) of the Ghana Council of Scientific and Industrial Research (CSIR); Global Forum for Agriculture Research, (GFAR, Rome), an FAO Affiliate; Ghana Union Assurance Companies; and the Ghana Road Management Board. Nana is also the Chairman of the Ghana Anti-Corruption Coalition (GACC), the local Civil Society Organization responsible for Research, Monitoring and

Policy dialogue with Government on corruption.



**DR. FOSTER  
ANSONG-BRIDJAN**

**GUEST SPEAKER**

DR. FOSTER ANSONG-BRIDJAN is the Director of Operations at National Ambulance Service of Ghana.

He is a highly motivated individual with experience in emergency medical service (Ambulance) operations and transport management, as well as supply chain management.

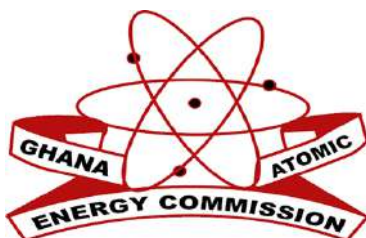
Dr Ansong Bridjan has a background in fire safety from Ghana National Fire Service, emergency preparedness and management from University of Ghana, and Disaster Risk Reduction training from University of Cape Coast.

He Studied for a Diploma and BSc at Greenhill College, GIMPA in operations and project management. He again studied for an MBA in logistics and supply chain management at Pentecost University and had his PhD at the Atlantic International University specialising in disaster management. Earlier in life, Dr Foster Ansong Bridjan studied at Accra Polytechnic for an HND in Mechanical Engineering (Automotive option) and was at KOTECH and St. Paul's Technical School for his secondary level education. He has worked at various positions at the National Ambulance Service since 2004



**SNAS -  
SCHOOL OF NUCLEAR  
AND ALLIED SCIENCES**

# ABSTRACTS ORAL PRESENTATIONS



# Decision Support System for sizing drying bins, fan selection and drying parameters determination for selected grains

Cedric K. Parker-Allotey<sup>1</sup>, Emmanuel Essien<sup>1</sup>, and Richard J. Bani<sup>1</sup>

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## Abstract

Grain drying is a very important step in the storage and handling of grains. Grains are normally dried and stored in round bins or flat storage systems. Mathematical modelling and computer simulations are extensively employed in the design of dryers and development of efficient grain drying control systems. Computer models make use of mathematical calculations and modelling to develop various solutions for specific drying problems or for the estimation and determination of various parameters needed to achieve specific drying needs. Computer models then create simulations based on these mathematical calculations and models to enable users make decisions, further calculations, and constructions. However, most computerized systems require expert level knowledge in drying to operate, and many of these systems do not also provide features which allow for economic decision making. In this project, a python-based computer program was developed which simplified certain calculations that must be made during the decision-making process in grain drying. This user-friendly program allows for its use by people with basic knowledge in drying systems. It also enables users to make accurate decisions with respect to budgeting and provides a database that allows users to select fans based on the calculated fan horsepower. The program was created to provide realistic estimates for each drying parameter depending on the inputs provided by the user. It is anticipated that this project will be a starting point for more sophisticated, user-friendly programs that even further simplify drying calculations, and provide more tools for economic decision making. It is recommended that the program can be further extended to accommodate more grains and drying methods. A mobile application version can also be created to enhance portability.

**Keywords:** Decision support system, drying bins, grain drying

# Assessment of the market for poultry by-products and their contribution to poultry farmers' revenue in Ghana

Etriakor K. Gbordzoe<sup>1</sup>, Akwasi Mensah-Bonsu<sup>1</sup>, and Edward E. Onumah<sup>1</sup>

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## Abstract

The paper assesses the market for the poultry by-products and their contribution to poultry farmers' revenue. The study employs descriptive statistics and a diagram to assess the nature of the poultry by-products market and uses a Tobit model to analyze the factors that influence the proportion of revenue contributed from poultry by-products. A Kendall's Coefficient of Concordance (W) was used to measure the level of agreement between the identified constraints. Data was collected from 120 poultry farms located in the Bono and Ashanti regions. The findings revealed that, the poultry by-product market has only one by-product (poultry dropping) being commercialized of which Côte d'Ivoire is the largest end user. Côte d'Ivoire consumes about 7000 metric tons of poultry droppings annually representing 75% of the total annual production from the study regions. The findings indicated that the average selling price of poultry dropping per 80 kg is GHS 6.00 with standard deviation of GHS 2.50. The results also revealed that, the average revenue accrued by a poultry farmer from the sale of poultry droppings annually is GHS 6,730.00, with standard deviation of GHS 8,338.00, which constitutes less than 1% of their annual revenue from poultry production. Ownership, litter size, membership of PFA and number of spent layers sold are variables that influence the proportion of revenue contributed from poultry droppings. The four most prevalent constraints among poultry farmers, in order of magnitude, are low prices for droppings, lack of processing and storage facilities for poultry dropping, seasonal demand, and buyers' distance. Government should support the development of value chains that would purchase, process, and sell poultry dropping and other poultry by-products to expand the market under the circular economy framework.

**Keywords:** Poultry, by-product, market, revenue, constraints

# A systematic review of factors associated with household food insecurity in Sub-Saharan Africa during Covid-19 Pandemic

Francis Z. Taabia<sup>1</sup>, Seth Adu-Afarwuah<sup>1</sup>, and Agartha N. Ohemeng<sup>1</sup>

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## Abstract

Sub-Saharan Africa bears the greatest burden of food insecurity in the world. The emergence of COVID-19 and its related restrictions pose further threats to food insecurity. Therefore, a systematic review was conducted to assess the available evidence on factors associated with household food insecurity in SSA during the pandemic. Three bibliographic databases and two search engines were searched on 30 October 2023 covering the period between March 2020 and October 2022. Peer-reviewed papers reporting the prevalence and/or factors of household food insecurity were eligible for inclusion. The STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) tool was used to assess the quality of articles included in this report. Twenty-nine publications from twelve countries were included in this review. Food insecurity experience and household food insecurity access scales were the most commonly used instruments for assessing household food insecurity. Reported household food insecurity ranged from 11.2% to 98.8% in SSA, with an average of 53.7%. COVID-19 restrictions, lower socioeconomic status; age and education status of HH heads, lower household income, a lack of alternative livelihood activities, and increased food prices; agricultural production challenges: inadequate farm inputs, inadequate extension visits, inadequate access to farmlands or credit facilities; political and ethnic conflicts; and climate change were associated with household food insecurity. The review identified COVID-19 pandemic, and its related restrictions worsened the existing factors associated with household food security. Especially, food supply chain and crop seasons were disrupted by COVID-19, and many people lost their jobs. Even though the review found no major changes in the prevalence of food insecurity in SSA, the unfolding effects of COVID-19 could make things worse if no steps are taken to provide social protection and agricultural support services to households.

**Keywords:** Food insecurity, hunger, households, factors, Sub-Saharan Africa

## The early stages of the COVID-19 Pandemic were associated with household food insecurity among adolescents with Sickle Cell Disease in the Greater Accra Region

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### Abstract

Sub-Saharan Africa bears the greatest burden of food insecurity in the world. The emergence of COVID-19 and its related restrictions pose further threats to food insecurity. Therefore, a systematic review was conducted to assess the available evidence on factors associated with household food insecurity in SSA during the pandemic. Three bibliographic databases and two search engines were searched on 30 October 2023 covering the period between March 2020 and October 2022. Peer-reviewed papers reporting the prevalence and/or factors of household food insecurity were eligible for inclusion. The STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) tool was used to assess the quality of articles included in this report. Twenty-nine publications from twelve countries were included in this review. Food insecurity experience and household food insecurity access scales were the most commonly used instruments for assessing household food insecurity. Reported household food insecurity ranged from 11.2% to 98.8% in SSA, with an average of 53.7%. COVID-19 restrictions, lower socioeconomic status; age and education status of HH heads, lower household income, a lack of alternative livelihood activities, and increased food prices; agricultural production challenges: inadequate farm inputs, inadequate extension visits, inadequate access to farmlands or credit facilities; political and ethnic conflicts; and climate change were associated with household food insecurity. The review identified COVID-19 pandemic, and its related restrictions worsened the existing factors associated with household food security. Especially, food supply chain and crop seasons were disrupted by COVID-19, and many people lost their jobs. Even though the review found no major changes in the prevalence of food insecurity in SSA, the unfolding effects of COVID-19 could make things worse if no steps are taken to provide social protection and agricultural support services to households.

**Keywords:** COVID-19, food insecurity, malnutrition, pandemic, coronavirus.

## Food interest of rural populations in the management of natural resources: Case of consumed birds by the Gouro People, Marahoué region, Côte d'Ivoire

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### Abstract

Game Consumption is becoming increasingly widespread in West Africa. It has become a real driver of wildlife extinction and birds are not spared. The needs and methods of harvesting this fauna regularly conflict with natural resource management programs. Thus, there is the need for a mechanism that combines both the food needs of populations and those of conservation. However, there are few works that highlight the interests of populations in this area. To raise this insufficiency, an ethnozoological study was initiated with the Gouro people bordering the Marahoué National Park, in Côte d'Ivoire. Its objective was to highlight the food preferences of this people, in terms of wild birds, in order to combine biodiversity conservation plans and wildlife harvesting. Through a survey from 2010 to 2013, equipped with a questionnaire guide and a bird identification guide, 1146 people were interviewed in 19 villages in the Marahoué region. This survey was able to list 223 species of birds consumed by this people. This list includes 25 migratory species, one vulnerable species, one endangered species and two near-threatened species. Eighteen species of these birds are highly valued in terms of consumption by the people. Finally, almost half of these highly valued species are forest species and another 33% are water birds. These results constitute one of the first data on the usefulness of birds in the life of populations. They shed light on how the interests of populations are taken into account in the various natural resource management programs.

**Keywords:** Conservation programs, Gouro people, bird consumption, preference



## Do farm operation injuries have an influence on household welfare of Cocoa farmers? Empirical evidence from Ghana.

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### Abstract

Future agriculture will need to produce more food to feed a growing global population. Farmer injuries may make it more difficult for them to produce enough food to feed the world's expanding population. In the light of rising number of injuries in the cocoa sector, the study sought to look into how these injuries proxied by the man hours lost affected the household welfare of cocoa farmers. The survey, which used a positivist paradigm, gathered information from 400 respondents using the multi-stage sampling technique. Data was descriptively and inferentially analyzed using means, standard deviations, percentages, frequencies, to bit and multiple linear regression model. The study revealed the total mean number of days lost to injuries is 78.99 days. Majority of the cocoa farmers (73.1%) are food insecure. Cocoa farmers are able to make a net income (profit) of about 11,106.2775GHC per cropping year. On average, cocoa farmers are able to produce 23 bags per season while the production per acre averagely is 3.7 bags. The study affirms that farm operation injuries affect farmers' food security status and productivity but not income. We believe that efforts at helping cocoa farmers to prevent or treat injury situations through patient health awareness program can be a significant way COCOBOD can improve cocoa farmers' household welfare status.

**Keywords:** Farm operations, food security, household welfare, income, injuries, productivity

## Studies on hematological profile and behavior of Juvenile *Oreochromis niloticus* exposed to Metalaxyl Fungicide

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### Abstract

Behavioral and hematological alterations of *Oreochromis niloticus* exposed to varying concentrations of Metalaxyl fungicide were evaluated. Ten (10) fish were batch-weighed and distributed into a set of 18 rectangular plastic tanks (75x45x45 cm) each filled with 30L of unchlorinated water. The range-finding tests for Metalaxyl fungicide was carried-out to determine the concentrations of the test solution for the definitive test (0, 500, 600, 700, 800 and 900 ml). After 96 hours of exposure, blood samples (1- 3ml) were collected and emptied into EDTA bottles for analysis. The 96hrs LC50 was 7.41 ml. Exposed fish show behavioral responses such as loss of reflex, air gulping, erratic swimming, fin deformation and molting. There was a significant difference with increase ( $p>0.05$ ) in PCV ( $21.00\pm 1.00$ - $28.00\pm 1.00$ ), RBC ( $1.05\pm 0.05$ - $1.35\pm 0.05$ ), Hemoglobin ( $7.00\pm 0.33$ - $9.34\pm 0.34$ ), WBC ( $1.65\pm 0.15$ - $2.15\pm 0.35$ ), MCV ( $200.00\pm 0.01$ - $210.56\pm 0.56$ ), MCH ( $66.67\pm 0.01$ - $70.19\pm 0.19$ ), lymphocytes ( $60.00\pm 8.00$ - $85.00\pm 3.00$ ) and monocytes ( $2.00\pm 0.01$ -  $2.50\pm 0.50$ ). Also reduction was noticed in MCHC ( $33.09\pm 0.09$ - $32.23\pm 1.12$ ) and granulocytes ( $38.00\pm 8.00$ - $13.00\pm 1.00$ ). The changes observed provide early warning signals for determination of levels of fungicides used in the field and its present and future potential risk to aquatic organisms. The American Heart Association recommended that fish be included in meals at least twice per week to meet the daily intake of omega-3 fatty acids (Yilmaz et al.,2007) however, fish are situated at the top of the aquatic food chain hence, they bioaccumulate toxicant from water. The content of toxicant in fish can counteract their beneficial effects especially on human health which in turn affect food security.

**Keywords:** Hematology, behavior, alterations, *Oreochromis niloticus*, metalaxyl

## Bioecology and management of some insect pests of quarantine importance and their implication for the export of vegetables

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### Abstract

The export of various vegetables from Ghana to the European Union and other international markets offer a good source of income to many actors in the vegetable value chain and offers a huge foreign exchange into the country. Despite the benefits, the export of most of these vegetables have been jeopardized by the presence of quarantine pests that lead to their rejection at the international market resulting in huge financial losses. For example, Ghana was banned from exporting some vegetables (pepper, eggplant, and the gourds) from 1st October 2015 to 31st December 2017 due to the continuous interception of quarantine pests in exported produce. Among the intercepted pests include the false codling moth (*Thaumatotibia leucotreta*), the melon thrips (*Thrips palmi*), sweet potato whiteflies (*Bemisia tabaci*), the eggplant fruit and shoot borer (*Leucinodes orbonalis*), fruit flies (*Ceratitis*, *Zeugodacus*, *Bactrocera* and *Dacus*). Other insect pests of quarantine importance include the recently introduced species, fall armyworm (*Spodoptera frugiperda*), and the tomato leaf miner, *Phthorimaea (Tuta) absoluta*. Several studies were undertaken during and after the EU ban on the export of some vegetables from Ghana to the EU, and this culminated into the development of the roadmap for pests' reduction in exported commodities. This review highlights some of the research undertaken on the bioecology and management of these pests of quarantine importance between 2016 and 2022. The implications of the research progress made in studying the bioecology and management of these pests to boost the export of vegetables into the EU and other international markets, and capacity building of the critical mass of experts to address quarantine pests' issues in Africa will be discussed. This information will be very useful for other African Caribbean Pacific (ACP) countries to meet the strict and very stringent requirements in international trade with the coming into force the new EU plant health regulations (EU regulation 2016/2031), fully applicable from 14 December 2019. Commission Implementing Regulation (EU) 2019/2072 establishes uniform conditions to implement Regulation (EU) 2016/2031. According to this new EU regulation, *S. frugiperda*, *T. leucotreta*, and some fruit flies (*B. dorsalis*, *B. zonata*, *Anastrepha ludens*, etc.) are regarded among the top twenty priority pests that require very stringent quarantine measures to prevent their spread.

**Keywords:** bioecology, quarantine, pests, vegetables

## Evaluation of selected natural preservatives on the sensory and storage properties of Fermented Locust Bean (Iru) Powder

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### Abstract

Indigenous legumes have the potential to greatly improve well-being, and economic status, as well as contribute positively to protein malnutrition and food security in developing countries. Iru is a traditional fermented-leguminous product that is considered a health condiment but characterized by short storage life. Iru powder (IP) was produced from dry-milled fermented locust bean seeds. A 5% each of garlic, ginger, turmeric, and their combination were added to the iru powder. Benzoic acid (0.1%) and samples without additives served as control. The nutritional, sensory attributes and microbiological shelf life of the products were determined using standard methods. The results were statistically analyzed using ANOVA at  $\alpha 0.05$ , and Duncan's multiple range test. There were significant differences ( $p < 0.05$ ) in the proximate compositions of the iru powder samples. Iru powder with the highest value for crude protein (40.96%) was the sample with ginger addition and the sample with turmeric had the highest carbohydrate (42.01%). The sample with no preservative had the highest energy value (570.09 kcal/g). The lowest values for crude protein (28.11 %) and energy (484.84 kcal/g) for iru powder samples were found in those with turmeric, while the sample with no preservative had the least carbohydrate (13.77%). All the IP samples were acceptable by the consumers with the IP containing ginger, having an overall acceptability value of 7.47. Iru powder had a total aerobic bacteria count that varied from 8.5 log CFU/mL to 11 log CFU/mL. The total lactic acid bacteria varied from 4 log CFU/mL to 6.2 log CFU/mL, while the total coliform bacteria count was from 6 log CFU/mL to 8.2 log CFU/mL. The results showed that fortification of powder with natural preservatives has the potential to enhance the nutritive, and sensory values as well as to increase the shelf life of the condiment.

**Keywords:** Fermented locust bean seed, iru powder, ginger, garlic, turmeric

## Perception of agribusiness firms about benefits and preferences for Credit Guarantee System

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### Abstract

The study examined the effect of perception and preferences of agribusinesses about a major Credit Guarantee System named Ghana Incentive-Based Risk Sharing and Agricultural Lending (GIRSAL). Heckman's sample selectivity Probit Model was applied on survey data collected from 353 agribusinesses firms, made up of 71 beneficiaries and 282 non-beneficiaries of GIRSAL services across 12 of the 16 administrative regions of Ghana. The study found that the Agribusinesses generally perceived credit guaranteed systems (CGS) to be beneficial. However, majority of the respondents were not sure of several benefit elements of CGS, including increased ability to access larger loan sizes, increased profit of agribusinesses, increased employee numbers, enhanced access to credit, longer loan terms and improved bankability. The general lack of knowledge and information among agribusinesses is the key limiting factor for successful operation of the GIRSAL system. The lack of knowledge and information limit the demand for appropriate credit. Due to the positive perception of benefits of CGS, the agribusiness owners expressed readiness and willingness to learn more about the intervention for increased access to finance. The study found that education level of the agribusiness owner, membership of farmer-based organization and years of experience in agribusinesses influence both the perception and preferences of agribusinesses about the credit guarantee systems. Another variable that influenced preference was access to agricultural extension services. The study recommends that GIRSAL management should undergo a massive public campaign on benefits of CGS among agribusinesses. The Ministry of Food and Agriculture should vigorously promote farmer-based organizations as a main vehicle for delivering technologies and business finance information and services. These will improve the ability of agribusiness to access finance and at the same time increase preferences for the credit guarantee schemes.

**Keywords:** Credit guarantee system, agribusiness firms, perceptions, preferences, GIRSA

## Time intensity evaluation of sensory attributes of flavoured skimmed milk yoghurt.

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### Abstract

Time intensity (TI) method of sensory evaluation is an extension of the conventional scaling method providing sequential information about perceived sensations instead of single rating with limited information. It provides panelists with the opportunity to scale their perceived sensations over time. This study sought to identify the key sensory attributes of FanYogo yoghurt and to use TI method to evaluate the change in perceived texture and flavour of the yoghurt. An application of continuous tracking approach to study frozen yoghurt will provide detail sensory information that could influence consumer acceptance. Trained panellists were used to establish a list of descriptors for the frozen yoghurt. Samples were presented and assessors evaluated and described the product for the modalities of flavour, mouth-feel and aftertaste using their own consumption style. Collation of descriptors with consumption style based on records taken was made. Consensus to established descriptors that best describes the product with definitions were generated together with reference and anchor terms. Ten trained panellists evaluated the frozen yoghurt after putting the sample into their mouth and then clicking the start button. They drag the marker to indicate the current flavour level. Any time they perceive a change in the intensity of the attribute they dragged the marker to indicate the current intensity and to zero when it ends. The identified descriptors were passion fruit, mango, sweet, sour, puckering, smooth, viscous, astringent, mango, and salivation. This study provides the sensory descriptors for frozen flavoured yoghurt with their dynamic intensities allowing for comparisons of sensory attributes of yoghurt samples to identify unique sensory attributes to delight consumers.

**Keywords:** Time intensity, sensory attributes, yoghurt

## Genotypic variability and plant character correlation among the wheat (*Triticum aestivum* L.) genotypes

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### Abstract

This study was done during the rainy season of 2015/2016 for the estimation of genotypic variability and plant character correlations in ten genotypes of wheat. The experiment was laid out in a randomized complete block design (RCBD) consisting of three replicates in the field. The quantitative characters measured were plant height, spike length, number of tiller per meter square (m<sup>2</sup>), days to 50% heading, number of days to maturity, number of spikes per meter square (m<sup>2</sup>), number of grain per 10 spikes, the weight of 10 spikes, 1000 grain weight (g) and grain yield in g/net plot. Grain yield had the highest estimate of the phenotypic coefficient of variance PCV (95.65) and genotypic coefficient of variation GCV (92.31). Heritability was highest for days to 50% heading (99.53%) and least for spike length (5.56%). The genetic gain was highest for grain yield/net plot (18.77%) and lowest for spike length (0.37%). Grain yield significantly correlated with days to 50% heading (0.63), the number of grains/spike (0.47), and the weight of spike (0.66). Therefore, these yield component characters showed wide genetic variation and can be explored for further improvement programs for grain yield in wheat breeding.

**Keywords:** Wheat, variability, character, genotypes, yield

## Genetic variation, genotype × environment interaction, and correlation among drought tolerance indices in cowpea

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### Abstract

Drought tolerance indices have become pointers on which selection of drought-tolerant genotypes of cowpea can be made. However, the information on variability and the influence of genotype (G) × environment (E) interaction (I) on the drought tolerance indices have not been seriously explored. Hence, the objective of this study was to assess the level of genetic variability and the effect of GEI on the drought tolerance indices of cowpea. The experiment was conducted in two seasons under screen house conditions. The genotype effect, environment, and GEI influenced the seed yield and all drought tolerance indices. Combined data across years showed that yield under non-stress conditions ranged between 10.47 g in G2 and 17.27 g in G7 while it ranged from 2.19 g in G3 to 6.89 g in G1 under drought stress. Mean rank, Principal Component (PC), and cluster pinpointed highly tolerant accessions (G1 and G6) from the highly susceptible ones (G2, G3, and G8). This study confirmed geometric mean (GM), yield index (YI), mean productivity (MP), stress tolerance index (STI), modified stress tolerance index for non-stress (MST1) and stress (MST2), GMP, and HM as the most suitable for selecting high-yielding for non-stress and high drought-tolerant accessions while drought resistance index (DRI), and yield stability index (YSI) were effective under drought conditions. All the indices showed moderate ( $\geq 30\%$ ) to high heritability ( $\geq 60\%$ ) and high GAM ( $\geq 20\%$ ) except MST2 which showed low heritability (12.73%).

**Keywords:** Genotypic correlations; heritability; stability, non-stress; drought stress



## Sensory evaluation and hematopoietic potential of fermented sorghum fortified with sorghum bicolor leaf powder in phenylhydrazine-induced anaemic rats

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### Abstract

Food fortification has become a standard approach to address micronutrient deficiency in vulnerable populations. Fermented sorghum (pap) is an important cereal and a staple crop in Africa while sorghum bicolor leaves (sbl) is known for its colorant properties. This study aimed at evaluating public acceptability of fortified Fermented sorghum and its hematopoietic potentials. SBL purchased from local market was dried and blended into powder. 0.5 g and 0.75 g were added to 9.5 g and 9.25 g of Fermented sorghum and made into pap. Questionnaire was designed to obtain organoleptic acceptance of the food. 30 healthy male Wistar rats were evenly distributed into six groups: (1) Control group placed on normal rat diet; (2) administered with 40 mg/kg body weight of 2,4-dinitrophenylhydrazine to induce anemia; (3) Placed on 0.5g sbl/9.5g of fermented sorghum; (4) administered with 40 mg/kg body weight of 2,4-dinitrophenylhydrazine and Placed on 0.5 g sbl/9.5g of fermented sorghum; (5) administered with toxicant and Placed on 0.75 g sbl/9.5g of fermented sorghum; (6) administered with 40mg/kg body weight of 2,4-dinitrophenylhydrazine and treated with 0.1 ml/kg of blood tonic. Bone marrow tissue was extracted for expression of Erythropoietin, Transferrin and IRP genes; Histopathological and hematological examinations were also carried out. Results obtained showed 75% overall acceptability of the fortified food compared to 85% of the unfortified food sample. There was significant increase in the PCV level of rats in groups 4 and 5 compared to group 2. There was upregulation of the erythropoietic genes compared to the toxicant treated group while the renal injury score was 2 (normal injury index) compared to 6 (severe injury index) in group 2. It is therefore concluded that sorghum bicolor leaves fortified pap has hematopoietic potentials with reasonable public acceptability and hence suggested as a cheap remedy for anemia.

**Keywords:** Sorghum bicolor leaves, anemia, erythropoiesis, sensory evaluation, food fortification.

# Investigating the adsorption rate of uremic toxins using locally synthesized zeolite for dialysis membrane application

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## Abstract

The kidney is an essential organ in the body that performs numerous metabolic functions. The basic functional unit of the kidney is the nephron. Damage to the nephrons may lead to a depletion of the kidney's function, resulting in kidney diseases or kidney failure. Globally, a significant number of kidney disease cases affect most people, making it a threat to human health (SDG goal 3). There are no medications to reverse the damage to the kidneys presently. However, the risk factors, such as the accumulation of toxins (uremic toxins) in the body that can speed up kidney damage, can be managed. These management techniques include the use of dialysis and drugs. Prior research shows that these dialysis membranes do not effectively remove some categories of toxins which may lead to morbidity and mortality. Ghana is resourced with many materials; as such, there is a need to investigate the adsorption capacity of local materials for dialysis membrane applications. Zeolite has been studied to offer auspicious properties such as pore sizes and good biocompatibility, making them a prominent candidate for dialysis membrane studies. Hence, this study investigates the adsorption capacity of locally synthesised zeolite by Tiburu et al., for dialysis membrane applications. The uremic toxins considered are urea, oxalate, oxalic acid, phenol, creatinine, and hydroquinone. Preliminary result shows that locally synthesized zeolite can adsorb some uremic toxins. Positive results from this study will be a step closer to developing new and efficient dialysis membranes.

**Keywords:** Kidney, dialysis, zeolite, uremic toxins, adsorption capacity

## Deep learning technique for efficient iris image classification

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### Abstract

This work presents an efficient iris classification model based on Deep Learning technique to proffer solutions to the challenges of the conventional methodologies. Iris has been umpired one of the most reliable biometric traits for authentication as a result of its unique patterns and stringency to spoof attack. However, studies have revealed that inaccurate matching and classification errors has characterized its processes in many authentication and identification applications as a result of inept classification methodologies. Data for the research work was sourced from the CASIA-Iris-lamp dataset. A total of 16,163 iris data were obtained for the work. Twenty (20) iterations were passed on the model to determine its accuracy. Spyder (Python 3.7) IDE platform was used for the data modeling and testing. The salient features were filtered, using a rectifier linear unit (ReLU) of the networks to increase the non-linearity of the image in the convolution layers. In order to avoid over-fitting of the learned features, a down-sampling method was used to reduce the size of the image and the input values. Performance metrics such as sensitivity, specificity and accuracy were considered in evaluating the performance of the model. Experimental results showed that the model performed well with classification accuracy of 98.57%, which is an improvement over the Benchmark model with 93.35%. The confusion matrix reported 0 false positives (FP) and 14 false negatives (FN) on the test set. This implies that the model correctly predicted all images belonging to right category as right irises while it wrongly predicted 12 images belonging to the left category. Connotationally, this proves that the right iris has higher accuracy compared to the left iris. Therefore, the model is recommended to all biometric security agencies, access control operators, and eye medical practitioners to improve efficiency in their domains of operation.

**Keywords:** Deep learning, classification, iris image, salient feature

# An ICT-based control and security model for implementation and evaluation of sustainable development goals at subnational levels in Nigeria

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## Abstract

The United Nations in 2015 adopted Sustainable Development Goals (SDG) to address seventeen (17) areas of global needs including poverty, hunger, climate change, low quality education, poor health and well-being, infrastructural deficit, costly and unclean energy, economic deprivation, gender inequality, conflicts, among others by 2030. Various governments including Nigeria have consequently adopted the programme, set up action plans and formulated sectorial policies towards actualising the SDG. However, the existing implementation and evaluation frameworks give much attention to Federal Government's (national level) SDG programmes, and greater achievements would have been facilitated if they are replicated at the subnational levels such as states and local governments. Information and Communication Technology (ICT) solutions have been employed in synergising implementation and evaluation programmes across organisations and systems. Particularly, Service-oriented Architecture (SOA), an ICT technology has been reliable in effective and cost-efficient integration and execution of services through infrastructure and software reuse but is challenged by security policy and data breaches, which cryptography could address. This paper therefore is aimed at developing a ICT-based model to integrate the Nigerian subnational levels and the national level SDG implementation and evaluation programmes. The study explicates some of the peculiarities of governance at state and local government levels in Nigeria; examines the peculiarities of the Federal Government's SDG implementation and evaluation programmes; reconciles their parameters, functions and structures; describes the various infrastructure and software requirements for the implementation and evaluation; designs an ICT-based model consisting of SOA-based controller and cryptography-based security agent for implementation and evaluation of the SDG; and assesses the acceptability of the model in terms of effectiveness, cost-efficiency and security concerns. The paper concludes that the proposed ICT model has good prospect in ensuring effective implementation and evaluation of Sustainable Development Goals at subnational levels without leading to huge costs and security risks.

**Keywords:** Sustainable Development Goals, Nigerian Governments, Information and Communication Technology, Service-oriented Architecture, Cryptography

## Monitoring patients' oxygen saturation and heart rate using wearable devices

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### Abstract

Manual monitoring of vital signs, which often fails to capture onset of deterioration, is the main monitoring modality in most Ghanaian hospitals due to high cost and inadequate supply of functioning patient bedside monitors. Consumer wearable devices (CWDs) are emerging, relatively low-cost technologies for continuous monitoring of human physiological status similar to clinical-grade devices; however, their validity has not been established in low-resource clinical settings. We aimed to (1) investigate the validity of the heart rate (HR) and oxygen saturation (SpO<sub>2</sub>) data from two widely used CWDs, the Fitbit Versa 2 and Xiaomi Mi Band 6, against gold-standard clinical bedside monitors used in one Ghanaian hospital and (2) develop a web application to capture and display CWD data in a clinician-friendly way. To examine validity of the CWDs, we visited the only quaternary care hospital in Ghana where a healthy volunteer simultaneously wore both CWDs and blood pressure cuffs on the same arm to measure HR and SpO<sub>2</sub>. The gold standards used were the Philips Intellivue MX 450 patient monitor and a smart blood pressure monitor used in the hospital. To test for concordance, we conducted Bland-Altman and Mean Absolute Percentage Error analyses. We also developed a web application that retrieves CWD data from the companies' API and displays it in near-real time as text and graphical trends. Compared to gold standards, the Fitbit Versa 2 had 96.87% and 96.67% measurement accuracies for HR, and the Xiaomi Mi Band 6 had 94.24% and 93.21% measurement accuracies for HR. The Xiaomi Mi Band 6 had 98.79% measurement accuracy for SpO<sub>2</sub>. The strong concordance between consumer wearable devices and gold standards supports potential implementation of consumer wearable devices as a novel method of vital sign monitoring in Ghanaian hospitals to replace manual monitoring, thus saving time and cost and improving patient outcomes. Further studies are needed to confirm these results.

**Keywords:** Emerging technologies, fitbit, xiaomi, continuous monitoring, validation

## Biomedical engineering and the innovation landscape in West Africa: A case study of Ghana

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### Abstract

This case study in Ghana is part of a larger study to map translational capacity for Biomedical Engineering (BME) and Medical Technology (MedTech) in anglophone West Africa. A systematic review was conducted to determine the strengths and opportunities for BME to drive healthcare improvements. The supply of biomedical engineers and technicians, their status and capability, and how these might present opportunities for meeting the needs of local healthcare providers through local sourcing and supply of appropriate MedTech products, were studied. Findings from West Africa will be compared to those of a similar audit recently conducted in East Africa. This report specifically presents the data from Ghana. Eight survey instruments were adapted from the East African study for BME training institutions, researchers and innovators, professional biomedical engineers, hospitals, private companies, incubator hubs, regulatory bodies and development agencies with partnerships in BME. Quantitative and qualitative data were collated and analyzed. Of the sixty responses received, n=33 were from professional engineers (86% of which were male), n=9 from private BME companies, n=7 from researchers and innovators (88% male), n=4 from health facilities, n=3 from tertiary training institutions, n=2 from development agencies, n=1 from the regulatory agency, and n=1 from an incubator hub. All groups bemoaned suboptimal conditions for innovation. Training institutions highlighted lack of teaching facilities and insufficient teaching staff as challenges; researchers, and innovators cited lack of funding, collaborators, and mentors. Most professional engineers work in clinical settings and identify a paucity of career development programmes as a significant challenge. Data also revealed that the discipline is still male dominated. This study highlights some challenges in the BME landscape and the impact on healthcare delivery and improved patient care. It also emphasizes themes that can help bridge the yawning gaps among academia, industry, and government regarding MedTech innovation.

**Keywords:** Biomedical engineering, medical technologies, innovation, healthcare Africa

# Investigating the applicability of a mathematical module for prediction of individual-specification fetal growth trajectory using ultrasound imaging

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## Abstract

Fetal growth can be considered as a measure of fetal well-being. Undetected fetal growth abnormalities may be associated with significant morbidity and mortality. Prenatal care tends to lower the risk of neonatal mortality and morbidity, as well as assessing fetal growth. Ultrasound has been used over the years to measure the anatomical segments of a fetus. The most popular measurements are as follows: CRL, biparietal diameter (BPD), head circumference (HC), abdominal circumference (AC) and femur length (FL). Growth models are crucial descriptive summaries that incorporate empirical facts and offer the chance to test hypotheses. Descriptive charts, also known as references, have been used often in clinical practice and research for decades. Some professional societies advise using standards, whereas others recommend using customized charts. The current WHO fetal growth charts are considered to be applicable internationally. Since they are standard charts, it will be prudent to test them in a specific environment. Growth charts can only describe how the fetus grows relative to other fetuses and cannot accurately predict individual child growth trajectory. Growth charts cannot be used to detect abnormalities early because a series of measurements must be taken over a period of time before pattern of growth of the fetus can be generated and interpreted. In this study, retrospective data will be gathered from a few hospitals, and a proposed mathematical module will be examined using MATLAB to determine its applicability in calculating the growth rate of the individual body parts of a fetus using ultrasound imaging to predict a potential growth trajectory of a single fetus. The success of this study would bring to light a novel, and much simpler module, that could aid in determining fetal body part growths for future growth prediction based on past growth, as well as allow for more precise identification and quantification of modifiable risk factors and individual health outcome prediction.

**Keywords:** Fetal growth, neonatal mortality, morbidity, growth prediction

# Optimized bids responsiveness evaluation model for improved performance in the public procurement sector and construction projects

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## Abstract

Traditionally, the public sector procurement and construction projects are largely based on the lowest bid award system. However, the practice has been characterized with continuous problems of inferior quality of construction facilities, high incidence of litigations, frequent cost overruns and use of poor quality of materials. Therefore, the quest for an optimized evaluation method motivated this research. This research work developed a multi-parameter bids evaluation model that integrated both the mandatory and weighted sub-factors criteria for effective evaluation. Different data analytical tools deployed on the data acquired include statistical mean value, relative importance index (RII), and correlation test to measures the strength of relationship between the observed data. To build the model, four different classification algorithms considered were tested to determine the best models with best predictive accuracy. From the performance metric, the pruned tree and rules induction outperform other two algorithms in the layers. They both have the same correctly classified instances of 99.4%, mean absolute error of 0.062, True positive rate and False positive rate of 0.994 and 0.001 respectively, ROC Area of 0.994 and recall weighted average of 0.994 respectively. This proves that both algorithms are suitable. However, the pruned tree was chosen as the best algorithm in this work because it has a lesser time of 0.01 seconds to build the model compared to rules induction with 0.1 seconds. The model will reduce the anomalies in the evaluation system and overcome the challenges of the classical methodologies. The evaluation model will result in quality improvement, guaranteed maximum value and quality delivery in the general construction projects. The model is highly recommended for efficient bid evaluation in general construction projects and procurements. However, the research paves the way for future research to use additional significant inputs, larger database and other background factors.

**Keywords:** Bids responsiveness, evaluation model, classification algorithms, multi-parameter, improved performance



# Femtosecond all-fiber amplifier similariton erbium doped fiber laser

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## Abstract

There has been significant progress in the development of Ultrashort pulsed fiber lasers, making them suitable for a broad range of applications such as material processing, ultrafast spectroscopy, biomedical applications, optical imaging, surgery, metrology, and optical communications. An Erbium-doped fiber laser, operating in the net normal amplifier similariton pulse regime, that generates femtosecond pulses at high repetition rate is presented. Mode-locking is achieved by nonlinear polarization evolution using manual fiber rotation paddles. The polarization controllers and the in-line polarizer act as a birefringent filter, eliminating the need for a filter. A 355 cm all-fiber ring cavity produced 73 fs pulses at a repetition rate of 52 MHz, centred at a wavelength of 1572 nm with average output power of 24 mW and pulse energy of 0.46 nJ

**Keywords:** Femtosecond pulse, erbium doped fiber laser, amplifier similariton, nonlinear polarization rotation.

## Terpenoid compounds from buchholzia coriacea seed exhibited inhibitory potential against sars spike protein receptor binding domain

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### Abstract

Corona Viruses (CoVs) are a family of viruses that cause respiratory and intestinal illnesses in humans and animals. They usually cause mild colds in people but the emergence of the severe acute respiratory syndrome (SARS) epidemic in China in 2002-2003 and the Middle East respiratory syndrome (MERS). Today, Human Corona Viruses (HCoVs) are well known for rapid evolution due to high nucleotide substitution and recombination rate. HCoVs have been linked with major outbreaks of human fatal pneumonia since the beginning of the 21st century. Buchholzia coriacea (BC) plant with the common name in Africa known as Wonderful kola is useful in traditional medicine for the treatment of a wide range of diseases due to its secondary metabolites. In this research work, the in-silico study of BC terpenoid compounds was evaluated for the inhibitory potential of SARS spike protein receptor binding domain. Terpenoid compounds were extracted from BC seed and the Gas Chromatography-Mass Spectrophotometer (GC-MS) analysis showed that it contained; Rutin, Phytic acid, Caffeic acid, Flavone, Ferulic acid, Gallic acid and Phenol. Molecular predictions based on the crystal structure were performed. These compounds were then docked with SARS spike protein receptor binding domain. Molecular docking revealed that they possess the following binding affinities; (Rutin -7.545 kcal/mol) has the highest binding affinity followed by (Caffeic acid, -7.297 kcal/mol), (Flavone, -7.276 kcal/mol), (Ferulic acid, -6.696 kcal/mol), (Gallic acid, -6.071 kcal/mol) and (Phenol, -4.732 kcal/mol) compared to the standard drug remdesivir having the binding affinity (-4.740 kcal/mol), screening out Phytic acid. The ADME properties of the terpenoids from BC were evaluated to explain their pharmacokinetic properties using Qikprop. The ADME results revealed that Caffeic acid, Gallic acid and Ferulic acid sailed through the 8 parameters of ADME analysis successfully. They could therefore serve as lead compounds in the treatment of SARS-COV.

**Keywords:** Terpenoid, inhibitory, Corona, affinities, pharmacokinetic, spike protein

# Training machine learning models for natural language processing in Ghana: An audio description dataset of five Ghanaian languages

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## Abstract

The advancement of computers and the proliferation of smart devices have made our daily activities convenient. Currently, we are capable of interacting with computing device using voice. This advancement has been made possible with the support of Machine Learning (ML) techniques and availability of datasets in various languages. Considering that contents may not be in languages we understand, it limits usage and accessibility of these technologies within some cultures. The inability to develop ML models that are capable of translating local languages can be attributed to the lack of local language datasets that are appropriate for training machine learning models. Accordingly, this study seeks to develop a novel open-source dataset of audio description of images in five Ghanaian languages (i.e., Akan, Ewe, Dagbani, Dagari and Kposo) to promote Natural Language Processing in these languages. To achieve this, a web crawler was used to download 5000 open-source images from the internet that are culturally relevant to Africa. A total of 1200 images were selected, categorized and used for the study. An Android application was developed to display the images and native speakers of each language were tasked to describe the images between 15 and 30 seconds. Each audio file was evaluated to ensure that it is the exact description of its corresponding image. The resultant database contained 5000 hours of audio description files in five distinct Ghanaian languages. The dataset is suitable for training voice recognition, object description, image captioning, and video subtitling models as well as language translation. It is our expectation that this dataset of images and corresponding audio description will facilitate ML research, particularly in natural language processing in Ghana.

**Keywords:** Machine learning, natural language processing, audio file, dataset

## Automated detection and labelling of lanes in gel electrophoresis images

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### Abstract

Labelling of lanes in gel electrophoresis images is the first step that precedes biological data analysis after gel images are obtained. Owing to lane distortions, band deformities and big data, precise interpretation and annotation of these lanes and bands can be laborious and may delay subsequent investigations. This project aims at expediting big data analysis by automating the detection and labelling of lanes in 96 well-plate gel electrophoresis images. Image preprocessing and object detection were performed to prepare images for subsequent processing and to detect bands respectively using OPEN CV library. Bounding boxes were generated around the detected bands to obtain their dimensions. The least x and y coordinates of the boxes were considered the first and last ladders. The number of lanes were then computed from the distance between the ladders. Labels were finally assigned to detected lanes. This algorithm was tested on twenty-four gel electrophoresis images, twelve of the images had lane widths of 9 and 10 whilst the remaining twelve had broader widths. The results showed that the algorithm worked best on the images with lane widths of 9 and 10 as it correctly labelled almost all of such images with a performance score of 83%. Conversely, it performed poorly to label images with broader widths. The algorithm may be improved to serve as an automated tool to aid in labelling gel electrophoresis images of different lane widths, thus saving time.

**Keywords:** Automated detection, gel electrophoresis, biological data, lane labelling

## Machine learning models for predicting half maximal inhibitory concentrations of compounds against vascular endothelial growth factor receptor 2 (VEGFR-2)

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### Abstract

Cancer is a severe disease that affects millions of lives worldwide resulting from the mutation of specific genes that control cell growth. Vascular Endothelial Growth Factor Receptor-2 (VEGFR-2), a vital receptor found on vascular endothelial cells, has been found to trigger angiogenesis in most malignant tumors thereby promoting cancer progression. Some approved inhibitors of this receptor for cancer treatment exhibit some unwanted side effects. Hence, this study aimed at developing machine learning models to predict the IC<sub>50</sub> of compounds capable of inhibiting the activities of VEGFR-2 to facilitate the discovery of more potent lead compounds with minimal or no side effects. Inhibitors of VEGFR-2 from the ChEMBL database were used as training data. Predictive models were developed using nine different algorithms comprising k-Nearest Neighbour (kNN), Random Forest (RF), Support Vector Regression (SVM), Decision Trees (DT), Linear Regression (LR), Extra trees Regression (ETR), Ridge Regression (RR), Lasso regression (LR), and Artificial Neural Network (ANN). Seven different molecular descriptors which include Mordred descriptors, Mold2 descriptors, Morgan fingerprints, PubChem fingerprints, Substructure fingerprints, Molecular, Access System fingerprints, and Atom pairs 2D fingerprints were used for each model. After evaluating these models, the ANN model with the Morgan Fingerprints outperformed the other models with an R-squared (R<sup>2</sup>) value of 0.55, normalized Root Mean Squared Error (RMSE) of 0.0254 and normalized Mean Absolute Error (MAE) of 0.00689. The ANN model was then deployed as a web application that can be used to screen chemical libraries in search of lead compounds for experimental validation towards the design of novel cancer biotherapeutics.

**Keywords:** VEGFR-2, machine Learning, Inhibitors, molecular descriptors, Artificial Neural Network (ANN).

## LTA zeolites synthesized at different temperatures and evaluating the drug loading capability

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### Abstract

Linde type A (LTA) zeolite is synthesized in the laboratory using organic templates and different synthetic methods such that the crystal size can be controlled for specific applications. Due to the porous structure, LTA zeolites have attracted significant research attentions in drug delivery system, because of the ability to enhance their loading capacity and evaluate the drug release profile to targeted tissues and organs. This study was to evaluate LTA zeolite synthesized at different temperatures and to monitor their drug loading capabilities. Characterization studies of the LTA zeolite were determined by FTIR, XRD and SEM. Two different concentrations of the cancer drug were used for the study. 100 mg LTA zeolite at the various temperatures were used. Doxorubicin absorbance was then confirmed by measuring the supernatant using JENWAY 6705 UV- Vis spectrophotometer at 486 nm. The FTIR signature peak intensities of the LTA zeolite revealed the functional groups present in the LTA zeolite and the drug. As the LTA zeolites synthesized at different temperatures increase, the intensity of the peaks reduces and hence the crystalline size reduces. The average crystal size of the three different temperatures of LTA zeolites were determined for the control as well as the drug loaded LTA zeolite.

**Keywords:** Zeolite, synthesis, drug, temperature

## Estimating bivariate tail coefficient: An exponential regression approach

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### Abstract

The problem of estimating the coefficient of bivariate tail dependence is considered here from the robustness point of view: it combines two apparently contradictory theories of robust statistics and extreme value statistics. The usual maximum likelihood based, or the moment type estimators of tail dependence coefficient are highly sensitive to the presence of outlying observations in data. This paper proposes an alternative robust estimator obtained by minimizing the density power divergence with suitable model assumptions. The robustness properties are examined through the classical influence function analysis. In addition, the performance of the proposed estimator is illustrated through an extensive empirical study considering several important bivariate extreme value distributions. Finally, the proposed estimator is used to estimate the tail dependence coefficient for a practical data set worker's compensation.

**Keywords:** Robust estimation, bivariate extreme value theory, tail dependence, density power divergence, exponential regression mode

## Effects of Ylang Ylang (*Cananga odorata*) leaf extract on blood glucose level and biochemicals related to Diabetes Nephropathy

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### Abstract

Diabetes is a serious health concern worldwide. The increasing number of diabetic patients coupled with the side effect of synthetic diabetic drugs makes it necessary to implement novel nutritional/therapeutic interventions. Ylang-ylang leaf is commonly used as a food source but possessed medicinal properties due to its numerous

phytochemicals. This study investigated the effects of oral administration of Ylang-ylang leaf extract on the fasting blood sugar level and kidney arginase, 5-nucleotidase, adenosine deaminase (ADA), superoxide dismutase (SOD), catalase, glutathione peroxidase (GPx) activities, nitric oxide (NO) thiobarbituric acid reactive species (TBARS), and reduced glutathione levels of streptozotocin (STZ)-induced diabetic rats. Forty-nine albino rats (190-200 g) were grouped into seven groups (n = 7), as follows: Normal control; untreated DM; DM treated with acarbose; DM treated with 200 and 400 mg/kg body weight of extracts, respectively and normal rats treated with 200 and 400 mg/kg of extracts. From the result, arginase, 5-nucleotidase, ADA activities, and TBARS significantly increased while SOD, CAT, GPx, blood glucose, NO, and GSH levels were reduced in the diabetic rats. These trends were reversed in the diabetic rats treated with extracts. In conclusion, Ylang-ylang leaf could be a promising nutraceutical therapy for the management of diabetic nephropathy.

**Keywords:** Diabetes, ylang-ylang leaf, nephropathy, phytochemicals.

## Predictors and pathways associated with potentially high risk for preeclampsia among pregnant women attending ante natal clinic in selected hospitals in Ghana

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### Abstract

Preeclampsia is one of the major complications associated with pregnancy with serious implications on maternal and foetal mortalities and later years' health conditions. This study determined the predictors associated with potentially high risk for preeclampsia (PE) and the pathway through which they operate. This was a prospective cohort study conducted among pregnant women, 20 weeks or less gestational age, attending antenatal clinic at two different hospitals in Accra, between May, 2018 and February, 2020. A total of 403 participated and followed up between 28 and 32 weeks and at 6 weeks postpartum. Data collection was in four parts; questionnaire interview, anthropometric (weight and height), biochemical and clinical. Potentially high risk for preeclampsia was defined as having at least one of the following: systolic blood pressure  $\geq$  130 mmHg, diastolic blood pressure  $\geq$  80 mmHg, oedema or proteinuria at any point in time during pregnancy through to 6 weeks postpartum. Data were analysed with SPSS Version



22 to determine the predictors and SPSS AMOS Version 21 was used in modelling to determine the pathways through which the predictors operate. Pregnant women who had estimated pre-pregnancy BMI  $\geq 30$  kg/m<sup>2</sup> and estimated pre-pregnancy weight  $\geq 71$  kg were at a significantly increased risk of been at a potentially high risk for PE [3.6 (1.09 - 11.75)] p 0.040 and 3.4 (1.250 - 12.703) p 0.019 respectively. Also a significant positive direct relationship was found between anthropometric indices (estimated pre-pregnancy BMI and estimated pre-pregnancy weight) and potentially high risk for PE ( $\beta = 0.519$ ; t-value = 8.545; p-value = 0.001). Predictors of potentially high risk for PE were estimated pre-pregnancy weight and BMI with anthropometric indices having a significant direct positive relationship with potentially high risk for PE.

**Keywords:** Pregnant women, preeclampsia, pre-pregnancy body mass index, predictors, pathways

## Kombucha is a safe health drink

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### Abstract

This study evaluated the safety of cocoa and black tea Kombucha for prophylaxis and of black tea Kombucha for therapeutic use by diabetics. The prophylactic use of the drinks was studied in ICR mice, and the therapeutic in alloxan-diabetic Wistar rats. Cocoa and black tea Kombucha extracts were administered daily at 10, 100, 1000 mg/kg to the mice. Similarly black tea Kombucha extract (25, 100 mg/kg) and standard anti-diabetic drugs, metformin (10 mg/kg) and glibenclamide (5 mg/kg) were administered to the diabetic rats. Body weights were determined weekly, and selected organ wet weights at termination. Serum biochemical indices of liver and kidney functions were determined at termination. Histological analyses were undertaken on heart, kidney, liver, and lung. Black tea and cocoa Kombucha did not significantly affect body weight of the treated mice and so the black tea on diabetic rats. There was increase in mean lung weight/kg body weight for black tea in mice at 1000 mg/kg. Morphologically, only black tea Kombucha caused renal tubular and glomerular enlargement at 1000 mg/kg in mice. Black tea Kombucha showed no adverse effect on cellular integrity of diabetic rat liver and kidney. Serum biochemical analysis also indicated no significant effect of both cocoa and black tea Kombucha on the levels of AST, ALP, and creatinine in mice, compared to controls, except higher ALP level for black tea Kombucha at 1000 mg/kg. For the diabetic rat, black tea Kombucha significantly reduced the elevated levels of ALP, AST, and creatinine. These results show both black tea and cocoa Kombucha had no adverse effect on the mice, except at very high dosage, and diabetic rats. Since 200

ml Kombucha is equivalent to 1000 mg extract, Kombucha at the doses consumed by humans (250 ml/day = 1250 mg/day) should be safe as a prophylactic, and for diabetics.

**Keywords:** Kombucha, tea, cocoa, safety, health

## Kombucha drinks possess potential anti-diabetic property

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### Abstract

Many oral anti-diabetic drugs have serious adverse effects hence the search for natural alternatives. Kombucha, a fermented beverage from natural substrates is claimed to help manage diabetic conditions. Clinical trials are yet to be conducted; however, studies using experimental animals could be used as indicator to authenticate claims to anti-diabetic potential. This study aimed to establish whether Kombucha drinks exhibit anti-diabetic property. Alloxan-induced male ICR mice were administered daily black tea and cocoa Kombucha extracts, and the standard drug glibenclamide over four weeks period. Body weights were taken weekly, and serum glucose levels determined every other week. Serum cholesterol and serum triacylglycerol were determined, and histopathological analysis of the pancreas was done at termination. While alloxan injection resulted in weight loss and hyperglycemia indicative of diabetic condition, administration of cocoa Kombucha extracts to the diabetic mice resulted in weight gain and significant hypoglycemic effect comparable to the standard drug, glibenclamide and the non-diabetic control. The black tea Kombucha also resulted in significant weight gain for glibenclamide and the non-diabetic control but less weight gain by the black tea Kombucha treated diabetics compared to the cocoa Kombucha treated. However, the hypoglycemic effect of the black tea on the diabetic mice was similar to that of cocoa Kombucha. No significant changes were observed in serum total cholesterol and triacylglycerol for treatment of diabetics with both cocoa and black tea Kombucha. Histopathologic analysis of the pancreas showed that for both cocoa and black tea Kombucha treated mice the hypercellularity of the pancreatic cells appeared to be significantly reversed, restoring beta cells' function, resulting in increased insulin secretion hence the hypoglycemic effect. The results appear to substantiate the claims, thus suggest that Kombucha drinks have the potential for use in prophylactic treatment or therapeutic management of diabetes.

**Keywords:** Kombucha, tea, cocoa, diabetes, alloxan

## Existing insights into micronutrient insufficiency among older adults in Africa

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### Abstract

Ageing is implicated in micronutrient deficiencies due to inadequate nutrient intakes resulting from factors such as impaired appetite, reduced food intake, and repetitive dietary choices. In a rapidly ageing African population, chronic diseases, decreased functional ability, or cognitive decline and disability are highly likely to arise. This review highlights the micronutrient status of ageing Africans and presents the opportunity for the advocacy of appropriate micronutrient consumption. Searches were done in google, google scholar and Pubmed for current literature on micronutrient status of adults 60 years and above in Africa. Insufficiencies that emerged were linked to iron [~12-57%], folate [~23-31%], vitamin B12 [~13-34%], calcium [56-62%], vitamin D [~23-65%], Vitamin A [~55%] and Thiamine [~30%]. Iron, calcium and vitamin D deficiencies were the most prevalent among older adults. Multiple underlying factors found to influence the insufficiencies include dietary intake, other existing micronutrient deficiencies, malabsorption, low hormone production, bleeding, medication, infections and chronic diseases. The findings intimate the scarcity of information on plasma or serum micronutrient concentrations for older adults often due to the high cost involved and the challenges that accompany handling this unique population. Hence, information reported was obtained mostly from dietary intakes. Existing literature shows high micronutrient deficiency of various levels among the older adults in Africa, although generally the information is scanty and mostly assessed from diet. Considering that older adults are at a higher risk, there is the urgent need for resources to be directed towards closing the gap in research regarding micronutrient status of ageing Africans and developing older-adult-centred interventions.

**Keywords:** Micronutrient deficiency, older adult, Malnutrition, Africa

## Gastrointestinal helminths of the Ethiopian Rock Hyrax (*Procavia capensis*; Pallas, 1760) in the north-east region of Ghana.

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### Abstract

Wildlife may serve as potential reservoirs, intermediate or accidental hosts of zoonotic pathogens due to their interactions with human beings. For the first time in Ghana, we report extempore the gastrointestinal parasites of three Ethiopian rock hyraxes captured in September 2021. Forty adult parasites (21 nematodes and 19 tapeworms) were recovered from the gastrointestinal tracts of these three game hyraxes (*Procavia capensis*, Pallas, 1760) from the hills of Bimabgu (near the Gambaga Scarp) in the North-East Region of Ghana. Adult worms comprising three *Trichuris* sp, 16 tapeworms, and 21 hookworms were identified. The intestinal faecal examination also detected ova of *Trichuris* sp, tapeworms, and hookworms, and results are presented alongside the results of the molecular determinations. Since wildlife has been identified as an important source of emerging human pathogens, including helminth parasites, there is an urgent need for sufficient literature on wildlife parasites in Ghana. Since the rock hyrax is hunted for its meat, there is a potential risk of transmission of these identified helminths and other zoonotic pathogens to humans.

**Keywords:** Zoonosis, Rock Hyrax, helminths, parasites, public health

## Antimicrobial dispensing practices in medicine outlets in Ghana: a maximum difference experiment design

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### Abstract

Antimicrobials are consumed by patients all around the world. Antimicrobials are readily available in countries with little resources. In order to provide quantifiable data for policy discussions to improve patient safety and care quality in Ghana's pharmaceutical industry, this study evaluated antimicrobial prescribing and dispensing procedures

in medicine outlets. The data for this study were obtained from a cross-sectional survey conducted between July and August 2022 in the greater Accra region through interviewer-questionnaire administration. A two-stage cluster and random sampling technique were used to sample 200 medicine outlets' staff. The MaxDiff model, rooted in random utility theory, was used to analyze their antimicrobial prescribing and dispensing practices. We found that medicine sales outlet staffs were highly concerned about following the drug act and not dispensing antimicrobials without a prescription, and usually refer the patient to get a prescription from a doctor if the patient has complications (like high fever, generalized malaise, fatigue as symptoms, sinusitis). Our findings provide information on the requirement for a nationwide surveillance system to track antimicrobial prescribing and dispensing procedures at medicine sales outlets. Hence, the selection of antimicrobials for treating infectious diseases may be informed by evidence-based antimicrobial prescribing and dispensing surveillance.

**Keywords:** Best-worst scaling experiments, antibiotics, antimicrobial dispensing practices, antimicrobial resistance, medicine sales outlet

## Water consumption changes during and after COVID-19 in Ghana

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### Abstract

Water consumption increases in the fight against infectious diseases and COVID-19 is no exception. There is evidence that across the globe water consumption increased as people stayed at home during the pandemic and “blended” working and studying followed. This study seeks to investigate how the water consumption patterns in Ghana were in the COVID-19 year and whether it has influenced water consumption over the past 2 years as some water use practices especially the regular washing of hands seem to have come to stay. The study employed descriptive statistics on a monthly time series data from 2016 to 2022 to determine the water consumption pattern prior to 2020. Interrupted Time Series Analysis (ITSA) was used to determine the impact

of the intervention (lockdown) with 57 data points consisting of 24 pre-interruption data points and 33 post-interruption data points were used. The method was chosen as it allows model time variable to measure the trend before the intervention and the immediate impact of the intervention. Even though overall water consumption increased by about 30%, ITSA did not show a significant difference ( $p$ -value=0.12) in the monthly water consumption trend before, during, and after the interruption. Further trend analysis would have been performed but for the nature of data collected by the water utility company in Ghana. This is necessary as the nation water utility need to understand the situation and plan for future unexpected outbreaks.

**Keywords:** Covid-19, Interrupted Time Series Analysis (ITSA), intervention, lockdown, water consumption.

## Effects of SARS-CoV-2 spike protein and ACE2 interaction on cancer properties and cytokine expression in cancer cell lines

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### Abstract

Cancer is one of the most common comorbidities of COVID-19, but the direct effect on cancer cells and the immunological impact of this is not well understood. The infection causes severe respiratory injury, organ failure, and hyper-production of inflammatory cytokines which could affect cancer progression. Successful infection is dependent on spike and ACE2 receptor interaction with priming of the spike by host proteases like TMPRSS2. These proteins involved in the entry are reportedly present in both healthy and cancerous cells and may play important roles in regulating cellular function. ACE2 expression levels were screened in some cancer cell lines using a dot blot assay. SARS-CoV-2 PV was produced to infect cancer cell lines. Proliferation and migration were analyzed using MTT and wound healing assays. Cytokines expression post-infection was performed using qRT-PCR. The effects were further confirmed using live virus (LV) infections. ACE2 was seen to be expressed highly in colorectal cells and low in breast and prostate cells. PV decreased 22RV1 proliferation and migration, but LV increased it. Both PV and LV infections increased cytokine levels in 22RV1. LV reduced proliferation and migration and downregulated IL-1 $\beta$  and IL-8 in DLD-1. The study highlights the effects of SARS-CoV-2 infection on cancer cells which may contribute to understanding disease severity in comorbid patients. The current findings suggest that infection affects

22RV1 and DLD-1 cellular properties and gene expression. PV and LV infections may have contrasting effects on cancer properties in different cell lines.

**Keywords:** Cancer, SARS-CoV-2, Comorbidities, Pseudovirus (PV), COVID-19

## **African fermented seeds as probiotic carriers for poultry feed and alternative to antibiotic growth promoters.**

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### **Abstract**

Cancer is one of the most common comorbidities of COVID-19, but the direct effect on cancer cells and the immunological impact of this is not well understood. The infection causes severe respiratory injury, organ failure, and hyper-production of inflammatory cytokines which could affect cancer progression. Successful infection is dependent on spike and ACE2 receptor interaction with priming of the spike by host proteases like TMPRSS2. These proteins involved in the entry are reportedly present in both healthy and cancerous cells and may play important roles in regulating cellular function. ACE2 expression levels were screened in some cancer cell lines using a dot blot assay. SARS-CoV-2 PV was produced to infect cancer cell lines. Proliferation and migration were analyzed using MTT and wound healing assays. Cytokines expression post-infection was performed using qRT-PCR. The effects were further confirmed using live virus (LV) infections. ACE2 was seen to be expressed highly in colorectal cells and low in breast and prostate cells. PV decreased 22RV1 proliferation and migration, but LV increased it. Both PV and LV infections increased cytokine levels in 22RV1. LV reduced proliferation and migration and downregulated IL-1 $\beta$  and IL-8 in DLD-1. The study highlights the effects of SARS-CoV-2 infection on cancer cells which may contribute to understanding disease severity in comorbid patients. The current findings suggest that infection affects 22RV1 and DLD-1 cellular properties and gene expression. PV and LV infections may have contrasting effects on cancer properties in different cell lines.

**Keywords:** Bacillus, probiotics, antimicrobial resistance, safe poultry

# Assessing the responsiveness of emergency medical services and the availability of diagnostic radiology equipment for injury management in health facilities in the Ashanti region of Ghana

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## Abstract

With the increase in the rate of road traffic crashes (RTC) in Ghana, there is a need for a more efficient pre-hospital management system that is responsive, reaches RTC victims in a timely manner, provides effective out-of-institution care, quickly identifies, and accesses the nearest and most appropriate health facility to transport victims to and successfully hands over same to institutional care givers. Emergency medical service (EMS) in Ghana is fraught with several challenges such as difficulty in locating sites of road traffic crashes and delays in dispatching ambulances resulting in poor response times, difficulty in locating the nearest and most suitable health facility with the necessary medical equipment to manage road traffic crash victims, long hand-off times of crash victims to health facilities due to poor communication between the EMS and hospital, and poor public knowledge of how to trigger the EMS. The objective of this study is therefore to improve coordination of information and allocation of resources between the public, EMS and health facilities. Geographic Positioning Systems (GPS) techniques will be used to map RTC blackspots, ambulance stations, health facilities and diagnostic imaging equipment such as Magnetic Resonance Imaging (MRI), Computed Tomography (CT), Fluoroscopy, plain X- Ray and Ultrasound machines required for RTC victim management across the Ashanti Region of Ghana. This will feed into a computerized decision-making algorithm using mathematical modelling which will be designed to judiciously allocate ambulance vehicles based on need and also, recommend the nearest and most suitable health facility to transport RTC victims to depending on their real-time acuity. It is expected that the software algorithm will help improve public access to EMS, reduce EMS response times, help make critical decisions about the nearest and most suitable health facility to transport road traffic crash victims to and improve survival rates of RTC victims.

**Keywords:** Road traffic crashes, emergency medical services, response time



## The use of pineapple leaf fiber for prosthetic socket application

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### Abstract

This work reports on the use of pineapple leaf fiber (PALF) as an alternative reinforcing material to the established, commonly used carbon fiber material for prosthetic socket fabrication. The high cost of carbon fiber motivates this research looking at an alternative reinforcing filler for composite development in resource-limited settings. The objective of the work was to study the influence of PALF orientation and volume fraction on methyl methacrylate-based polymer matrix for prosthetic socket application. PALF/methyl methacrylate-based (MMA) composites with 0°, 45° and 90° fiber orientations were made with 5-50 v/v fiber volume fractions. The PALF/MMA composites were subjected to a three-point flexural test to determine the effect of fiber volume fraction and orientation on the flexural properties of the composite. The results showed that 40% v/v PALF/MMA composite with 0° fiber orientation recorded the highest flexural strength (50 MPa) and stiffness (1700 MPa). Considering the average load range exerted on prosthetic sockets, the flexural performance of the novel composite characterized in this work suggests that it is ideally suitable for socket- limb load transfer, especially in resource-constrained parts of the world.

**Keywords:** Prosthetics, pineapple leaf fiber, composite, polymer

## Objective assessment of shared plate eating in urban and rural households in Ghana using a wearable camera

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### Abstract

Shared plate eating (SPE) is a common practice among household members in low- and middle-income countries (LMICs). However, traditional dietary assessment tools are not designed to assess individual dietary intake data from SPE, hence the need for innovative methods of dietary assessment in such settings. In this study, we investigated the frequency of household SPE and other dynamics during SPE across rural and urban households in Ghana using a wearable camera. We hypothesized that rural, compared to urban households, would engage more in SPE occasions because of differences in work schedules, distance of work and school away from home, and availability of resources within the household. We used a relatively new technology – the Automatic Ingestion Monitor (AIM-2) – to assess SPE in 60 households from an urban (n=30) and a rural (n=30) community in Ghana. This wearable device worn by the father, mother, and an index child passively captured food intake images in front of the individual including the immediate surroundings throughout the day. Eating dynamics including SPE were assessed by viewing images examined in custom-made AIM Annotation software. Initial results show about a third (11/30) of urban compared to most (29/30) of rural households who participated in the study partook in SPE. In rural community, it was commonplace for non-household members to join a SPE occasion, for children and adults to eat together, and for couples to eat together. Differences in economic activities and greater time away from home of urban mothers and fathers may have limited the SPE of urban compared with rural households. The scenarios and frequency of SPE in LMIC households, especially in the rural community, highlight the relevance of objective dietary assessment methods in such settings to assist in evaluating SPE and accurately inform nutrition interventions and policies.

**Keywords:** Shared plate eating, low- and middle-income countries, automatic ingestion monitor

# Quantifying the carbon footprint of multi-specialist hospital in Ghana and opportunities to go green

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## Abstract

A carbon footprint is the amount of carbon dioxide released into the atmosphere as a result of the activities of a particular individual, organization, or community (Minoglou et al., 2017). Research undertaken by Health Care Without Harm indicates the global carbon footprint of the healthcare sector is estimated at 2 gigatons of CO<sub>2</sub>e which is equivalent to the annual greenhouse gases produced by 514 coal power plants and if the global healthcare sector was a country, it would have been the fifth-largest emitter of greenhouse gases in the world (Karliner et al., 2019). This supports the need to mitigate emissions from the healthcare sector in each country (Karliner et al., 2019). In the healthcare sector, there has been a slow acceptance to take responsibility and mitigate greenhouse gas (GHG) emissions produced as a result of healthcare activities (Tomson, 2015). This study quantified the carbon footprint of a multi-specialist hospital in Ghana and identified how the hospital can reduce its adverse impacts on the environment including achieving carbon neutrality. The total emissions from both direct and indirect sources of CO<sub>2</sub>e quantified based on the Greenhouse Gas Protocol accounting standards, resulted in 465.79 tonnes of CO<sub>2</sub>e for the year 2021. Regarding the major sources of greenhouse gas emissions from the hospital, the study revealed electricity consumption, generation of electricity from the backup power plant, and the hospital fleet of vehicles as the sources of greenhouse gas emissions. The electricity consumption from the national grid contributed the most to emissions at 55.94% from the hospital's operations followed by the generation of electricity from an onsite power plant at 39.24%, diesel-powered vehicles at 3.62%, and petrol-powered vehicles contributing 1.21% of the total GHG emissions of the hospital. The study further gives recommendations on proper utilization of waste, generation of energy from 100% renewable sources, green procurement, and attaining EDGE certification as some of the ways the hospital can reduce its adverse impact on the environment.

**Keywords:** Greenhouse gases, carbon emissions, carbon footprint, climate-smart healthcare

## Predictors of weight loss maintenance success among previous participants of a commercial weight loss programme in Accra, Ghana.

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### Abstract

Although weight loss programmes are efficacious in yielding temporary weight loss, maintenance of the weight loss attained has been challenging. Considering the challenges associated with Weight Loss Maintenance (WLM) success, studies on the predictors of WLM success are needed to enhance the development of interventions that will improve the odds of WLM success for health sustenance. A retrospective cohort study involving 230 participants who enrolled in a commercial weight loss programme between 2008 and 2016 was undertaken in Accra, Ghana. WLM success was defined as achieving  $\geq 5.0\%$  weight loss below starting weight for at least six months post weight loss intervention and unsuccessful WLM as otherwise. Information on demographic, behavioural, psychosocial, programme based characteristics and perceived barriers to WLM success was obtained. Logistic regression analysis was conducted to identify the predictors of WLM success. Achieving  $\geq 10\%$  weight loss increased the odds of WLM success (AOR = 6.72, 95.0% C.I = 3.15-14.31). Similarly, logging physical activity (AOR = 3.52, 95.0% C.I = 1.49-8.32), limiting food portions at mealtimes (AOR = 3.51, 95.0% C.I = 1.07-11.57), and a good/excellent perceived competence in carrying out behaviours for weight maintenance (AOR = 5.93, 95.0% C.I = 1.74-20.19), increased the odds of successful WLM. Being out of the weight loss treatment for three years or more as at the time of this study reduced the odds of WLM success (AOR = 0.46, 95.0% C.I = 0.22-0.97). A high magnitude of weight loss ( $\geq 10.0\%$ ), post weight loss physical activity logging, food portion control and a good/excellent self-efficacy in weight management behaviours increased the odds of WLM success. A longer time out of treatment (three years or more) decreased the odds of successful WLM.

**Keywords:** Weight, loss, maintenance, mealtimes, predictors, food,

# Drivers of increasing cost of poultry production in Ghana; trend analysis of input prices from 2010-2021

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## Abstract

Protein deficiency is a global problem which can be corrected by the incremental intake of protein from both plant and animal sources. This disastrous situation of protein deficiency is projected to further deteriorate as the demand for protein continues to increase due to factors such as increasing population growth rate, rapid urbanisation and rising income levels. Several measures such as increasing nutritious plants production and increasing animal production including increasing fish farming, have been put in place to increase the dietary protein supply in Ghana. However, these measures have not produced the desired results due to factors such as high cost of production, cultural and religious beliefs against the consumption of some animal species, diseases, pests, and poor knowledge of farmers. In a bid to reduce the cost of production so that production can be increased, this study sought to investigate the drivers of increasing cost of poultry production in Ghana by collecting data from poultry farmers, feed millers, feed ingredient dealers, Animal Production Directorate, and other dealers in the poultry value chain. The results showed that input prices generally increased proportionally from 2010 – 2021 with increase in poultry feed, with feed accounting for 70% of poultry production costs. The highest three main feed input drivers of the ever-increasing cost of poultry production in Ghana being fish meal, soya bean meal and maize respectively, which are key ingredients in poultry feed. It will therefore be helpful if more research is conducted into finding cheaper, locally available, and more sustainable alternatives to poultry feed including fish meal, soya bean meal and maize so as to reduce the cost of poultry products. Measures that encourage more local production and local processing of soya beans will be beneficial.

**Keywords:** Poultry, value chain, production, Ghana

## Monitoring and evaluating climate change adaptation programmes using adaptation frameworks of interaction and outcomes

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### Abstract

Climate change has become one of the biggest challenges confronting the world's economic, social and environmental development efforts today. Responses to these challenges normally fall into two broad categories, namely mitigation and adaptation. The climate change mitigation comprises actions taken to eliminate the anthropogenic root cause of climate change global warming, driven by an increased accumulation of atmospheric greenhouse gases (GHGs) whilst the climate change adaptation is about learning to live with the impacts of climate change. Climate change adaptation, the focus of this study, is important because historical factors contributing to climate change cannot be reversed, making adapting to the inevitable impacts of climate change a necessity and not an option. Many adaptation frameworks have been developed to manage climate change programmes but the outcome and impact of these programmes are not certain till another climate change event strikes. This could be minimised if adaptation frameworks have strong monitoring and evaluation component to test every stage of ideas and activities towards the instituted climate change programmes. It is for this cause that this study developed and proposed two novel climate change adaptation frameworks namely: adaptation framework of interaction and the adaptation framework of outcomes. The adaptation framework of interaction details the possible adaptation options (activities and ideas) that stakeholders can choose from while the adaptation framework of outcomes monitors and evaluate every stage of implementing the adaptation options. This is expected to ensure robust adaptation programmes that can withstand any possible climate change disruptions.

**Key words:** Adaptation, climate change, framework, programme, monitoring, evaluation

# Influence of extension methods used under the planting for food and jobs programme on adoption of improved technologies.

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## Abstract

An important tenet of government agricultural intervention is the increased adoption of improved technologies by beneficiaries. In particular, the Planting for Food and Jobs (PFJ) programme launched by the Government of Ghana in 2017 aims to improve food security, reduce poverty, and create employment through the incremental adoption of improved technologies (improved seeds and fertilizer). Ways through which technologies have been disseminated and the adoption of technologies under the PFJ remain scarce in the extant literature. Our study addresses three research questions, first, what extension methods remain used under the PFJ programme? To what extent has specific extension methods influenced farmer participation? And finally, how has participation influenced the adoption of improved agricultural technologies. Relying on a cross sectional survey involving 100 smallholder farmers in the Awutu Senya West District, we find that the individual and group extension methods are the dominant ways through which technologies have been disseminated. Specifically, farm visits and phone calls are the main individual extension methods used. For the group extension methods, we find group meetings as the most dominant method used. Ironically, the extension methods used had no significant influence on the levels of participation. However, farmers participation in the programme had a positive significant influence on the adoption of improved technologies. We recommend that the Ministry of Food and Agriculture (MoFA) target broadening participation by improving the enabling environment and the entry requirements. Specifically, MoFA should ensure consistent and timely supply of inputs, and ensure effective market linkages, which often tends to be overlooked.

**Key words:** Agriculture, programme, intervention, planting, farmers

# Revisiting the application of extreme value theory to the management of a hydroelectric dam

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## Abstract

This study uses Extreme Value Theory to model the tail behaviour of the water levels in the Akosombo dam, which produces over a third of electricity in Ghana. The goal is to determine estimates of exceedance probabilities for various levels of the dam that may lead to flooding in downstream communities and/or breach the integrity of the dam. The study starts by evaluating the domain of attraction for the dam's water level data and fits it to the Generalized Extreme Value, Generalized Pareto distributions, and the Right-Truncated Generalized Pareto distributions to account for truncation that is naturally provided by the height of the dam. The shape and scale parameters of these distributions are estimated using Maximum Likelihood and Bayesian estimation methods. The results show that the dam water level data has a negative shape parameter, and thus, it is in the Weibull domain of attraction. Also, the estimates of the exceedance probabilities indicate that it is unlikely for the dam's water level to rise above its maximum level under the current operating environment.

**Keywords:** Univariate Extreme Value Theory, Truncation, Right-Truncated Peaks-Over-Threshold, Generalized Pareto Distribution, Generalized Extreme Value Distribution



## The influence of storage temperature and humidity on chocolate retailed in hot climate using phase change material

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### Abstract

The appearance of heat related bloom around chocolate is as a result of failure and inappropriate storage of chocolate. This is commonly found among the street sellers of chocolate who sell in the sweltering sun of the streets of Accra and Kumasi. A Phase Change Material (S27) was used to regulate the surrounding temperature of the chocolate and to preserve them. To mimic the street sellers, the experiment was set up in an open space outside directly under the sun. Two (2) and three (3) packs of PCM were placed in a chest for 7 hours during the day. Also a box of chocolate was placed directly under the sun. A data logger was used to measure the temperature and humidity of the chocolates. The maximum temperature of the environment was 38.9°C. The surrounding temperature of chocolates kept under 3 packs of PCM recorded a maximum value of 29.8°C and a minimum value of 23.1°C whereas the surrounding temperature of chocolates with 2 packs of PCM recorded a maximum value of 33.7°C and a minimum value of 26.3 °C. The surrounding temperature of the chocolate placed directly under the sun recorded a maximum temperature of 45.2°C. It was observed that the chocolates melted under this condition due to the heat accumulated in the box of chocolates. There was a whitish substance formed around the chocolate when left to dry after some days. While the ones kept under PCM conditions maintained their physical properties. The humidity of the chocolate with 3 packs of PCM recorded the highest value followed by the 2 packs of PCM. The chocolate placed directly under the hot sun had the lowest humidity since the heat dried up the moisture around it. In effect the chocolates kept under 3 packs of PCM was considered to be more effective since it can keep the chocolates cooler for a longer period and also no traces of moisture was found around the chocolates.

**Keywords:** PCM, Chocolate, Humidity, Temperature, Preservation.

## Carboxymethyl chitosan- $\beta$ -cyclodextrin nanoparticles as a drug delivery system: evaluation against mcf-7 breast cancer cells

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### Abstract

The aim of this study was to generate a new type of nanoparticles made of carboxymethyl chitosan (CMC) and carboxymethyl  $\beta$ -cyclodextrin (CM  $\beta$ -CD) and to characterize it. This nanoparticulate system should have a potential for the association and delivery of hydrophilic and hydrophobic drugs as well as undergo further conjugation to other macromolecules such as antibodies for targeted delivery especially in cancer therapy. Various CMC concentrations and a fixed concentration of CM  $\beta$ -CD were processed to nanoparticles via the ionic gelation technique by grafting the CM  $\beta$ -CD onto CMC using water-soluble 1-ethyl-3-(3-dimethylaminopropyl) carbodiimide (EDC) and N-hydroxysuccinimide (NHS) as the condensing agents. The resulting nanoparticles were spherical in shape as shown by atomic force microscopy with an average size range of 124–298 nm and showed a negative zeta potential. Doxorubicin hydrochloride (DOX), a water soluble anticancer drug, was loaded in the nanoparticles with a high encapsulation efficiency. The in vitro drug release showed that the release of DOX from the nanoparticles could be effectively sustained. The anti-tumor activity of the released DOX was assessed using a MCF-7 breast cancer cell line. The cytotoxicity evaluation showed the drug loaded nanoparticles inhibition on MCF-7 breast cancer cells.

**Keywords:** Chitosan, Cyclodextrin, Nanoparticles, Drug Delivery system, Targeted Drug Delivery, Cancer.

## pH-sensitive biogenic silica-chitosan composite for targeted folic acid delivery

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### Abstract

The drug loading of silica derived from organic compounds satisfies the need for effective biocompatible carriers for sustained and targeted delivery. Silica is a naturally occurring material that is biocompatible and biodegradable. However, studies reveal silica nanoparticles' drug loading and release capabilities are uncontrolled and erratic. In this paper, we modified biogenic silica (BS) with chitosan to improve the loading and release capabilities in vitro. The BS was prepared by calcining for 48 hours at 600. The modification was accomplished by immersing BS in a chitosan solution overnight. The composite was characterised using Fourier transform infrared spectroscopy (FTIR) and X-ray diffractometry (XRD). Folic acid loading and release studies were performed for the BS alone and the composite using UV-Vis spectrophotometry analysis at a wavelength of 285 nm. The folic acid loading was done at a pH of 9, and release studies were done at pH of 7.24 and 10.40. Results from the comparative analysis of the BS and the composite showed improvements in drug encapsulation efficiency of 29.79 and 73.96%, respectively. Thus, the findings show the potential application of folic acid delivery in the jejunum.

**Keywords:** Drug delivery, folic acid, biogenic silica, composite

## Exposure assessment of some heavy metals (arsenic, lead, cadmium, mercury, copper and zinc) in locally produced rice sold in accra metropolis

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### Abstract

In Ghana, rice is the second most important cereal after corn. It serves as a convenient food for both urban and rural consumers. Despite this, there is growing concern about heavy metal contamination in rice locally produced. The contamination of rice with heavy metals poses a threat to food safety and public health. This study assessed consumer exposure to heavy metals (Arsenic, Lead, Cadmium, Mercury, Copper, and Zinc) in locally produced rice sold in the Accra Metropolitan Area, Ghana. The study involved a consumer survey as well as analysis of the presence and concentration of heavy metals in rice sampled from markets in Accra. The consumer survey revealed an average rice consumption of 221.67 grams/day and 496.36 grams/ week among adults with a body weight of 60–69 kg. For children, with an average weight of 21–30 kg the average rice consumption was 58.33 grams/day and 142.43 grams/week. The study analyzed thirty (30) local rice samples to determine the concentration of Arsenic, Lead, Cadmium, Mercury, Copper, and Zinc in them. The concentration of the heavy metals in all 30 rice samples were found to be below the maximum permissible level stated in the heavy metal standards for food as established by the Codex Alimentarius Commission. However, health risk assessment revealed that consumption of local rice poses both non-carcinogenic and carcinogenic risks in adults and children. The main concerns were Arsenic and Lead for adults and Arsenic, Lead and, Cadmium for children. The non-carcinogenic and carcinogenic risk for Arsenic, Lead, and Cadmium were higher than the recommended standard values. The study also found that the concentration of essential micronutrients like Copper and Zinc in the rice samples were lower compared to the other metals.

**Keywords:** Heavy metals, rice, exposure, arsenic, carcinogenic

## Aging and phosphorus availability in biochar and biochar compost

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### Abstract

Phosphorus deficiency has become one of the main problems limiting crop production in the northern part of Ghana. Consequently, various attempts, including the use of biochar and biochar-compost have been directed at making the nutrient more available. Use of such amendments have improved on P availability for two consecutive seasons in soils without further applications. The use of the two amendments have become a cost-effective way of producing crops in this era of high cost of inorganic fertilizer and shortages. Understanding the mechanism of P availability of biochar and biochar-compost would demand fractionation to determine the fraction of P that enhances availability. Fractionation of biochar and biochar-compost which had aged for one year and two years using the modified Hedley's procedure was carried out to ascertain the effect of aging, if any, on the different P pools. The results indicate that both amendments were dominated by water extractable P. The ratio of water extractable P to total P in the one and two year old biochar types were 50.1 and 33.0%, respectively. The one year old biochar-compost had 410.18 mg/kg water extractable P which increased significantly to 464.30 mg/kg after two years of aging. The water available P in the biochar-compost was more than twice the contents in the biochar. Biochar and biochar-compost showed increasing trend in total P content with aging. Two-year aging of the two amendments led to dominance of resin P. The results showed that the two amendments have liming potential due to their high pH. The one year old biochar and the biochar compost could be used as P fertilizer for short duration crop cultivation and for dry season farming while the two year old amendments could be used as P fertilizer for perennial crop cultivation.

**Keywords:** biochar, compost, Ph, fertilizer, fractionation

## Zinc sorption characteristics of biochar and biochar-compost

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### Abstract

Biochar and biochar compost have been known to increase P availability in soils of northern Ghana. However, the soils of northern Ghana have also been found to be low in Zn content and therefore amended with Zn from external sources to increase availability. To understand the effect of co-application of Zn fertilizers with biochar or biochar-compost to soil, it is imperative to first elucidate the mechanism of Zn adsorption and desorption on biochar and biochar compost. Batch sorption experiments to elucidate the effect of pH and Zn concentration on Zn adsorption by the two amendments were investigated for Zn concentrations between 0.2 mM and 1.6 mM and initial pH ranges of between 2 and 12 at 10 mM ionic strength. Zinc desorption was thereafter carried out between equilibrium pH range of 4.05 and 6.43 at the highest Zn concentration of 1.6 mM. The results indicate that optimal pH for Zn adsorption was at equilibrium pH between 6 and 6.5 where P is of high availability in soil solution implying that availability of P will lead to Zn deficiency should the two nutrients be co-applied to soil. The strongest affinity for Zn was discovered in biochar-compost, with an estimated maximum adsorption of 2500 mg/kg. The findings show that both the Freundlich and Langmuir isotherms accurately characterize Zn sorption. Zinc desorbability decreased with increase in equilibrium pH confirming decreased availability at higher pH. Biochar-compost was found to have higher Zn desorption rate than biochar. Surface precipitation of Zn by phosphorus was found to be the main mechanism of Zn sorption with pH controlling desorbability.

**Keywords:** Desorbability, zinc, concentration, fertilizers, adsorption, phosphorus

## **Role of invasive species in global food security: The case of spotted wing drosophila *Drosophila suzukii* matsumura (diptera: drosophilidae) and brown marmorated stink bug *halyomorpha halys* (stål) (Hemiptera: Pentatomidae) in tree fruit and berry crop production in the U.S.**

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### **Abstract**

Globally, it is estimated that the economic cost of invasive species has been more than \$1.288 trillion over the past 50 years. Since the Green Revolution, which saw a sharp increase in commercial agricultural production, more than 6,500 nonindigenous species have been established in the United States, posing great risks to native plants, animals, microorganisms, valued ecosystems, and human and wildlife health. These invasive species are estimated to cause more than \$26 billion in losses annually. Among these are some of the most devastating insects that attack crops, forests, and livestock causing huge economic losses. This presentation will examine the importance of damage caused by two invasive species, the spotted wing drosophila *Drosophila suzukii* (Diptera: Drosophilidae) and the brown marmorated stink bug *Hyalomorpha halys* (Hemiptera: Pentatomidae) in tree fruit and berry crops in the USA. These species invaded the U.S. in the past two decades and caused more than \$1 billion in losses annually, causing a great threat to food security. The U.S. Department of Agriculture has provided huge sums of money for research and education to manage these invasive insects. I will discuss successful efforts made in the past few years to manage these insects in the context of integrated pest management.

**Keywords:** Green, invasive, species, plants, production

## Current status, challenges and prospects of quail farming in Ghana

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### Abstract

This paper presents the current status of quail farming in Ghana, the challenges that the quail farming sector is facing and the opportunities that the sector seeks to offer. Data were collected through interviews with the aid of structured questionnaire and analysed using SPSS 26.0. Data gathered for this research was collected from five regions namely, the Greater Accra region, Ashanti region, Volta region, Central region and the Upper West region of Ghana. The Snowball Sampling Technique was used in order to successfully reach the farmers in each of the regions. The respondents for the study were small, medium and large-scale quail farmers. The study revealed that in Ghana, two major breeds of quails (Japanese and Jumbo Giant quails) are reared, but the Japanese quail is the most common due to its prolificacy and ability to tolerate intensive colony battery cage management systems for egg production. The 90% of the quail farmers were males who were middle-aged, well-educated and had less than five years of experience in quail farming. Also, the majority (65%) of the farmers kept more than 200 birds and earned an average monthly income of GHS- 1,000.00. The challenges identified in the study were overall sector disorganization, lack of standardized quail feed, lack of ready market access and information for smallholder producers, and high feed costs, among others. The study concludes that quail farming is still at the infant stage in Ghana and there is a need to promote quail farming development and to consider the special needs of women when government policies on social activities are developed in order to realize the full potential of women's contribution to quail farming.

**Keywords:** Smallholder, production, farming, farmers, management,



## Performance of some selected eggplant (*Solanum* spp.) accessions to eggplant fruit and shoot borer under field and screenhouse conditions.

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### Abstract

The eggplant, *Solanum* spp. is a significant vegetable for indigenous African communities. Production is widespread, but the common challenge is insect pests attack including the destructive eggplant fruit and shoot borer (EFSB), *Leucinodes* spp. The larva feeds by tunnelling tender shoots or boring into fruits causing plant wilt or death and loss of fruit value. Farmers rely on synthetic insecticides to manage the pest, but this has severe consequences such as residues on fruits and insecticide resistance development. Hence the need for management options which are safe, cost-effective, and sustainable. Host plant resistance is an inherent natural phenomenon based on the plant's self-defense mechanisms, and it is compatible with other control methods. In this study, we evaluated the performance of five eggplant accessions (RV100213, RV100248, RV100250, RV100307 and Legon1) against EFSB, in open fields at the Forest and Horticultural Crop Research Center, Kade and under-screenhouse conditions during two cropping seasons in 2022. Plant growth parameters, fruit yield and insect damage or incidence, were analyzed at  $p \leq 0.05$  and used as indices for plant performance against the EFSB. The data collected indicated that plant height, the number of leaves and fruit yield differed significantly between the accessions in both field and screen house experiments. The percentage of EFSB infestation ranged between 29% – 45% for shoots and 20% – 62% for fruits, which indicates EFSB's preference for fruits. Generally, EFSB infestation for all the tested accessions ranked between moderately susceptible to highly susceptible on a 6-point scale for host plant resistance. The findings of this study can be used to determine when it is best to start management procedures to prevent EFSB infestation in the fields. It is also recommended that host plant resistance should be combined with other environmentally friendly methods for the management of the eggplant fruit and shoot borer.

**Keywords:** *Solanum* spp., eggplant accessions, *Leucinodes* sp., host plant resistance.

## Review of the effects of the threats of ticks infestation on cattle in the coastal savanna

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### Abstract

Ticks transmit the widest diversity of haemoparasitic diseases that are responsible for the mortality of ruminants and acute shortage of animal protein in most parts of sub-Saharan Africa. Annually, the cost associated with tick-related death of cattle and loss of productivity annually exceeded \$100 billion worldwide. This threat may vary between countries due to differences in the species and the breed of cattle. There are many species of vector ticks in Ghana. Currently, data on the effect of ticks on productivity of cattle reared by smallholder farmers is lacking in Ghana. Notably, small farmers own >70% of the approximately 2 million cattle. The focus of the present study is to assess the prevalence and problems of ticks on cattle farms. This knowledge will illuminate gaps in the prevailing control measures that can be corrected to increase the production of meat and milk. The potential for scale up production is enormous as evidenced by the availability of vast feed resources. If the threat of ticks and the associated tick-borne disease could be removed or significantly diminished, it will allow a complete overhaul and expansion of the beef and dairy animal production.

**Keywords:** Ticks, cattle, prevalence, production, prevalence

## Combining ability studies and root-knot nematodes resistance in tomato genotypes in Ghana in open and protected conditions

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### Abstract

Tomato (*Solanum lycopersicum* L) is an essential vegetable produced all over the world. Tomato production is woefully inadequate in Ghana due to abiotic and biotic stress including root-knot nematodes (*Meloidogyne* spp) infection leading to high import of raw and processed tomato products. The purpose of the study was to determine the levels of the hybrid resistance to root-knot nematodes (RKN) and combining abilities of the parental inbred lines. In this study, 25 F1 tomato genotypes generated with North Carolina Design II mating fashion using ten inbred lines obtained from West Africa Centre for Crop Improvement (WACCI), University of Ghana and three commercial checks were evaluated. The evaluation was conducted in the greenhouse to determine the levels of RKN resistance with Completely Randomized Design and an open field used to determine combining abilities of the parental inbreds with Alpha Lattice Design. Reproductive factor (1-4) was used to score RKN resistance levels. number of J2, general combining ability (GCA) and Specific combining ability (SCA) had significant differences ( $P < 0.05$ ). The results indicated that Mongal F1 (check), G19LxB2 and C2xB2 are non-host whilst C2xB3, G19xB4, KILELE F1 (check), G19xB5 and C2xB4 are poor host. Three genotypes were good hosts whilst fifteen genotypes together with PETOMECH F1 (check) were excellent hosts. The GCA good general combiners observed were recorded in number of locules (NL), fruit pH, fruit firmness and brix were are G19L (-3.18), B2 (1.88), G19 (6.12) and W(-4.16). SCA exhibited B5xW (68.87) in t/ha, B2xC1 (7.97) in NL, B5xG19L (25.43) in ND50%FS and B5xW (43.01) in ND50%F. Identification of root-knot nematode resistant hybrids (F1) will boost tomato yield, increase income and nutritional composition in humans

**Keywords:** Genotype, tomato, combining ability, host, root-knot nematodes

# Achieving rice self-sufficiency through enhanced profitability and effective constraint management

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## Abstract

Globally, rice self-sufficiency is linked to consistent and increased output year-on-year by producing households. How small holder farmers manage inputs for profitability and address constraints in key rice growing areas in developing countries is a key concern for self-sufficiency. A case study of Ghana selected 120 rice farmers using a multistage sampling technique in the North Tongu District of the Volta Region. Descriptive statistics, gross margin analysis, augmented Cobb Douglas regression modeling and the Kendall's Coefficient of Concordance were used in analyzing the data gathered from the respondents. Analysis of the background of the study respondents showed that majority were males, below the age of 60 years and had received basic education (literate). The average number of years of experience in rice farming was approximately 11 years. Many (41.7%) of the respondents belonged to a farmer organization and all of them sold 90 percent of the harvested rice. The result from the gross margin analysis showed that rice production in the study area was profitable; a GHS1.00 invested gained GHS0.90 per hectare. The results of the regression analysis showed that being male, having a larger farm size, and using the right quantity of fertilizer and seed, boosted growth in rice output, contributing to national rice self-sufficiency. Nevertheless, to sustain the growth, the following constraints need to be addressed: High cost of inputs, high cost of irrigation, lack of high yield varieties and difficulty in obtaining loan. The major recommendations are that government of Ghana should continue its support for the rice sector, provide subsidized inputs (seed and fertilizer) and create the enabling environment for rice farmers at the local level, to work with stakeholders to increase their area of land cultivated to rice, obtain affordable credit and attract more female and youth to the sector.

**Keywords:** Self-sufficiency, Inputs, Profitability, Constraints, Rice farmers

# Irrigation technology enhances productivity of okra farmers in peri-urban Ghana: lessons from the Greater Accra and Eastern Regions

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## Abstract

Low farm productivity does not only affect household income but also national food and nutrition security. How irrigation technology, which enhances aspects of productivity with respect to land, labour, and capital should be investigated to guide both national policy action and private investments, is the focus of this study. Using data from 230 okra-based farmers, randomly selected from peri-urban areas of the Eastern and Greater Accra regions of Ghana, the study addresses three issues: 1) the operations involved in cropping activities, 2) the labour and land productivity (output per unit area) and 3) the determinants of land and labour productivity. The study uses information obtained through face-to-face interviews and guided by a well-structured questionnaire. In addition to descriptive statistics, a modified Cobb Douglas production function is employed in the analysis of data. Majority of the farmers interviewed were males, literate and belonged to a farmer organization that provided capacity-building and technical information on agronomy and mechanisation. The farm operations examined were orthodox – using manual land preparation approaches, direct planting of seed, watering using mainly tube and can irrigation and managing weeds, pests, diseases, and soil fertility with both organic and inorganic materials. In terms of productivity, the average farmer spent one hour to produce about eight kilogrammes of okra or harvested approximately 3,113 Kg/Ha of okra. Results from the Cobb Douglass analysis revealed that the tube and can irrigation, organic manures, fungicides and herbicides are important factors of productivity. The socio-economic factors of importance are farmer's age, experience, marital status, land ownership status, and residential status. The institutional factors tested—contract farming and farmer organisation— were considered important for labour productivity. The study recommends that both public and private investors should focus on improving the types of irrigation, trust building in contract/farmer organisation schemes and ensure application of quality productivity-enhancing inputs in providing support to farmers.

**Keywords:** Irrigation, productivity, farm inputs, okra, peri-urban

# The role of micronutrients in the prevention and management of neurodevelopmental disorders: a systematic review

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## Abstract

The prevalence of various neurodevelopmental disorders (NDs) in children continue to progress along a world that is increasingly advancing in research, technology and record keeping. The usual long-term nature of these disorders causes many caregivers to use complementary and alternative medicine (CAM) to help improve the lives of affected children or to prevent the condition from occurring. Micronutrients are among the commonly used CAM in many instances. The objective of this review is to determine the role that micronutrients play in the prevention and management of NDs. To achieve the objective, a search for eligible studies published overtime up to January 2023 was conducted on PUBMED, semantic scholar, TandFonline, and World Health Organisation's International Clinical Trials Registry. The search yielded 2,362 studies; however, 145 reports were included in the review. The data indicated that serum levels of micronutrients were significantly lower in children with autism spectrum disorder (ASD) and Attention Deficit Hyperactivity Disorder (ADHD) compared to Typically Developing (TD) children. Also, micronutrient usage was associated with perceived improvement in ASD and ADHD symptoms with maternal prenatal intakes and levels of micronutrients lowering the odds of ASD in offspring. Clearly then, appropriate use of micronutrients in the management of NDs may decrease the severity of these conditions. Additionally, improving maternal serum levels of micronutrients before and during pregnancy may potentially reduce the risk of ASD.

**Keywords:** Micronutrients, Nutrition, neurodevelopmental disorders, autism, attention deficit hyperactivity disorder, children

## Susceptibility of five cowpea varieties to field insect pests

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### Abstract

Cowpea, *Vigna unguiculata*, is a popular food crop in the tropics and subtropics. The crop is particularly susceptible to pests and diseases, limiting its yield. The use of host plant resistance in pest management has become necessary, because it is an environmentally friendly approach. This study assessed the susceptibility of some selected cowpea varieties to field insect pests, to make recommendations to farmers. Insect pest infestation of five improved cowpea varieties ('Asontem', 'Golinga', Kirk house, 'Padi Tuya' and 'Wang Kae') was assessed at different developmental stages of the plant on the field. Mean yield parameters such as the number of pods per plant, weight of pods per plant, length of pod, number of seeds per pod, number of loci per pod, seed weight per pod, 100-seed weight, and total yield were assessed. 'Golinga' and 'Wang Kae' recorded the highest number of pods per plant in the minor and major seasons, respectively while 'Padi Tuya' had the least number of pods per plant in both seasons. 'Asontem' and 'Padi Tuya' recorded the highest and lowest yield respectively in both seasons. Correlation analysis between insect infestations and yield of the varieties in the field showed that *Aphis craccivora* infestation was negatively correlated ( $r = -0.2368$ ,  $p > 0.05$ ) with total yield in the major season. *Megalurothrips sjostedti* infestation was negatively correlated with the total yield in the major season ( $r = -0.0784$ ,  $p > 0.005$ ) and minor season ( $r = -0.4232$ ,  $p > 0.01$ ). *Maruca vitrata* infestation was positively correlated with the total yield ( $r = 0.0636$ ,  $p > 0.05$ ) in the major season and negatively correlated with total yield ( $r = -0.3767$ ,  $p > 0.05$ ) in the minor season. The findings indicate that host plant resistance using 'Golinga' can be combined with other environmentally friendly methods, for the effective management of cowpea insect pests.

**Keywords:** Cowpea, insect pest, susceptibility, infestation

## **Agricultural labour availability, food production and food security: perspectives of non-migrant agricultural households in southern Ghana.**

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### **Abstract**

Sustainable food production can contribute to food availability and affordability, but largely contingent on the availability of agricultural labour in rural economies where food is mostly produced. The adverse impacts of climate change on food production, food security, intensification, and limited economic opportunities have resulted in labour out-migration. Borne out of this concern, this study examines the effect of agricultural labour out-migration on food production and its implication, particularly for food security. Specifically, from the perspectives of non-migrant household members in migrant households. Relying on cross-sectional data on 200 migrant households selected through multi-stage sampling, we answer the question: What is the effect of agricultural labour out-migration on food security outcomes? We find an inverse relationship between labour availability and the perceived effect on food production. Implying that labour out-migration reduces food security outcomes. Most (80.5%) households are saddled with seasonal food insecurities. Leading to illegal cross-border trade of food items with dire implications for the transfer of crop pests and diseases. We suggest, the Department of Agriculture provide incentives that will attract the youth to stay in remote locations to improve upon agricultural production. This will require intensive farmer education on farming as a business while, intensifying education on climate variability and change adaptation strategies by stimulating technical and organizational innovations using indigenous knowledge.

**Keywords:** Food, security, households, migrants, labour



## Oil palm empty fruit bunch and irrigation effects on growth, dry matter yield, and radiation use efficiency of eggplant cultivated in Ghana

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### Abstract

To improve the current low production constrained by rainfed agriculture on degraded soils, two seasons' experiment with eggplant was grown on an Acrisol in Ghana using irrigation and oil palm empty fruit bunch (EFB). EFB was applied as biochar (BC) and as organic mulch (OM) at rates of 0 t ha<sup>-1</sup> (BC0, OM0), 20 t ha<sup>-1</sup> (BC20, OM20), and 40 t ha<sup>-1</sup> (BC40, OM40) in combination with three irrigation treatments, thus, non-irrigated (I0), deficit irrigated (I60), and full irrigated (I100) plots. Air-dried EFB BC was applied into plots at about 20 cm, while raw EFB OM was spread on the surface of the plots. The I100 plots were irrigated to field capacity (FC) every 3-4 days according to PR2 profile probe measurement. The I60 plots received 60% of the amount given to the I100 plots on the day of irrigation, while the I0 plots were rain-fed, thus, received no irrigation water. In the first season, eggplant leaf area index (LAI), fresh fruit yield (FFY), total dry matter yield (TDMY), accumulated intercepted photosynthetically active radiation (AIPAR), and radiation-use efficiency (RUE) were neither affected by irrigation nor the EFB options. In the second season, however, EFB affected the measured crop variables of LAI, FFY, TDMY, AIPAR, and RUE, which were significantly ( $p \leq .05$ ) higher than the unamended treatment. Except for FFY under BC-amended plots during the second season, irrigation did not affect the measured eggplant parameters, perhaps due to the substantial rainfall during the experimental seasons. Our study proves that oil palm EFB can enhance eggplant growth, FFY, TDMY, AIPAR, and RUE on weathered tropical soils. An increase in fruit yield of eggplant with EFB designates sustainable food security and hence improvement in crop production among smallholder vegetable farmers while mitigating the effects of climate change.

**Keywords:** Climate change, food security, weathered tropical soils, smallholder vegetable farmers, rainfed agriculture.

## Factors influencing the adoption of improved industrial cassava varieties among farmers in the Yilo Krobo District of the Eastern Region.

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### Abstract

Cassava is a major food crop for food security and also an industrial crop. However, the low adoption of modern agricultural technologies among cassava farmers has been identified as one of the primary causes of low agricultural productivity and an increase in poverty levels. Agricultural technological advancement (such as improved cassava varieties) is the most important factor in increasing agricultural productivity and reducing poverty. The study estimates the adoption rate and adoption intensity of improved industrial cassava varieties, assesses the factors that influence the adoption of the improved cassava varieties, and the constraints of cassava farmers in adopting improved industrial cassava varieties. Using primary data from 120 farmers from four (4) communities in the Yilo Krobo district, the study revealed that the average adoption rate of the improved industrial cassava varieties, what is known to the farmers as the "Agric" variety is 36.36% and an adoption intensity of 0.55 implying that, on average, 55% of cultivated land of cassava (average farm size of 1.87ha) is under the improved industrial varieties. An analysis of the determinants of adoption with the Tobit model showed that education and farmer participation in field demonstrations, and access to extension services, experience, and access to accredited planting material positively influence the adoption intensity of improved cassava while the cost of labor and, perception of disease susceptibility of the "Agric" cassava variety negatively influence the adoption intensity of the improved industrial cassava varieties in the study area. Income is the most constraining factor that affects cassava farmers, while lack of appropriate storage facilities is the least constraint. The study recommends that ready market for cassava will increase farmers' income and entice the youth to venture into agriculture cassava production for industrialization.

**Keywords:** Improved cassava varieties, Adoption rate, Garret ranking, Agriculture productivity, and Agriculture technology.

## Insecticidal activities of cinnamic acid esters isolated from *Ocimum gratissimum* L. and *Vitellaria paradoxa* Gaertn leaves against *Tribolium castaneum* Hebst (Coleoptera: Tenebrionidae).

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### Abstract

Pest management using botanicals has been widely practiced in sub-Saharan Africa and other parts of the world in recent times. The natural compounds present in these botanicals are known to be responsible for the protection they offer against insect pests. Some of these compounds may act as single compounds to produce an effect or they may be synergistically effective. In the present study using a bioassay guided approach, two cinnamic acid derivatives, methyl cinnamate and sitosterol cinnamate, were isolated from the leaves of *Ocimum gratissimum* and *Vitellaria paradoxa*, respectively. The two cinnamic acid derivatives were found to show higher levels of insecticidal, larvicidal and larval growth inhibition activities against *Tribolium castaneum*. The LC50 of methyl cinnamate was determined to be 26.92mgmL<sup>-1</sup> (95% CL: 1.18.66 – 38.84 mg mL<sup>-1</sup> ; slope ± SE: 2.84 ± 0.81) for the adult 8.31 mg mL<sup>-1</sup> (95% CL: 2.39 – 28.83 mg mL<sup>-1</sup> ; slope ± SE: 0.66 ± 0.28) for the larvae while the LC50 of sitosterol cinnamate was determined to be 6.92 mg mL<sup>-1</sup> (95% CL: 3.97– 12.06mgmL<sup>-1</sup>;slope±SE:1.59±0.12) theadultand3.91mgmL<sup>-1</sup>(95%CL:2.21–6.93mgmL<sup>-1</sup>;slope±SE:1.52±0.13) for the larvae. Generally, the susceptibility of adult *T. castaneum* to these cinnamic acid esters can be directly associated with the concentration as well as time of exposure to the compounds. The isolated compounds support the use of *O. gratissimum* and *V. paradoxa* as important botanicals for the management of storage pests.

**Keywords:** Methyl cinnamate, -sitosterol, sitosterol cinnamate, larvicidal activity, *Tribolium castaneum*

# Planting for Food and Jobs (PFJ) Participation and Smallholder Farmers' Technical Efficiency: Evidence from Rice Farmers in Northern Ghana

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## Abstract

Against the backdrop of multiple production and marketing challenges that smallholder farmers face across the nation, the Government of Ghana in 2017 introduced the Planting for Food and Jobs (PFJ) programme to help address these issues. The programme provides farmers access to inputs at subsidized prices, extension services, and output markets. Using data from the 2021 rice season, 397 smallholder rice farmers in northern Ghana were surveyed to determine factors that influence farmers' participation in the PFJ programme, evaluate the impact of the programme on technical efficiency (TE) of smallholder rice farmers as well as identify and rank the constraints farmers face to participate in the programme. Using a Probit model, we find that education level, farm size, FBO membership of farmers, nativity/residence of extension agent were significantly positive determinants of PFJ participation. Due to self-selection into PFJ, we use a sample selection stochastic production frontier model to account for potential selection bias arising from observed and unobserved attributes. The empirical results reveal that PFJ beneficiaries had significantly higher mean TE scores than non-beneficiaries in both the conventional (64% versus 53%) and sample selection (68% versus 50%) models. Moreover, the results of Kendall's W show that the most pressing constraint faced by rice farmers was the lack of funds to purchase inputs from the programme. The second ranked was respondents' perception of nepotism/corruption in the programme. Finally, the least ranked constraint was farmers' unawareness of the implementation of the programme. The study recommends that government should allocate more funds to the programme to increase the number of beneficiary smallholder farmers. Furthermore, sub-programmes should be created to target common denominators like white collar workers to increase participation in the programme. Also, the Ministry of Food and Agriculture (MoFA) should engage financial institutions and insurers to provide credit to liquidity-constrained farmers.

**Keywords:** Planting for food and jobs (PFJ), selection bias, technical efficiency, smallholder rice farmers, Northern Ghana

## Formulation of plantain-based snack ('kaklo') from orange fleshed sweet potato and bambara groundnut flour blend

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### Abstract

'Kaklo' is a delicious traditional Ghanaian snack made from very ripe plantain. This study was designed to assess the formulation of plantain-based snack ('kaklo') fortified with orange fleshed sweet potato (SPF) and Bambara groundnut (BGF) flour blends. In this study, four flour blends were produced which included SPF90%:BGF10%, SPF85%:BGF15%, SPF80%:BGF20%, and SPF75%:BGF25%. The 100%BGF and 100%SPF flours were used as control (for comparison with the flour blends). Proximate composition and functional properties of the flours, sensory and quality characteristics of the 'kaklo' produced from the flour blends were evaluated. Results of the functional properties of the flours showed there were variations in the flour samples owing to differences in their composition. The results of the proximate composition showed moisture values ranged from  $4.56\pm 0.03\%$  to  $65.88\pm 0.29\%$ ,  $2.15\pm 0.02\%$  to  $21.42\pm 0.18\%$  for protein,  $0.21\pm 0.01\%$  to  $8.72\pm 0.29\%$  for fat,  $1.49\pm 0.36\%$  to  $3.85\pm 0.28\%$  for ash,  $26\pm 0.54\%$  to  $78.78\pm 0.13\%$  for carbohydrate, and  $3.18\pm 0.31\%$  to  $4.70\pm 0.91\%$  for fibre, respectively. Total carotenoids content had values from  $7.22\pm 0.00$  mg to  $9.86\pm 0.00$  mg and total sugar was from  $11.58\pm 0.00\%$  to  $16.74\pm 0.00\%$  for the flour blends evaluated. Overall sensory scores from consumer acceptance test of 'Kaklo' ranged from  $7.04 \pm 1.76$  to  $7.43\pm 1.33$  which translated to liked moderately. 'Kaklo' produced from 100% BGF was liked moderately (overall liking score of  $7.04\pm 1.76$ ) by consumers as well as 'Kaklo' produced from SPF75%:BGF25% (with an overall liking score of  $7.43\pm 1.33$ ). However, no significant difference ( $p>0.05$ ) was recorded between the overall liking score of 'Kaklo' produced from all the flour blends. This indicated that orange fleshed sweet potato and Bambara groundnut flour blends can be used for making acceptable and nutritious plantain based-snack ('Kaklo'). Also, it will promote the consumption of these underutilized crops, improve nutrition especially vitamin A deficiency and enhance food security.

**Keywords:** 'kaklo', bambara groundnut, Sweet potato, functional, sensory

## Physicochemical, functional and sensory characteristics of a breakfast cereal made from sprouted finger millet-maize composite flour

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### Abstract

The performance of sprouted finger millet in breakfast cereal production was studied regarding its physicochemical, functional and sensory characteristics. The aim of this study was to develop an instant breakfast cereal from Sprouted Finger Millet, Maize and Date Fruit composite flour and evaluate its physical, chemical, functional and sensory properties. A process for the production of flour from finger millet, maize and date fruit was developed, where finger millet flour was incorporated at 0%, 40%, 50%, 60%, 70% and 90% to investigate its physicochemical and functional characteristics. The Tristimulus colour ( $L^*$  value), physicochemical, functional and sensory characteristics of composite flour samples were analyzed. Moisture, ash contents of the composite flour samples increased significantly ( $p \leq 0.05$ ) while carbohydrate and protein contents significantly ( $p \leq 0.05$ ) decreased with increasing amount of Sprouted Finger Millet Flour (SFMF) incorporation. Functional properties also increased significantly ( $p \leq 0.05$ ) among the composite flour samples with the exception of bulk density which decreased significantly ( $p \leq 0.05$ ) with increasing amount of SFMF. Tristimulus  $L^*$  value of the composite flours significantly ( $p \leq 0.05$ ) decreased. Sensory analysis of the breakfast cereal samples showed that breakfast cereal with 40% and 50% SFMF had the highest overall acceptability, colour, and taste scores ( $p \leq 0.05$ ).

**Keywords:** Tristimulus colour, physicochemical, sensory, functional characteristics, bulk density

## Assessment of social factors that promote the susceptibility of communities to coastal hazards in the Volta estuary

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### Abstract

Social vulnerability studies are important to inform policy decisions on targeted social interventions to reduce disaster risk among vulnerable communities. Although vulnerability assessments have been widely conducted along the coast of Ghana, they are not focused on the social factors that contribute to the susceptibility of households and communities to disaster risks. This study therefore examines the social factors that affect the susceptibility of households and communities within five (5) kilometers east and west of the Volta estuary using location-specific indicator variables. The indicator-based approach which employed validated local community indicators was used. Equal weighting was used for exposure, sensitivity, and adaptive capacity indicators and standardized using the min-max formula. Results indicate that by their location, all This study therefore examines the social factors that affect the susceptibility of households and communities within five (5) kilometers east and west of the Volta estuary using location-specific indicator variables. The indicator-based approach which employed validated local community indicators was used. Equal weighting was used for exposure, sensitivity, and adaptive capacity indicators and standardized using the min-max formula. Results indicate that by their location, all communities within the study area were exposed climate change related-hazards, however, two communities, Azizanya in Ada East district and Fuveme in Anloga district were more highly exposed to the climate change-related hazards. The two communities had unweighted index of 0.50 and 0.76 respectively. Sensitivity among communities was generally high ranging from 0.00 to 0.87 due to several social factors including low household income, high number of children and aged at home, lack of certain social amenities including roads, health facilities, markets, schools etc. Having been living in the area for centuries, the communities recorded high adaptive capacity and were able to withstand the ravages of the ocean and the river system. Households and communities developed various adaptation measures such as relocation to nearby communities or higher grounds, open spaces and packing of their belongings on higher objects such as tables in addition to occasional dredging and sea defence structures from government. An integrated approach to disaster management is hereby proposed. The integrated approach involves government, community-based organisations, communities, households, and other stakeholders coming together to design a comprehensive approach to resolving coastal disasters.

**Keywords:** Estuarine; social, vulnerability, climate-change, disaster, risk.

## Importance, etiology and control of stylar end rot disease of guava in Ghana

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### Abstract

Cultivation of exotic guava fruits in Ghana is gaining importance in some parts of Ghana due to the high prices the fruits are fetching in urban areas of the country. Observations have shown that some of the fruits rot while in the tree, thereby threatening the profitability of this newly developing industry. Research was carried out to assess the extent of the spread of the disease, determine the cause of the disease and formulate a control measure against the disease. Survey was carried out in some selected districts of the Volta and Greater Accra Regions where orchards of the disease were present and the disease incidence and severity were determined. After that samples of the diseased fruits were collected and the possible causal agent isolated on media and characterized using its cultural and morphological features, complemented with sequence analysis of the internal transcribed spacer region, partial beta tubulin gene and the alpha elongation gene. Some copper based fungicides were evaluated for their efficacy against the pathogen and the disease incidence and severity in the field. The disease was prevalent in all the districts surveyed with disease incidence of 100% in all farms surveyed while severity ranged from 0.5 to 1.2. The fungus, *Lasiodiplodia theobromae* was isolated and confirmed as the causal agent of the disease when it was able to cause the disease. The pathogen was highly sensitive to all the four copper based fungicides evaluated. All of the copper based fungicides were able to reduce the disease incidence and severity in the field. The nature of the disease symptoms and the identity of the causal agent suggest the disease to be the same as the stylar end disease of guava reported in India. To the best of my knowledge this is the first report of guava stylar end rot disease of guava in Ghana.

**Keywords:** Guava, Copper based fungicides, *Lasiodiplodia theobromae*, internal transcribed spacer region, Beta tubulin, Alpha elongation gene.



# Engineering and environmental radiation performance of geomaterials in Southwestern Nigeria

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## Abstract

Performance of geomaterials which are sources of construction aggregates depends on their geotechnical characteristics and their availability constitute radiation exposure to the environment. This study evaluated geotechnical properties of some rocks coupled with the evolving radiological hazards from radiometric survey. This guarantees the performance of migmatite-gneiss, granite, charnockite and quartzite as building stones and ensure environmental safety. The aggregate impact value (AIV), aggregate crushing value (ACV) and Los Angeles abrasion value (LAAB) of migmatite-gneiss, granite and charnockite in the range 14.79% – 23.52%, 18.32% - 28.93% and 25.22% - 34.55% respectively indicate soundness and durability of the rocks for civil engineering constructions. Quality strength characteristics possess by the rocks confirm their suitability as construction aggregates except the quartzite which cannot withstand the load bearing capacity of multistory units as a result of its low strength.  $^{40}\text{K}$ ,  $^{238}\text{U}$  and  $^{232}\text{Th}$  weighted average elemental and activity concentrations of the rocks are  $2.85 \pm 1.08\%$ ,  $3.08 \pm 0.46$  ppm,  $22.38 \pm 8.15$  ppm and  $892.72 \pm 337.83$ ,  $38.06 \pm 5.67$ ,  $90.84 \pm 33.09$  Bq kg<sup>-1</sup> respectively.  $90.09$  nGy h<sup>-1</sup> estimated absorbed dose rate of the rocks falls within the specified value of  $120$  nGy h<sup>-1</sup> for geomaterials, although, its above  $60$  nGy h<sup>-1</sup> world mean value. Indoor effective dose rate, HE (indoor) of  $0.442$  mSv y<sup>-1</sup>, outdoor effective dose rate, HE (outdoor) of  $0.114$  mSv y<sup>-1</sup>, internal (H<sub>in</sub>) and external (H<sub>ex</sub>) radiation hazard indices of  $0.742$  and  $0.639$  mSv y<sup>-1</sup> are below world permissible limit. Results show the rocks are safe as construction materials as they pose no radiation threat to people and the environment. Increased annual gonadal dose equivalent (AGDE) ( $777.485$  μSv y<sup>-1</sup>) and excess lifetime cancer risk (ELCR) of  $1.545 \times 10^{-3}$  imply that regular environmental radiological checking of geomaterials should be adopted before usage in construction. This will avert radiological related diseases. This study provides vital geotechnical and environmental radiological information against contemporary health challenges.

**Keywords:** Geomaterials, geotechnical characteristics, radiometric survey, radiological hazard, construction aggregates

# Assessment of benthic macroinvertebrates and heavy metal content of sediments, fish and shellfish in the Pra Estuary, Ghana

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## Abstract

Gold-mining activities can potentially cause pollution of aquatic ecosystems through the release of hazardous chemical substances and cause adverse ecological, human health and socio-economic impacts. This study investigated benthic macroinvertebrates and heavy metal contents in surface sediments, fish, and shellfish from the gold-mining impacted Pra estuary and the ecological and human health implications. Twenty (20) grab sediments, five fish species (*Chrysichthys nigrodigitatus*, *Cynoglossus senegalensis*, *Ethmalosa fimbriata*, *Pseudotholithus senegalensis*, and *Pseudotolithus elongatus*), and one shellfish species (*Crassostrea tulipa*) were sampled from the Pra estuary in April 2019 and analysed for heavy metals (Cu, Zn, Ni, Hg and Fe). Grab sediments were also sampled for benthic macroinvertebrates analysis. Sediment Quality Guidelines (SQGs) namely the effects-range low (ERL) and the effects-range median (ERM) were used to assess the potential toxicological risk of the estuarine sediments. Total Target Hazard Quotients (TTHQ) were also derived to assess the potential human health implications fish and shellfish consumption. The results showed an absence of benthic macroinvertebrate in the sediments. The mean concentrations of Zn ( $114.5 \pm 56.7$  mg.kg<sup>-1</sup> dw) and Hg ( $113.1 \pm 32.5$  mg.kg<sup>-1</sup> dw) were lower than their ERLs and thus, pose no appreciable toxicological risk. The mean concentrations of Cu ( $89.3 \pm 39.6$  mgkg<sup>-1</sup> dw) and Ni ( $42.8 \pm 9.8$  mgkg<sup>-1</sup> dw) exceeded their ERLs but were less than their ERMs and thus, pose potentially moderate toxicological risk. This could partly account for the non-detection of benthic macroinvertebrates in the sediments. The sediments had higher concentrations of Cu, Zn, Ni and Fe than the biota, except for Hg in *C. tulipa*, which makes *C. tulipa* the best bioindicator of heavy metal contamination in the Pra estuary. The TTHQs of the analysed heavy metal were less than 1 for all the biota except *C. tulipa*, indicating that the consumption of *C. tulipa* will likely result in non-carcinogenic effects, whereas consumption of the analysed fish species is unlikely to cause non-carcinogenic effects due to Cu, Zn, Ni and Hg contamination.

**Keywords:** Benthic macroinvertebrates, heavy metals, sediments, fish, shellfish, Pra Estuary

## Sustainable development and climate change in Ghana - the nuclear power factor

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### Abstract

The phenomenon of climate change continues to have a negative impact on socio-economic development of Africa with Ghana not being an exception. The quotidian problems such as degrading of our ecosystem, effects on human health, food, and water insecurity etc., threaten our very existence and those of generations yet unborn. The global scientific consensus is that fossil fuel energy generation and its utilization is responsible for the increased atmospheric CO<sub>2</sub> concentrations; a major cause of positive radiative forcing of the earth resulting to the changing climate of the globe. Carbon dioxide alone contributes about 50% to global warming of which 87% are anthropogenic sources linked to coal, natural gas, and oil combustion. According to the national energy statistics, the amount of CO<sub>2</sub> emitted from fossil sources in Ghana as of 2016 stood at 14,468,986 tons with an annual average increment of 3.2%. At present (2021), CO<sub>2</sub> emission in Ghana is estimated to be about 23.6 million tons at 0.52 tons per capita. Again, the major contributor is fossil fuel production and consumption. Thus, the most effective and sustainable approach to deal with climate change and to ensure sustainable development lie mainly in the energy sector. In this regard, policies relating to production and utilization of energy are very crucial and should be informed on key issues such as emissions, sustainability, and environmental impact. Nuclear power offers that efficient and effective solution to work down on CO<sub>2</sub> emission and save the environment from a looming destruction. Nuclear power offers the choice to harness our resources to meet our current and later energy needs without burdening future generations with a broken environment and associated health, economic and environmental crises.

**Keywords:** Climate change, Carbon dioxide, energy, emissions, nuclear

## Climate resilience of water sources in coastal communities in the eastern coast of Ghana, 2021

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### Abstract

Access to safe water is a basic human right. However, over 2 billion people globally lack access. As climate change vulnerabilities increase, access to safe water remains a challenge. Coastal areas generally lack access to safe water due to poor water, hygiene, and sanitation. These areas also remain vulnerable to climate change consequences. Thus, building resilience of their water sources is essential to improve access to safe water. We conducted a preliminary study to assess resilience of water sources in selected coastal communities in Ghana. We conducted a cross-sectional study in Anyanui, Ateteti, Anyako, Mumford and Opetekwei in July 2021. We conducted key informant interviews among community leaders in charge of water structures eliciting responses on resilience nature, and climate variability they experience. Using a checklist, we assessed the features that made various water sources resilient to adverse weather conditions. Data were presented in text, and tables. The main water sources in the communities were stand pipe, harvested rain water tanks, storage tanks and wells. Standpipes (80%;4/5) and wells (80%;4/5) were the most common sources. All standpipes had a raised platform above 1.5m made of cement which protected them from flooding. Wells were mostly uncovered. Rainwater tanks and storage water tanks had no flush nor filter systems for easy cleaning or water change. Water was stored in tanks for up to 3 months. Some communities (60%;3/5) reported experiencing both perennial floods and drought. No community reported any water sources being affected by flooding. Most of the water sources in the coastal communities were improved water sources. Standpipes were the only water sources with resilient structures to withstand flooding. There is the need to improve the resilience of water sources through capacity building and community management.

**Keywords:** Water source, resilience, coastal community, climate change

## Green synthesized magnetite from tetrapleura tetraptera for fluoride mitigation in aqueous media

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### Abstract

The utilization of greener remediation methods is required due to the growing concerns of environmental protection and sustainability. In this regard, the use of biosynthesized iron nanoparticles offers a viable path. This thesis describes the synthesis of stabilized iron nanoparticles using fruit of Tetrapleura tetraptera as source of extract. Due to combination of different phytochemicals confirmed to be present in the extract through phytochemical screening, reduction and capping of iron nanoparticles was successfully achieved. The change in colour of the extract solution from light brown to dark black verified the capping of iron nanoparticles. XRD analysis confirmed peaks of iron oxide nanoparticles and particle size of 30 nm as calculated from Scherrer's equation. FTIR of both extract and iron nanomaterial confirmed functional groups associated with the phytochemicals in the extract. UV-Vis spectrum peak of 300 nm was observed which was within the range for iron nanoparticles. Fluoride was successfully removed at high efficiency of 94% by the iron nanoparticles. Fluoride removal occurred by chemisorption on multiple active sites as confirmed by the kinetic and isotherm modelling. The results show the successful synthesis of magnetite from Tetrapleura tetraptera extract and its important effect in fluoride removal from aqueous media. This work therefore provides a sustainable design strategy for fluoride removal in water filtration systems.

**Keywords:** Green synthesis, magnetite, iron oxide, fluoride reduction, tetrapleura tetraptera

## Antioxidant activity and phenolic content of selected vegetables dehydrated with different drying methods

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### Abstract

Drying is a useful technique, employed to offer a low-cost product, with an extended shelf-life. However, different drying procedures may yield products of different nutraceutical and antioxidant contents. In this study, selected vegetables, namely, carrots, turkey berries, amaranth leaves, and eggplant leaves, were blanched at different times and dehydrated by freeze-drying (FD), oven-drying (OD), and solar drying (SD). The aqueous and ethanolic extracts of the samples were evaluated for their antioxidant potentials based on their polyphenolic and flavonoid contents as well as 2, 2-Diphenyl-1-picrylhydrazyl hydrate (DPPH) free radical scavenging activities. The amount of total phenolic compounds extracted was determined using the Folin-Ciocalteu reagent. Total flavonoid content was determined using the aluminum chloride colorimetric assay method and results were expressed as microgram quercetin equivalent per gram on a dry basis ( $\mu\text{g QE/gdb}$ ). The antioxidant activities were evaluated using the DPPH scavenging activity. Results show higher concentrations of total flavonoids, total phenolics, and scavenging activity in ethanolic extracts than in aqueous extracts. Freeze-dried samples showed higher concentrations of total phenols and antioxidant activity in the extracts compared to oven and solar-dried samples. Amaranth leaves were the richest in flavonoids ( $547.10\mu\text{g QE/gdb}$ ) while turkey berries showed the highest antioxidant activity against DPPH (79.29%). Significant differences ( $p < 0.05$ ) existed between antioxidant activities, and total phenolic and flavonoid contents of the samples analyzed. Dehydrated vegetables are potentially rich sources of dietary polyphenolic compounds and antioxidants and can contribute important health benefits to consumers.

**Keywords:** Drying, Antioxidant activity, Phenolic content, Vegetables

## Particle size distribution and emulsion ability of cocoa shells processed with different methods

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### Abstract

Cocoa bean shells are a major by-product of the cocoa processing industry which have high potential for inclusion in the human diet. A key challenge associated with the conversion of cocoa shells into a food ingredient is a difficulty in milling which often results in relatively large particle sizes of cocoa shell powders. The objective of this study was to assess the effect of different processing methods on particle size reduction and the ability of these particles to formulate emulsions. Cocoa bean shells were subjected to different processing regimes: roasting at 125, 135 and 145 °C for 20 and 30 minutes, steaming for 15 minutes (and subsequent drying) and oven drying at 70°C for 7 hours, and compared to the unprocessed cocoa shell sample. Particle size distribution was determined by milling and sieving and emulsion ability by measuring the volume of emulsion formed after homogenizing milled cocoa shell in equal parts of oil and water. Steamed and roasted cocoa shells had higher percentages of particles larger than 500 µm and lower percentages of desired fines below 200 µm (2.08 to 18.76%) in comparison to unprocessed (20.11%) and oven dried cocoa shells (22.80%). Emulsion ability of unprocessed cocoa shells (23.33%) was most enhanced by steam treatment (32%). Roasting, steaming and oven drying are not effective treatments for improving particle size reduction, but steaming could improve emulsion ability of cocoa bean shells.

**Keywords:** Cocoa shell, particle size, emulsion ability, roasting, drying

## Non-canonical amino homoarginine as a potential substituent to improve antimicrobial peptide trypsinolytic stability

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### Abstract

The prevalence of antibiotic resistance (AMR) has rendered many of the antibiotics ineffective against clinically significant pathogens and therefore, exploration of novel antimicrobial agents has become necessary. One of such novel agents is antimicrobial peptides (AMPs). AMPs are widely distributed in nature as part of the immune system and can be effective against bacteria, viruses, and fungi. They are an attractive alternative to conventional antibiotics because pathogens are less likely to develop resistance to AMPs. However, they are liable to protease degradation, and this has hampered their use as replacements for antibiotics in clinical settings. There is evidence that substitution of amino acids for their non-canonical (NC) analogues improves proteolytic stability. In the case of AMPs, increased activity and selectivity against pathogens has also been observed. Homo arginine is an analogue of arginine with an extra methylene group. In this study, we establish that a 10-unit polymer of Homoarginine (PLHR10) has similar activity before and after trypsin treatment compared with Mel4 (KNKRKRRRRRRRGRRRR), an AMP with arginine repeats. Minimum Inhibition assays were done using PLHR10 and Mel4 against *S. aureus* ATCC 6538 and *P. aeruginosa* ATCC 19660. From this study, it can be postulated that stability against trypsin can be conferred on Mel4 by substituting arginine with homoarginine with no loss of activity.

**Keywords:** Antimicrobial resistance(AMR), antimicrobial peptides(AMP), non-canonical amino acid analogues



## Preparation of Ag@metal oxide (Zno/Cuo) core-shell nanoparticles as non-cytotoxic inorganic bactericides

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### Abstract

Organic bactericides are becoming ineffective because they easily decompose, and the bacteria also develop resistance to them. This has driven research into the possible use of inorganic nanoparticles (NPs) as alternative bactericides because the antibacterial mechanism of action of these NPs do not allow for the development of resistance by the bacteria. Silver (Ag) particles have long been known to have very good antibacterial activity. However, research has recently shown that Ag NPs have cytotoxic effects, and hence, can be harmful to the humans. Therefore, this work aims to cover the Ag NPs with a thin layer (1-2 nm) of cyto-friendly metal oxides (ZnO and CuO), in a core-shell morphology, that will eliminate or reduce the cytotoxicity of the Ag NPs but at the same time allow the core Ag NPs to perform their antibacterial activity. The NPs were prepared using a micro-emulsion/sol-gel techniques and a low-temperature hotwater-treatment crystallization method. Five samples were prepared: Ag@ZnO, Ag@CuO and bare Ag, bare ZnO and bare CuO as controls. Preliminary results from UV-Vis spectrometry and Tauc plot band gap calculations suggest the formation of these NPs; the core-shell NPs showed red-shifted plasmonic resonance peaks from that of the bare Ag NPs (420 nm). The bare metal oxides showed estimated band gaps around 3 eV, while the Ag NPs showed panchromatic light absorbance across the UV-Vis-IR regions, i.e., ~ 0 eV. Non-toxic inorganic bactericides will be affordable and environmentally friendly with various applications in fields such as medicine and various water treatment systems.

**Keywords:** Inorganic bactericides; core-shell nanoparticles, non-cytotoxic, Ag, CuO, ZnO

## The effect of multi-sized Pt<sub>3</sub>Ni@TiO<sub>2</sub> electrocatalyst core-shell nanoparticle for stable proton exchange membrane fuel cell

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### Abstract

The proton exchange membrane fuel cell (PEMFC) is an electrochemical device that converts chemical energy inherent in carbonless fuel such as hydrogen gas (H<sub>2</sub> gas) into electrical energy with zero emission of carbon Dioxide. PEMFCs emerged as a result of the quest for cleaner and greener source of energy to replace the fast-depleting non-renewable energy sources from fossil fuels which are sources of various kinds of environmental pollutions which also affects climate change and its related problems on life as a whole. The effective material for the electro-catalyst portion of the PEMFC must possess characteristics such as good activity, good selectivity, stability, and effective poison resistance for which platinum is the most suitable. However, platinum is very scarce and hence expensive. The replacement of one portion of platinum with nickel has proven to increase performance by ninety folds but unfortunately easily fouls out and de-alloys during the operation of the PEMFC. This project therefore investigated the effect of multi-sized Pt<sub>3</sub>Ni@TiO<sub>2</sub> electro-catalyst core shell nanoparticles on the stable performance of the PEMFC. The multi-sized Pt<sub>3</sub>Ni@TiO<sub>2</sub> was synthesized using Hydrogen hexachloroplatinate (IV) and Nickel sulfate hexahydrate as precursor materials for the Pt<sub>3</sub>Ni and Titanium (IV) isopropoxide as the precursor material for the TiO<sub>2</sub> in Dimethylformamide as solvent using the refluxing method. A black precipitate of Pt<sub>3</sub>Ni@TiO<sub>2</sub> forms which does not settle readily as the pristine TiO<sub>2</sub> and Pt<sub>3</sub>Ni does. Also, there is no two- phased color observation of Pt<sub>3</sub>Ni@TiO<sub>2</sub> implying the presence of a core-shell morphology in Pt<sub>3</sub>Ni@TiO<sub>2</sub>.

**Keywords:** Environment, Energy, PEMFC, Nanoparticles, Refluxing

# Cactin, MID2, and prognosis of breast cancer in African Women

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## Abstract

Black patients are diagnosed with breast cancer at younger ages than White patients are. There is evidence indicating that among younger patients with breast cancer, Black patients tend to have poorer prognoses. As these differences remain only partially resolved, these studies aim to elucidate those unique underlying molecular biological features. Using expression (RNAseq) data of cancer-relevant genes from the Cancer Genome Atlas, a Transcriptional Regulatory Network (TRN) was learned via inference algorithm. Genes expressed differentially between stage II breast cancer patients 50 years old or younger and Black (BAA50) and their White counterparts (W50) were identified. Master Regulators driving those difference in gene expression were identified. Among the Master Regulators are CACTIN, which is involved in regulating the innate immune response, and MID2 also known as TRIM1, which is involved in microtubule stabilization. CACTIN has higher expression in BAA50 while MID2 has lower expression. Patients with low MID2 expression had poorer prognosis than those with higher expression. On the other hand, all patients with high CACTIN expression had poorer prognosis than those with lower expression. Moreover, there are distinct far-reaching differences in gene expression between patients with low CACTIN expression, and those with high CACTIN expression. Similarly, distinct patterns of gene expression exist between patients with low MID2 expression, and those with high MID2 expression. A TRN revealed a Feed-Forward Motif between CACTIN, TAF6L and ZNF628, all of which have higher expression in patient samples expressing higher levels of CACTIN. CACTIN is also targeted by TCF3, which is also up-regulated in patients with high CACTIN expression. MID2, on the other hand, is target by EBF2, and ZFX, which is up-regulated in patients with high MID2 expression. These underscore key roles for CACTIN and MID2 in the underlying events associated with poorer survival in younger African breast cancer patients.

**Keywords:** Breast, cancer, gene, patients, CACTIN, MID2

## Computational modelling and inhibition of echis ocellatus venom acidic phospholipase A2 by ethnopharmacologically derived compounds: structure-activity relationship

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### Abstract

Snake (*Echis ocellatus*) envenomation is a category A neglected tropical disease caused by specific proteins in their venom. *Echis ocellatus* envenoming kills more than 20,000 people in Sub-Saharan Africa every year. Current anti-venoms utilized in treatment are ineffective, expensive and trigger adverse reactions in victims, hence becoming therapeutic challenge. Plant based natural compounds have emerged as promising alternatives in the pursuit of effective anti-envenomation drugs. In *Echis ocellatus* venom, the diverse effects of acidic phospholipase A2 present an opportunity in inhibition and eventual drug discovery. The focus of this project was to predict potential inhibitors of PLA2 from phytochemicals notable for treating snakebites traditionally. A total of 380 compounds were retrieved and filtered using physicochemical profiling. These were docked against homology modelled structure of PLA2. Novel structural insights into the binding mechanisms were elucidated using LigPlot+ and molecular dynamics simulations. Seven compounds were identified as potential bioactive molecules with relatively good binding energies below -7.6 kcal/mol and are worthy of further development as biotherapeutic agents for snake envenomation.

**Keywords:** Snake envenomation, Anti-venom, Phospholipase A2, Bioactive molecules, Homology modelling, Inhibition, Binding energies.

# Mineral concentrations and heavy metal contamination of mangrove oysters (*crassostrea gasar*) from selected estuarine sites in Ghana

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## Abstract

Oysters offer a rich source of dietary nutrients for women shellfishers in Ghana, but data on the mineral concentrations and heavy metal contamination of oysters across estuarine sites are scanty. This study aimed to compare the mineral concentrations and heavy metal contamination of oysters across three estuary sites in Ghana. A total of 915 oysters from the Densu, Narkwa, and Whin estuaries were analyzed using an atomic absorption spectrophotometer and microwave plasma atomic emission spectroscopy. The mineral and heavy metal concentrations (mg/kg wet weight) were summarized as mean±SD and compared with ANOVA. In total, the mineral concentrations were iron: 125±111, zinc: 82±71, cobalt: 27±27, chromium: 22±30, copper: 9.0±6.0, manganese: 7.0±9.0, selenium: 5.4±6.0, calcium: 2698±3216, potassium: 4282±4567, phosphorus: 3470±5416, and magnesium: 937±559. Narkwa oysters had greater concentrations of five microminerals (Fe, Cr, Ni, Se, and Zn) than the Whin and Densu oysters ( $p < 0.001$ ). Mg and K concentrations were higher in Densu oysters than in Narkwa and Whin oysters,  $p < 0.001$ , and P and Na concentrations were higher in Narkwa oysters than in Densu oysters,  $p < 0.001$ . The heavy metal concentrations in all samples were arsenic: 102±132, cadmium: 9.0±9.6, lead: 15±15, and mercury: 38±83. The Narkwa oysters had greater concentrations of heavy metals (As, Cd, Pb, and Hg) than the Whin and Densu oysters,  $p < 0.001$ . While Densu oysters had higher concentrations of Hg and Pb than Whin oysters ( $p < 0.001$ ), the concentrations of Cd and As were greater in Whin oysters than Densu oysters ( $p < 0.001$ ). Oysters are rich in several minerals, but the high concentrations of heavy metal contamination, notably mercury and arsenic, could outweigh their nutritional benefits for women shellfishers in Ghana. Efforts should target reducing contamination in the estuaries for wholesome oyster production and intake.

**Keywords:** Heavy metals, mineral, oysters, concentration, and estuarine sites

## Long memory cointegration in the analysis of maximum, minimum and range temperatures in Africa: implications for climate change

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### Abstract

This paper deals with the analysis of the temperatures in a group of 36 African countries. By looking at the maximum, minimum and the range (the difference between the maximum and the minimum) and using a long memory model based on fractional integration and cointegration, we first show that all series display a long memory pattern, with a significant positive time trend in 29 countries for the maximum temperatures and in 33 for the minimum ones. Looking at the range, the estimated value for the order of integration is smaller than the one based on maximum or minimum temperatures in 17 countries. Performing fractional cointegration tests between the maximum and minimum temperatures our results indicate that the two series cointegrate in the classical sense (i.e., with a short memory equilibrium relationship) in a group of 11 countries, and there is another group of eight countries displaying cointegration in a fractional sense.

**Keywords:** Africa, Maximum temperatures, Minimum temperature, Fractional integration, Fractional cointegration

# Influence of climate change adaptation strategies on maize productivity in two agro- ecological zones in Ghana

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## Abstract

This study sought to investigate how the adaptation strategies employed by Ghanaian maize farmers in response to climate change affect their productivity. Data were collected from 386 maize farmers through face-to-face structured interviews from 11 communities across the transition and deciduous forest agro-ecological zones of Ghana. The study employed the Independent two-sample t Test to test for significant differences of maize productivity across the two agro-ecological zones and used the Cobb-Douglas production function to assess the determinants of maize productivity. The results of the study suggest that maize farmers implemented both indigenous adaptation strategies and other adaptation strategies introduced by research institutions and agricultural extension service providers. In addition, maize farmers in the transition zone had higher yields compared to those in the deciduous forest zone. Moreover, the use of fertilizers, other agrochemicals, the agro-ecological zone of farmers, and application of introduced adaptation strategies were found to significantly influence the maize productivity of respondents. The use of other agrochemicals and the application of introduced adaptation strategies positively influenced maize productivity while fertilizer use had a negative influence on maize productivity. The study recommends the need to provide maize farmers with location-specific information on the combination of adaptation strategies, the right quantity and type of fertilizers, and other agrochemicals to help achieve optimum productivity. Furthermore, policymakers should plan agricultural policies in terms of adaptation to climate change, with focus on relevant strategies to increase farmers' productivity.

**Keywords:** Climate change adaptation, adaptation strategies, agricultural productivity, Agro-ecological zones, Smallholder Farmers

## Facies, depositional environment and provenance studies of the yabraso and bimbila formations of the voltaian basin

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### Abstract

Detailed analysis on the facies, depositional environments, and provenance studies of the Yabraso and Bimbila Formations of the Kwahu Group and Oti Group, is presented in this paper. The Yabraso Formation, in the study area is characterized by three main facies including Graded bedding coarsening upwards, graded bedding fining upwards and cross-bedded, ripple marked sandstone facies. The graded bedding coarsening upwards affirms an alluvial environment influence while the sub-roundness in the sandstones suggests fluvial environment which dried up quickly and carried sediments for a short time. The cross-bedded, ripple-marked sandstone facies on a prodelta environment and the graded bedding fining upwards were deposited in a lacustrine environment. The Yabraso sandstone sediments experienced high chemical weathering within a humid climate and sourced from probably the Birimian Supergroup, especially since the quartz pebbles and cobbles of the Breccia within it are very similar to the Birimian quartz veins, deposited on a passive margin and from a felsic rock provenance. The Bimbila Formation which is found directly on top of the Yabraso Sandstone Formation, is divided into three (3) main facies including the lower siliciclastic sediments, the carbonate lithofacies and the upper siliciclastic sediment lithofacies. The upper siliciclastic sediments lithofacies are deposited on a shoreline environment in a humid climate. The carbonate lithofacies of the Bimbila Formation indicate a warmer environment probably deposited in a lacustrine environment. The upper siliciclastic sediment facies are silt and mud sized, indicating a deeper water depth. The Bimbila Formation is probably of a lacustrine environment, where sediments were deposited in a humid environment, on a passive margin and from felsic rocks.

**Keywords:** Yabraso formation, Bimbila formation, Voltaian basin, Facies studies, Depositional environment



# Activity budget, diet, and habitat use of the Gambian sun squirrel in urban landscape

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## Abstract

Urbanization alters the ecological landscape and modifies natural habitats, posing novel and serious challenge to many wildlife species. Although many studies have investigated the coping strategies of vertebrates, such as birds and large mammals in urban landscape, there remains scant information on medium-sized arboreal mammals. Here, I studied the activity budget, habitat use and diet composition of the Gambian sun squirrel (*Heliosciurus gambianus*) in the University of Ghana main campus. Data was collected in the wet and dry seasons using focal sampling. Activities was grouped into seven categories. The habitat use, foraging behaviour and diet composition of the squirrels were recorded. The diet/habitat preferences were analyzed using the Ivlev's electivity index. The time spent on each activity was computed and the niche breadth was estimated using Shannon's index, and Simpson's index. I also estimated the dietary niche overlap between months and between the wet and dry seasons using the Bray Curtis similarity. The Gambian sun squirrels generally exhibited a bimodal activity pattern and they spent much of their time on feeding (43.8%), foraging (23.1%), and observing (12.5%). Squirrel activity was highest during the dry season, but dietary niche breadth was highest in the wet season. Squirrels were strictly herbivorous, and they exhibited variation in diet on monthly basis. They were highly selective in the tree species. Squirrels were normally encounters on secondary branches; they rarely used the ground. Some used the attics as nests while others used tree holes. I found that sticking strictly to herbivorous diet is one of the behavioural adaptation and coping strategy of the squirrels on the University of Ghana main campus. My findings provide a better insight into the behavioural adaptation and coping strategy of the squirrels in urban areas and can be used to inform the conservation of wildlife in urban landscape.

**Keywords:** Squirrels, Activity budget, Foraging behaviour, Environmental sustainability.

## Exhumed residual mantle peridotite in an ancient oceanic basin at the southeastern margin of the West African Craton, Ghana

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### Abstract

The occurrence of exhumed mantle peridotite, gabbro, tectono-sedimentary breccias, volcanic rocks, marine and continental sedimentary units, in the Buem structural unit (BUS) of the Pan-African Dahomeyide belt share similarities with typical ophiolite sequence. The BSU ophiolite complex, however, is incomplete (with the absence of sheeted dyke complex) compared to the classical Penrose ophiolite sequence such as Oman and Troodos ophiolite and its lithological components are in both primary and tectonic contacts. Nonetheless, the BSU is characterized by features that are consistent with ocean-continent transition ophiolites similar to those of Iberia-Newfoundland and Alpine-Apennine. In the BSU, the serpentinised peridotite dominates in terms of volumes and it is either overlain by oceanic sediments, mafic volcanic or plutonic rocks, which are subordinate. The geochemical and isotopic characteristics of the mafic volcanic and plutonic rocks associated with the BSU serpentinised peridotites are most similar to those of magmas formed by melting of the depleted mantle. These MORB-type rocks have been interpreted as an embryonic oceanic crust formed during the transition from rifting to seafloor spreading during the opening of the Pharusian Ocean. Geochemical and geochronological data for the clastic sedimentary rocks of the BSU associated with the mafic-ultramafic rocks suggest passive margin deposits, deposited during the opening of the Pharusian Ocean. Comparing the results from this study to data from the Novo Oriente Group indicate an evolution of the West Gondwana Orogen from initial mantle exhumation followed by syn-rift magmatism (Novo Oriente Group) and early stages of seafloor spreading (BSU mafic-ultramafic rocks) as has been proposed for the Alpine ophiolites. Thus, ophiolites in the West Gondwana Orogen are of two main domains; proximal OCT of the Novo Oriente Group and distal embryonic oceanic crust of the BSU, formed during the break-up of the supercontinent Rodinia.

**Keywords:** Ophiolite, mantle, peridotite, exhumation, sea floor spreading.

## Preparation of uniform size and shape Pt<sub>3</sub>Ni@TiO<sub>2</sub> core-shell electrocatalyst NPs for stable PEM-Fuel cell for sustainable renewable energy

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### Abstract

A strong alternative sustainable source of energy is PEM-FCs, which are being developed mainly for automobiles, stationary fuel cell generators, and portable fuel cell applications. Pt nanoparticles (NPs) are the best material for the electrocatalyst component in these FCs. However, it has challenges with stability/durability and high cost, among others. One approach to overcoming these challenges is to replace part of the Pt with other metals in the form of alloys, which also enhance their performance. Pt<sub>3</sub>Ni(111), whose surface is 10-fold more active for the oxygen reduction reaction than the corresponding pristine Pt(111), is such an alloy. However, it de-alloys under FC operation. In this work we attempted to shell the Pt<sub>3</sub>Ni in a thin (~ 1-2 nm) TiO<sub>2</sub> metal oxide layer in a Pt<sub>3</sub>Ni@TiO<sub>2</sub> core-shell (C-S) morphology to stop the de-alloying as metal oxides have excellent chemical and electrical stability. Pt<sub>3</sub>Ni@TiO<sub>2</sub> C-S NPs were synthesized using facile techniques of microemulsion/sol-gel and hot-water treatment crystallization to obtain uniformly sized and shaped Pt<sub>3</sub>Ni@TiO<sub>2</sub> NPs. As controls, pristine Pt<sub>3</sub>Ni and TiO<sub>2</sub> NPs were also prepared. The XRD-Scherrer equation results showed Pt<sub>3</sub>Ni@TiO<sub>2</sub> NPs of about 4 nm with no TiO<sub>2</sub> peaks, but the SEM-EDX results showed the presence of TiO<sub>2</sub>, suggesting a very thin TiO<sub>2</sub> shell below the detection limit of powder XRD and the desired optimal electrocatalyst NP size of 1.5 nm being achieved. In addition, no secondary phase colors were observed in the Pt<sub>3</sub>Ni@TiO<sub>2</sub> suspension. These preliminary results suggest a successful preparation of Pt<sub>3</sub>Ni@TiO<sub>2</sub> C-S NPs. These findings demonstrate a high potential for making a significant contribution by developing affordable and stable PEM-FCs for home generators, electric vehicles, and electronic devices.

**Keywords:** Pt<sub>3</sub>Ni@TiO<sub>2</sub> nanoparticles, Core-shell, Electrocatalyst, PEM-FCs, Fuel cell stability, Metal oxide, Titania

# Nutrition education improves knowledge and consumer behavior towards the usage of green leafy vegetables and legumes in households in the Greater Accra Metropolis

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## Abstract

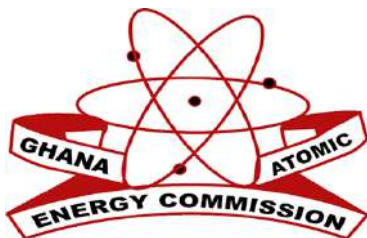
Green leafy vegetables and legumes are potential sources of iron and other micronutrients and hence has the potential to alleviate iron and iron deficiency anaemia, and hidden hunger. Iron deficiency anaemia (IDA) is a major global public health issue which has consequences for maternal and child nutrition and health outcomes. In Ghana, 51% of pregnant women in Accra were anaemic in 2018 while 40% had iron deficiency (Ghana Micronutrient Survey, 2017). However, a significant barrier to low consumption and usage of iron-rich foods is lack of information regarding their nutrient content and health importance. To quantify the effect of nutrition education on knowledge and consumer behavior towards the usage of green leafy vegetables and legumes among households in the Greater Accra metropolis. This was a longitudinal investigation that used quasi experimental design (pretest-posttest control group) for six months nutrition education among 120 households. The study setting was the Greater Accra Metropolitan Area. Knowledge, Attitude, and Practice (KAP) data were collected and analysed quantitatively using repeated ANOVA and Chi-Square test. Our findings showed no significance difference between the intervention and the control group at baseline for KAP ( $p= 0.92, 0.07, 0.23$ ). However, KAP substantially improved among the intervention group compared with the control group at endline ( $p= 0.00, 0.03, 0.03$ ). Similarly, good knowledge increased from 55% (baseline) to 100% (endline) among the intervention group while a decrease in good knowledge was observed in the control group (56% to 20%) from baseline to endline. Good attitude and practice showed similar trends. Nutrition education improved KAP among households as well has increased consumption of green leafy vegetables and legumes. These findings have implications for SDGs 2 and 3 health promotion for Ghana.

**Keywords:** Nutrition education, Green leafy vegetables, legumes, knowledge, attitude, practice



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# ABSTRACTS POSTER PRESENTATIONS



# Physical activity, screen time, and barriers to exercise among adolescents in the La Nkwatanag Public Junior High Schools, Accra

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## Abstract

Physical activity (PA) in adolescence mediates physical and mental health, cognitive development and protects against NCDs in adulthood. Globally, including Ghana, most of the adolescents are physically inactive with more screen time. Physical education in schools which could help improve the situation is reported to contribute about 40% to PA among adolescents. The study investigated the prevalence of PA and screen time and explored barriers to exercise at school. This study was cross-sectional and conducted at the La Nkwantanang Municipality. Participants were 333 adolescents (10 to 19 years) randomly selected from 7 Junior High Schools. Seven focus group discussions were held, and PA was assessed following WHO recommendation. Continuous data were analysed as means  $\pm$  SD and categorical data as frequencies and percentages. Binary logistic regression was performed to identify factors associated with recommended PA. Majority of the participants were girls (61.9%) and early adolescents (60.1%). About 57% did not meet WHO recommendation on PA and 75.7% had normal screen time. Barriers to exercise at the schools were the attire for exercise, lack of facilities to clean up after exercising, lack of time and interest in exercise, and poor knowledge of the benefits of exercise. The odds of recommended PA was 2 times higher among participants with high nutrition knowledge, attitude and practice (NKAP) score compared to those with low score [AOR 2.24; 95%CI (1.09 - 4.60),  $p = 0.001$ ]. The participants with no television at home were 5 times more likely to meet the recommended PA compared to those with television at home [AOR 5.06; 95%CI (1.94 - 13.21),  $p = 0.028$ ]. Generally, low prevalence of PA was observed. High NKAP scores and not having television at home were associated with recommended PA. Interventions to improve PA among adolescents should address the barriers to exercise at schools.

**Keywords:** Physical activity, Screen time, Barriers, Exercise, Adolescent

## The association between maternal socio-economic status, time available for care and the nutritional status of children from 0 to 2 years

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### Abstract

The first 1000 days of life is a crucial window where inadequate nutrition and childcare time may cause irreparable conditions that adversely impact the growth and development of the child. There is limited research on time available for childcare by mothers and the nutritional status of children aged 0-2 years. To assess the relationship between maternal socioeconomic status, childcare time and the nutritional status of children aged 0-2 years. A cross-sectional study using a semi-structured questionnaire was used to gather data from a 100 mother-child pairs presenting at the Child Welfare Clinic (CWC) of the University of Ghana Hospital. Data analysis was performed using SPSS version 26 and WHO anthro software, and malnutrition indices were characterized based on z-scores obtained. Logistic regression was used to predict how maternal socioeconomic status and childcare time influenced the nutritional status of children. The mean age of mothers and children were  $33.14 \pm 5.75$  years and  $10.60 \pm 6.64$  months old respectively. 81% of mothers worked 4-6 days a week. With a mean minimum dietary diversity (MDD) score of  $6.26 \pm 2.08$ , most children met their required dietary diversity. Prevalence of wasting, underweight and stunting among the children were 6%, 5% and 7%, respectively. There was a significant difference in working hours of mothers whose children were wasted [md (mean difference)-1.231, p-0.048] but not underweight (md-0.628, p-0.248) and stunting (md-1.155, p-0.188) versus mothers whose children were of normal nutritional status. No significant relationship existed between maternal employment and the nutritional status of children ( $p > 0.05$ ). Stunting was high in the 19-24 months age group, underweight existed in the 7-12 months age group, and wasting was more prevalent in the 0-6 months age group. Increase in working hours of mothers was related to wasting, but not underweight and stunting among our study participants.

**Keywords:** Children, care, socioeconomic, prevalence, underweight

## Robots in higher educational learning: Prospects and concerns

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### Abstract

The rapid advancement of computing technologies has facilitated the implementation of Artificial Intelligence in Education (AIED) applications. One of such applications is the ChatGPT- a large language model trained by OpenAI. It is equipped with the abilities of task assistance such as answering general and mathematical questions, generating texts, and assisting with research and writing. Since its introduction in November 2022, it has proven to be very innovative, disruptive and also holds a very promising prospect in the acquisition of knowledge. AI applications in higher education and learning provides a rich area for interdisciplinary research. In this conceptual paper, we discuss the role of robots such as ChatGPT in research, the academic learning process and the ethical concerns in the use of such emerging technologies in the classroom. We assertively conclude that AI applications such as ChatGPT is going to completely transform the way in which students actively acquire and process knowledge.

**Keywords:** ChatGPT, OpenAI, Higher Education, Ethics, Learning

## Antibiotic resistance profile and efficacy of sanitizer treatments on e. Coli o157:h7 isolated from leafy green vegetables

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### Abstract

Foodborne outbreaks have been linked to pathogens in the food supply chain, notably E. coli O157:H7 associated with vegetables. Public health concerns exist over the rise of multi-drug resistant bacteria in food. This study assessed the E. coli O157:H7 (n=20) isolated from green leafy vegetables (n=328) in a prior study in Accra for their antibiotic resistance profile, biofilm-forming ability, and the efficacy of sanitizers on spiked vegetables. The disk diffusion assay was used to assess antibiotic resistance profile of E.



coli O157:H7 against 11 generally prescribed human antibiotics, crystal violet assay for biofilm-forming ability, and challenge test used for efficacy of some sanitizing treatments against E. coli O157:H7 counts on lettuce and cabbage leaves. Seventeen out of the twenty isolates used were resistant to one or more of the antibiotics used, and 50% of the isolates (10/20) were multidrug resistant (MDR). The E. coli O157:H7 isolates were mostly resistant to ampicillin (15/20), sulfisoxazole (12/20), and streptomycin (12/20). Some isolates were positive for *bla<sub>shv</sub>* (10/20) and *bla<sub>TEM</sub>* (15/20) genes associated with beta lactamase resistance (such as ampicillin) and, *strA* (8/20) and *strB* (14/20) associated with streptomycin resistance. The MIC range for the E. coli O157:H7 isolates against ampicillin, trimethoprim and tetracycline was 16-256µg/ml, and streptomycin and cefoxitin was 32- 128µg/ml. The E. coli O157:H7 isolates formed strong (10/20) and moderate (4/20) biofilms. Treatments with chlorine, lemon juice, peracetic acid, and vinegar significantly ( $p \leq 0.05$ ) reduced microbial counts on lettuce and cabbage by 0.95 to 1.93 log CFU/g. Rinsing vegetables with salt water and tap water did not significantly reduce E. coli O157:H7 counts. The study suggests that sanitizing treatment with lemon juice (30%), chlorine (200ppm), peracetic acid (80ppm), and vinegar (30%) can reduce counts of antibiotic resistant E. coli on green leafy vegetables.

**Keywords:** E. coli O157:H7, vegetables, antibiotic resistance, biofilm, sanitizers

## Effect of essential oil (clove and thyme) coating on the quality and shelf life of eggs

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### Abstract

The effect of essential oils (clove and thyme) coating on the quality of fresh eggs was evaluated during storage at 25±2°C and 4°C for 5 weeks. The egg quality was evaluated using Haugh unit (HU), albumen pH, yolk index (YI) and shell thickness as indicators. The assessment was made for unsanitized eggs (control), clove-sanitized eggs (SC), thyme sanitized eggs (ST) and eggs sanitized with mixture of oils (1:1; thyme:clove) (STC). Furthermore, microorganisms prevalent on the eggs were identified and their susceptibility to the essential oils were determined as minimum inhibitory concentration (MIC) of oils. Data were subjected to variance analysis, and statistical significance was observed at  $p < 0.05$ . It was found that pH, HU and YI of clove sanitized (SC) did not differ ( $p > 0.05$ ) from the control irrespective of storage temperature. Shell thickness was not affected by the treatment during storage at 25±2°C and 4°C for 5 weeks. The thyme

oil and mixed oil (thyme and clove) preserved the internal quality of the eggs for up to 3 weeks longer than unsanitized eggs at 25±2°C and 4°C for 5 weeks and 2 weeks longer at 40C with reference to HU, YI, and pH. Microbial analysis showed that clove oil was most effective against E. coli (generic and O15:H7) and Salmonella enteritidis at 1% minimum inhibitory concentration while thyme oil was most effective against Citrobacter freundii at 5% minimum inhibitory concentration. Also, Citrobacter freundii was most prevalent on the eggs than E. coli and Salmonella enteritidis. In conclusion, thyme and clove oils influenced the internal quality of eggs during storage. Also, clove oil showed stronger antibacterial effect than thyme oil. Thus, the mixture of oils (clove and thyme ) treatment may be a better option. Thus, essential oil can preserve internal quality, increase shelf life and also improve the microbial quality of eggs.

**Keywords:** Eggs, clove, thyme, storage, quality

## Determinants of cocoa farm rehabilitation in the volta cocoa region, Ghana

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### Abstract

This study examined the determinants of cocoa farm rehabilitation in the Volta Cocoa Region of Ghana. Specifically, the study looked at the key stakeholders in the value chain of cocoa farm rehabilitation, the extent of cocoa farm rehabilitation, determinants of cocoa farm rehabilitation, and farmer's constraints to cocoa farm rehabilitation in the Volta Cocoa Region. In achieving the stated objectives, the study adopted the descriptive research design utilizing a quantitative method of data analysis. A sample of 400 cocoa farmers was used for the study. A well-organized questionnaire was used to collect primary data from cocoa farmers. Data analysis was done using descriptive and inferential analysis. Findings from the study indicated that stakeholders in the value chain of cocoa farm rehabilitation include COCOBOD, technical staff, private service providers, technical assistants, surveyors, cartography officers, disease spotters, community extension agents, information technology staff, farmer unions as well as cocoa farmers who help identify diseased and over aged farms for the rehabilitation program to be activated. The average extent of cocoa farms in the Volta Cocoa Region is 29.0%. Factors that affect cocoa farmers' decisions to rehabilitate include the age of the cocoa farm and the primary occupation (farming) of the farmer. The proportion of cocoa farm land to be rehabilitated by the farmer is also influenced by the gender, age and other factors. The study found that land tenure and finance were major barriers to cocoa farm rehabilitation in the region. In order to improve rehabilitation efforts on cocoa farms in the districts and throughout the Volta Cocoa Region, the study recommend

that the stakeholders in cocoa farm rehabilitation must collaborate to identify diseased and over-aged farms so that the rehabilitation program can be intensified.

**Keywords:** Cocoa, rehabilitation, cocoa farm sizes, stakeholders, challenges

## Exploring the role of carrot juice in enhancing the sensory properties of bissap juice extract

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### Abstract

Hibiscus-based juices are known for their instability during processing and storage. A study conducted showed that addition of carrot juice to bissap could improve its sensory properties. Therefore, the aim of this study was to determine the biochemical changes occurring between bissap-carrot blends during storage and how these changes affect its sensory properties. Three bissap-carrot blends were produced; Bissap+Carrot+preservative (BCSB), Bissap+Blanched Carrot+preservative (BBCSB), and Bissap+Carrot+Sugar+Preservative +Flavour (SB) which were stored in plastic bottles at ambient temperature (28°C). Total soluble solids, pH, titratable acidity, colour, total monomeric anthocyanins, total phenolics, beta-carotene, and antioxidant activity were evaluated in freshly prepared blends, and after, 7, 21, 35, 49, 63, 77 and 91 days of storage. A difference from control sensory test was conducted on all samples during storage. Assessors determined how different fresh controls were from the ambient stored samples in terms of overall difference, appearance, aroma, flavour, mouthfeel, and aftertaste using a 6-point category scale. The results showed that pH, total phenolics, colour, total monomeric anthocyanins, titratable acidity, total soluble solids, and beta-carotene content of the samples decreased significantly at the end of storage whilst antioxidant capacity increased significantly. Sensory results showed that all samples at day 7 of storage were not significantly different from control samples but significant differences for all attributes started to show from day 21 of storage. The degree of differences observed for modalities aroma, flavour, mouthfeel, and aftertaste during storage were between 0-2 (no difference - slight difference) whilst appearance was between 0-4 (no difference- moderately large difference). Generally, the significant overall differences observed were due mainly to changes in appearance and flavour. The rapid change in colour during storage correlates with the significant decrease in

the total monomeric anthocyanins and beta-carotene content of the samples which are known to be the main colour pigments in bissap and carrots.

**Keywords:** Bissap, carrot, difference from control test, sensory, colour pigments

## Farmers' preference for agricultural technology transfer modes and its implication for inorganic fertilizer use and maize yield: Evidence from Guinea Savannah and Transitional Zones of Ghana

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### Abstract

Technology development and use are crucial for improving crop yields and food security. In Ghana, several technologies have been introduced to farmers over the years, however, yield increases have been slow. In transferring technologies, different transfer modes are used, suggesting that impacts could vary. This study examined maize farmers' preferences for agricultural technology transfer modes and their impact on inorganic fertilizer use and maize yield in the Guinea Savannah and Transitional agroecological zones of Ghana. The study used primary data collected from 690 maize farmers. Descriptive statistics were used to describe the modes of agricultural technology transfer. Mean scores were used to analyse farmers' perceptions of the effectiveness of agricultural technology transfer modes. The multinomial endogenous switching regression (MESR) model was used to analyse the impact of the modes of agricultural technology transfer on the quantity of inorganic fertilizer used. The multinomial endogenous treatment effect (METE) model was used to examine the effect of agricultural technology transfer modes on the maize yield. The results showed that individual farm visits, technology demonstration fields, household extension, group extension, farmer-tofarmer mode of transfer, and radio programmes were the main modes of agricultural technology transfer. Individual farm visit was the most preferred and perceived as the most effective mode of transfer. From the econometric analysis, the transfer of agricultural technologies through extension only, a combination of extension and mass media, and the combination of all identified modes of transfer significantly increased inorganic fertilizer application by 165.5%, 114.5%, and 125.2%, respectively. Transfer of agricultural technologies through extension agents only, farmer-to-farmer only, a combination of extension and farmer-to-farmer, and the combination of extension and mass media significantly increased

maize yield by 15.1%, 18.8%, 34.6%, and 34.0%, respectively. Based on the findings, it is recommended that extension agents provide extension services to farmers on their fields. To achieve this, more human, financial, and logistical support is required from MoFA and NGOs.

**Keywords:** Agricultural technology, technology transfer modes, MESR model, METE model, maize farmers

## Bacterial diversity of wild and farmed African Nile tilapia (*Oreochromis niloticus*) from the Eastern and Greater Accra Regions.

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### Abstract

African Nile Tilapia, a popular product of aquaculture, is farmed to provide solutions to dwindling marine fish stocks. Its contribution to food security and economic development is affected by fish pathogens leading to death in fish farms, rapid spoilage after capture and it has been associated with foodborne illness. There is lack of holistic data on the bacterial diversity of farmed and wild tilapia in Ghana. This study provides the first comprehensive report on bacterial diversity of tilapia from 7 farms and 5 landing sites in Greater Accra and Eastern regions using MinION 16S rRNA sequencing technology. Several amplicon pipelines for diversity analysis were done using Guppy, Nanoplot, Porechop, centrifuge and R software. We identified 1648 bacterial species on tilapia from various sites. The top ten abundant bacterial genus' were *Streptococcus* (23.87%), *Bacillus* (9.48%), *Clostridium* (9.00%), *Lactococcus* (8.81%), *Staphylococcus* (4.26%), *Escherichia* (3.42%), *Clostridioides* (3.39%), *Macrocooccus* (2.99%) and *Weissella* (2.82%). Among fish pathogens, *Streptococcus agalactiae* was most abundant in both wild and farmed tilapia and it has been associated with tilapia mortality. The most abundant spoilage bacteria included *Lactococcus lactis*, *Micrococcus caseolyticus*, *Pseudomonas* and *Aeromonas* spp. Several bacterial pathogens that cause disease in humans were present on fish samples. Among the significant species were, *Clostridium botulinum*,

*Clostridium. perfringens, Vibrio cholerae, Vibrio parahaeolyticus, Vibrio vulnificus, Salmonella enterica, Eschericia coli and Yersinia enterocolitica.* Bacteria species richness was high in both wild and farmed tilapia, with no significant differences between them ( $P=0.84$ ) in both Greater Accra and Eastern regions ( $P=0.72$ ). The predominant spoilage and pathogenic bacterial are organisms that need to be target controlled to enhance quality and safety of tilapia from Great Accra and Eastern regions.

**Keywords:** Tilapia, bacterial diversity, fish, farmed.

## Maize seed production in Ghana can benefit from Internet of Things (IoT)

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### Abstract

Traditional methods of maize seed production have been characterized by low productivity, excessive use of physical labour, overreliance on rainfed agriculture, inefficient input use, poor data and record management systems, poor soil management practices, inaccurate weather and water measurements and sole reliance on seed growers' historical or local knowledge. Recent advancements in Internet of Things (IoT) technologies and innovations for smart farming and business are well documented. The deployment of smart farming technologies can assist seed producers and businesses in performing their tasks more efficiently and effectively. The IoT package includes among others, sensors for measurement of physical parameters (volume of water, soil and water temperature, humidity, wind speed and rainfall), remote monitoring and controllers for applying of inputs in real time. This study carried out an on-field experimental comparison of deploying IoT in hybrid maize seed production to the conventional approach. The study found that the IoT approach led to water savings of 57 percent as compared to the conventional approach and was more profitable (the benefit-to-cost ratio of the IoT approach was 1.50 and that of the conventional approach was 0.77). The deployment of IoT in hybrid maize seed production also led to a yield increase of 18 percent over the conventional approach. Three key constraints relate to investment capital, energy and device design. The investment in the IoT package is capital intensive hence it is recommended that seed producers form groups that allow them to jointly own the technology for their production activities. In addition, the use of

solar power and other sources of renewable energy should be explored to support the energy demands for deploying the IoT and complementary systems of irrigation. The IoT technology prioritize be made more user-friendly, as well as supporting deployment in multiple local languages and mobile phone SMS alerts

**Keywords:** Internet of Things, seed business, productivity, profitability, Ghana

## **Preliminary studies on the presence of the eggplant fruit and shoot borer, *Leucinodes laisalis* (Walker, Lepidoptera:Crambidae) in solanum spp in Ghana**

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### **Abstract**

Garden eggs, *Solanum* spp., are found mainly in tropical Africa and Asia. They are primarily grown for their immature fruits. While trade volumes of garden eggs are not readily known, the small volumes exported to the EU were further reduced after a ban was placed on vegetables from Ghana in October 2015 when large numbers of insect pests of quarantine importance like the *Leucinodes* spp. were found in vegetable consignments bound for the European market. Recently, the presence of some species of the genus *Leucinodes* in Ghana and Africa has come under contention. The *L. orbonalis* for example has been reported in Ghana by many authors over the years. Initial studies reported that three species in the *Leucinodes orbonalis* complex found in Africa were not conspecific with species found in Asia. It is therefore important to scout for and know the species of the *Leucinodes* complex present in Ghana. The objective of this study was to perform a preliminary study to determine the types *Leucinodes* spp. found in Ghana. Samples of garden egg fruits were collected from four regions of Southern Ghana. The fruits were put into incubation chambers which were kept in the Laboratory with a temperature of  $27 \pm 3$  °C and a relative humidity of  $80 \pm 3\%$ . The pupae were collected and put into separate containers till they emerged into adult moths and were identified. Morphological studies revealed the presence of *Leucinodes laisalis*, a previously unreported species in Ghana. In addition, the presence of another species in the *Leucinodes* complex was also found. It is believed that this species has been wrongly identified over the years as *Leucinodes orbonalis*. In order to confirm, it is expected that molecular identification is carried out. This will bring finality to the presence or absence

of *Leucinodes orbonalis* in Ghana

**Keywords:** Garden eggs, *leucinodes orbonalis*, *leucinodes laisalis*

## Food security and dietary diversity: a phenomenological study of smallholder farmers in rural communities, central region

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### Abstract

Food insecurity, poverty, limited diet quality and diversity are significant global problems. Several households rely on crops and livestock to meet their dietary needs. Smallholder farmers are primary producers of food consumed in rural areas. However, when it comes to food insecurity, they are the most vulnerable group. This study was conducted to investigate the perspectives of smallholder farmers on food security and dietary diversity in rural areas in the Central Region of Ghana. The study employed a qualitative approach using a phenomenological study design. The study location was three (3) rural communities; Atonkwa, Abbina and Kuful, all located within the Elmina township. A total of thirty (30) smallholder household heads were selected through a multi-stage sampling method. Thematic content analysis was used to analyse the data collected. The predetermined themes were organised food availability and access, causes of food insecurity, determinants of dietary diversity and coping strategies. Twelve (12) sub-themes emerged from the interviews conducted. The findings indicated that the perceived causes of food insecurity were based on socioeconomic factors and climate variability, affecting the availability and access to food. The diversity of food consumed within the household was determined by household food production, socio-economic factors, and information access and use. Based on the results, it was suggested that to help fix the social and economic problems that lead to food insecurity, the government should improve implementation measures and effectively monitor and evaluate policies such as free school uniforms and exercise books, the Livelihood Empowerment Against Poverty (LEAP) program, and the National Health Insurance Scheme (NHIS).

**Keywords:** Food security, dietary diversity, Central Region, experiences, coping strategies



## The effect of wet milling on the physical and rheological characteristics of slurry made from *Moringa oleifera* seeds.

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### Abstract

Moringa oleifera seeds are nutrient dense with several health benefits, however, they have limited food applications due to sensory, rheological, and techno-functional challenges. In food processing, several quality attributes of seeds can be improved through milling. Hence, the aim of this preliminary study was to investigate the influence of wet milling methods (shear milling and centrifugal milling) on selected physical and rheological properties of Moringa oleifera seeds. Full fat Moringa seeds (FFM) and Defatted Moringa Seed Meal (DFM) were used in this study. Differences in the milling technique and composition of the Moringa seeds resulted in significant variations ( $p < 0.001$ ) in the particle size, flow rate and viscosity of the slurry. Both milling techniques showed a multimodal particle distribution, however CM of FFM resulted in the smallest particle size ( $D_v(90)$ : 151 $\mu$ m). CM also increased the final viscosity of the FFM slurry (FFM:123mPas) during pasting as compared with the SM technique (FFM:81mPas). Both milling methods resulted in a slurry that exhibited shear thinning properties. Overall, CM can significantly improve the quality of Moringa seed slurry which can be used for varied food applications. The diverse impact of the milling methods on the physical and rheological properties of slurry from Moringa seeds can be used to target different techno-functionalities in food products.

**Keywords:** Moringa seeds, shear milling, centrifugal milling, wet milling, viscosity

## Evaluation of *Trichoderma harzianum* as a bio-control agent against root-knot nematode in okra

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### Abstract

The root-knot nematode is a very destructive pest and is known to parasitize a vast number of crops including okra accounting for grievous economic losses. *Trichoderma harzianum*, a prevalent culturable fungus has shown to have the inherent ability to

suppress the growth of plant pathogenic microorganisms. This experiment evaluated the biocontrol potential of this bio-fungicide (*T. harzianum*) against root-knot nematode (RKN) infections in okra under potting conditions. *Trichoderma harzianum* (strain FIC) in three spore concentrations ( $1.1 \times 10^6$  cells per 5ml,  $2.2 \times 10^6$  cells per 5 ml and  $4.4 \times 10^6$  cells per 5 ml) and Velum (a synthetic nematicide) were tested for their nematicidal potential against RKNs. The experiment was laid out in a completely randomized design (CRD) with each treatment replicated three times. Treatments were applied to 300 plants pre-inoculated with approximately 100 second stage juveniles. Improved growth of nematode-infected plants and decrease in the root-galling index and the number of eggs per gram of root were achieved when nematode-inoculated plants were treated with *T. harzianum* preparations. Reproductive factors for nematode populations in *T. harzianum* treated plants were less than one ( $<1$ ) as opposed to ( $>1$ ) observed in control. Okra plants that received  $4.4 \times 10^6$  cells per 5ml of *T. harzianum* had the highest plant growth parameters (plant height, stem girth, chlorophyll content, shoot weights and yield). The highest fruit yield per plant (151.2 g) was on okra plants that received  $4.4 \times 10^6$  cells/5 ml representing a 54.6% increase over control. This study reveal the efficacy of *T. harzianum* in controlling RNK and improving growth of okra plants.

**Keywords:** Root-knot nematode, *Trichoderma harzianum*, bio-control, nematicida

## Assessment of microbial quality of table eggs sold in selected markets in the Abuakwa South Municipality of the Easter Region, Ghana.

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### Abstract

Microbial contamination of table eggs has important consequences on the poultry industry. The associated illness from contaminated eggs is a serious worldwide public health problem. Contaminated eggs and their products increase the risk of illness humans. The purpose of this study was to investigate the microbial quality of table eggs sold in some markets of the Abuakwa Municipal of the Eastern Region. A total of four hundred (400) were collected randomly from five (5) selected markets and sent to the laboratory of the University College of Agriculture and Environmental Studies (UCAES), Bunso, Eastern Region. Standard microbiological tests were performed to identify microbes on and in the collected eggs. The following bacterial species were isolated from eggs shell surfaces and contents; *Streptococcus spp*, *Salmonella spp*, *Staphylococcus spp*, *Bacillus spp*, *Escheichia spp*, *Diplococci* and *Diplococci* and

*Carynebacteria*, *Aspergillus spp* and *Mucor*. The mean Total Viable Count (TVC) from the shell and content in each market were found to be higher than the ICMSF (1998) mean TVC standard of  $10 \times 10^5$  gm/cfu or mean log of 6.00. Although *Salmonella spp* were not prevalent in this study, effective control measures should be in place to avoid any serious public health problem.

**Keywords:** Microbial, quality, contaminated, eggs, market

## Insect fauna of cashew and mango at the University of Ghana Farm, Legon

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### Abstract

This study was conducted to identify the Insect Fauna of Cashew and Mango at the University of Ghana Farm, Legon, and to collect and preserve the collected species in the Department of Crop Science Entomology Laboratory. Using chemical knock-down approach, Cydim Super®, an emulsifiable concentrate containing 36 g cypermethrin and 400 g dimethoate per litre was applied at a concentration of 2 ml/L on selected Cashew and Mango trees. A total of 205 insects made up of 10 orders and 26 families were collected comprising of 110 insects from Cashew (*Anacardium occidentale*) and 95 insects from Mango (*Magnifera indica L*). The Order with the most collected insects in both Cashew and Mango trees is Dictyoptera. In contrast, the Orders with the least collected insects were Neuroptera, Blattodea, and Homoptera. The insects were further categorized into beneficial and pests. In Cashew, 33 insects made up of 4 orders and 9 families were identified as beneficial while 61 made up of 8 orders and 6 families as pests, and 1 as neither pest nor beneficial. In Mango, 74 insects made up of 4 orders and 8 families were identified as beneficial insects while 36 made up of 8 orders and 20 families as pests. The insects were then pinned, mounted, and safely preserved in insect storage boxes in the Department of Crop Science Entomology Laboratory with appropriate labels. The significant recommendations are that this experiment or study be conducted at other University of Ghana research centres or farms on the same or different trees at different times of the day or year to understand their insect diversities. Likewise, the insect storage boxes are suitable for enhanced teaching and learning since it also reduces direct contact with the contents of the insect storage boxes (preserved insects) using Quick Response code (QR) technology.

**Keywords:** Cashew, mango, insect, trees,

## Microbiological quality of lettuce irrigated with treated wastewater

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### Abstract

Vegetable farming occurs at rural and urban areas in Ghana. Farmers situate their farms close to water bodies for irrigation to meet production demands. This study evaluated the quality of wastewater treated by biochar at the Legon Sewage Treatment Plant, and the microbiological quality of lettuce irrigated with the treated wastewater. Treated wastewater was collected from the start and ends of irrigation pipes on three occasions and analysed for physical (electrical conductivity, total dissolved solids (TDS), salinity, pH), and microbiological quality (Enterococcus, total coliforms, faecal coliforms and *E. coli* counts). Lettuce heads (n=54) were randomly sampled from wastewater-fed and rain-fed beds on three occasions and assessed for the presence of total aerobic bacteria, Enterobacteriaceae, *E. coli*, *Salmonella*, Enterococcus, and yeast and mold counts the mean conductivity, TDS, salinity and pH of the treated wastewater was 973  $\mu\text{S}/\text{m}$ , 684 ppm, 488 ppm and 7.38 respectively. The microbiological quality of the wastewater ranged from <3 to 10 CFU/100mL for Enterococcus, 9 to 290 CFU/100 mL for total coliforms, <3 to 290 CFU/100 mL for faecal coliforms counts, and 66.7% prevalence of *E. coli*. Point of wastewater collection had no effect ( $p>0.05$ ) on the quality of the treated wastewater. Mean total aerobic bacteria, yeast and mold, Enterobacteriaceae, and Enterococcus counts on treated wastewater-fed lettuce were 5.65, 5.05, 5.06 and 3.90 log CFU/g, respectively, and that of rain-fed lettuce were 5.52, 4.97, 5.00 and 4.35 log CFU/g, respectively. *E. coli* was not detected in both treated wastewater-fed and rain-fed lettuce, but *Salmonella* was detected in 33% (1 out of 3) of wastewater-fed lettuce. Although the use of treated wastewater or rainwater for irrigation had no effect ( $p>0.05$ ) on microbiological counts, the presence of *Salmonella* on treated wastewater-fed lettuce indicates the need of further treatment to make treated wastewater an alternative water source for irrigation.

**Keywords:** Treated wastewater, irrigation, lettuce, *E. coli*

# Quality of sachet and bottled water in Ayawaso West Municipality

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## Abstract

Packaged water consumption in Ghana has increased significantly in recent years, attributed to consumers' perception of packaged drinking water being a safer and healthier alternative compared to other water sources. This study's objectives were to identify major sources of drinking water and the quality of packaged water. A semi-structured questionnaire was administered to 400 participants in the Ayawaso West Municipality and the most drank four sachet water (n=24), and three bottled water (n=18) brands were sampled from some retailed outlets in the municipality and analyzed for their chemical (pH, conductivity, and total dissolved solids (TDS)) and bacteriological (total coliform, *E. coli*, *Enterococcus* spp., and heterotrophic plate counts) quality. The study participants' major sources of drinking water were sachet water (55%), bottled water (30%), and tap water (15%) and were influenced by factors such as taste, quality, packaging, and brand for bottled and sachet water and availability for tap water. About 31% of the water samples tested positive for total coliform (16.7% bottled water and 50% sachet water). *E. coli* was detected in 9.5% of the water samples (8.3% bottled water and 11% sachet water) and *Enterococcus* spp. was present in 11.9% of samples examined (4% bottled water and 22% sachet water). Heterotrophic plate counts of the samples ranged from 42 to 186 CFU/100ml. pH of the samples ranged from 7.04 to 7.94, conductivity from 8.88 to 96.53  $\mu\text{S}/\text{cm}$ , and TDS from 6 to 86.4 mg/L. Although the water samples analyzed in this study were within the chemical requirements of the Ghana Standards Authority for drinking water, the bacteriological requirements were not met. It is recommended that Good Manufacturing Practices in the processing and packaging of drinking water be enforced by regulatory agencies, with retailers, and consumers educated on how to minimize packaged water contamination.

**Keywords:** Drinking water quality, packaged water, *E. coli*

## Prediction of aromatase inhibitors as potential breast cancer therapy in postmenopausal women using machine learning

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### Abstract

Breast cancer continues to be the most prevalent cancer recorded yearly contributing to high mortality rate of women globally. Estrogen and its receptors are well known for enhancing the proliferation of breast cancer in women especially for those who have attained postmenopausal stage. While estrogen is essential in women, at the postmenopausal stage, higher levels cause breast cancer. Deactivating the aromatization of androgens to estrogen will serve as an effective measure to block the pathway needed to fuel carcinogenesis. This study aimed at developing machine learning models to predict inhibitors against aromatase. Five machine learning algorithms were developed using 4175 aromatase inhibitors from the ChEMBL database. These models included K-Nearest Neighbor (KNN), Random Forest (RF), Support Vector Machine (SVM), Logistic Regression (LR) and Decision Tree (DT). A 5-fold cross validation was undertaken to avoid overfitting or underfitting of the dataset. The SVM model emerged as the best performing model with accuracy of 80%, F1 score of 79% and area under the curve of the receiver operating characteristics curve (ROC - AUC) of 89%; followed by KNN with accuracy of 80%, F1 score of 79% and ROC - AUC of 79%. The rest of the models comprising RF, LR and DT had accuracies of 79%, 78% and 79%, respectively.

**Keywords:** Aromatase, k-nearest neighbor, random forest, support vector machine, logistic regression, decision tree, inhibitors

# Effects graded levels of biochar inclusion on nutritive value and gas production characteristics of brachiaria mulatto ii

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## Abstract

Effects of graded levels of rice husk biochar (RHB) inclusion on nutritive value and in vitro gas production (GP) of Brachiaria mulatto II (BM) were assessed. Nutritive parameters included crude protein (CP), neutral detergent fibre (NDF) and acid detergent fibre (ADF). Short chain fatty acids (SCFA), Organic (OMD) and dry matter digestibilities (DMD) and Relative feeding value (RFV) were estimated from in vitro GP parameters. Feed samples comprised leaf, stem and whole fractions of BM at 60, 90 and 120 harvest days (HD), each mixed with 0, 15 and 30 g/kg RHB. Hohenheim gas test was used to determine GP at 3, 6, 9, 12, 24, 36, 48, 72 and 96 hours and  $p = a + b(1 - e^{-ct})$ , used to describe GP kinetics. Data were analyzed with general linear model of Minitab®18.1 and means separated using Tukey's test at 5% significance. Feed samples contained 5.04-14.96% CP, 59.74-79.75% NDF and 27.25-79.43% ADF with GP ranging from 19.17-29.00ml/200mgDM at a rate constant (c) of 0.018-0.05ml/h. RHB level and HD significantly ( $p < 0.05$ ) affected GP at 3, 6, 9 and 12 hours. Whole plants at 90 and 120 HD with 30g/kg and 15g/kg RHB respectively, had the highest GP (22.17ml/200mgDM) at a rate of 0.033ml/hr. Leaf and stem GP ranged from 20.38-29.00ml/200mgDM with corresponding GP rate of 0.03-0.05ml/h. Leaf and stem fractions at 60 HD had the highest GP of 29 and 26.38ml/200mgDM respectively at a rate of 0.03ml/hr. The highest OMD (39.53%) and SCF(0.36 $\mu$ mmol) were obtained for leaves at 60 HD with 15 g/kg RHB inclusion. DMD and RFV differed ( $p < 0.05$ ) between feed samples with highest DMD (65.20%) and RFV (122.70) obtained for leaves with 0g/kg RHB at 60 and 120 HD respectively. GP from feed samples indicate up to 30g/kg RHB can be utilized as ruminant feed additive.

**Keywords:** *In vitro*, rice husk, harvest date, ruminant, additive

## Investigating the antibacterial activity of drug loaded bacterial cellulose-zeolite composites for wound healing applications

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### Abstract

Wound dressings have long been used to aid healing by providing a physical barrier against infection, maintaining a moist wound environment, and absorbing exudates around the wound. An ideal wound dressing should be able to facilitate a suitable healing environment, maintain high humidity at the wound site, remove excess exudates, have non-toxicity and non-allergy reaction, allow oxygen exchange, be comfortable, cost-effective and prevent microbial invasion. Bacterial cellulose (BC), as a new type of wound dressing material, has attracted more and more attention due to its good physicochemical and mechanical properties, outstanding biocompatibility and biodegradability. In spite of all these many excellent properties BC possess for wound dressing, it lacks antibacterial activity and this limits its application in wound dressings. Many studies have prepared BC-based composite materials with antibacterial function as wound dressing. The high porosity and surface area of BC allow the introduction and release of antimicrobial agents, drugs and other biological functional materials. This proposal suggests developing a bacterial cellulose based potential wound dressing material using BC and LTA Zeolite. LTA zeolite will be prepared using locally sourced kaolin and will then be used to modify BC pellicles to form a biocomposite. The resulting biocomposite will be synthesized with Antibacterial drugs to form a BC-LTA Zeolite-Antibacterial drug complex which will be characterized by Scanning Electron Microscopy (SEM), X-ray Diffractometry (XRD), Fourier Transform Infrared Spectroscopy (FTIR), and Thermogravimetric Analysis analysis. Antibacterial studies will be performed on the composite to check its antibacterial efficacy and inhibition

**Keywords:** *Antibacterial, Biocomposite, Wound Dressing, Wound Healing, Biocompatibility*



# Learning from and leaning on nature for resilience to climate change hazards: opportunities and challenges for nature-based solutions in Ghana's coastal communities.

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## Abstract

Climate change is no longer just an abstract discussion. The evidence indicating that the ongoing climate change is principally caused by human activities is now scientifically clear. Every social-ecological system is currently bearing the brunt of climate change. The rise in sea levels, worsening floods, erosion and storm surges, loss of critical biodiversity and ecosystems coupled with displacement and destruction of livelihood systems are some of the obvious effects of climate change in coastal areas, where the majority of the world's population live. Ghana's coastal areas are not exempted from the negative effects and challenges of climate change-induced hazard with evidence showing threats to existing socio-economic, cultural, governance and biophysical systems. The clarity and urgency of this challenge make it critical to identify, incorporate, accelerate sustainable and viable resilient strategies which can provide diverse benefits to the environment and humanity. Nature-based solutions have proven to provide flexible, cost-effective, and broadly applicable alternatives for mitigating and adapting to the effects of climate change. They have become critical tools at adaptation planners' disposal for addressing the threats that climate change poses to biodiversity, ecosystems, people's lives and livelihoods. This research uses videos, pictures, in-depth interviews, and observations to critically examine the implications of climate change in selected coastal communities in Ghana. It explores the opportunities and challenges for the use of nature-based solutions for addressing climate change and its related challenges in selected coastal communities in Ghana. The study highlights the best nature-based strategies and approaches for enhancing resilience and mitigating effects. In the end, this study is aiming at interdepartmental experimental projects such as constructed wetlands and mangrove restoration in coastal areas to test their effectiveness in climate change mitigation and adaptation and also as a method of ensuring water security in Ghana.

**Keywords:** *Anlo beach, coastal areas, floods, poverty, Keta*

## Investigating the antibacterial activity of hydroxyapatite/cellulose nanocrystal composite for water treatment

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### Abstract

The prevalence of waterborne diseases in the rural parts of Ghana, especially in the northern regions, has raised the need to purify water before consumption. Microbes that find their way into groundwater from sewage systems and animal excreta have caused many life-threatening diseases. The challenges involved in the existing antibacterial water treatment methods, such as high costs, health risks, and antibacterial resistance, have created the need for safer and more effective alternatives in addressing these issues. Hydroxyapatite, a calcium-phosphate mineral, has long been used in water treatment applications, especially in the adsorption of heavy metals, dyes, and other ions from wastewater. Its chemical stability, biocompatibility, and ability to preserve the quality of water have made it an ideal material for water treatment. Yet, due to its minimal antibacterial properties, it has seen minimal use in antibacterial water treatment. However, studies have shown that the addition of cellulose could enhance the antibacterial activity through the release of some radical species that have the potential to alter the cell wall/membrane of bacteria and inhibit their respiratory activities, ultimately resulting in bacteria death. Thus, this proposal introduces a hydroxyapatite/cellulose nanocrystal composite with enhanced antibacterial activity using various synthesis techniques and varying amounts of cellulose nanocrystals. The composite will be characterized using Fourier transform infrared spectroscopy (FTIR), X-ray diffractometry (XRD), Raman spectroscopy, and cyclic voltammetry. Disk diffusion tests and colony-forming unit tests will be done to investigate its antibacterial activity.

**Keywords:** *hydroxyapatite, cellulose nanocrystals, antibacterial activity, water treatment*

# Understanding drivers of non-compliance of guidelines for urban tree planting and green spaces in Ghana's building regulations: Perspectives from residential house owners'

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## Abstract

Globally, cities are growing and expanding at unprecedented rate with more than half of the world's population living in cities. The ongoing presents sustainable development challenges cities in this climate crisis era. The loss and degradation of ecological landscapes and resources such as trees and green spaces, which provide critical ecosystem services for sustaining a good quality of life for humans are direct effects of rapidly growing cities. Therefore, policy interventions aimed at conserving trees and green spaces in urban residential building and construction activities cannot be over-emphasized. The objective of this study was to examine residential house owners' non-compliance to national building codes and regulations for the plantation and integration of trees vegetation, and green spaces in residential housing development. The study was undertaken in the Madina, a suburb of Accra. Data were collected through household questionnaire surveys, key informant interviews, participant observations and photography. The Relative importance index was used to analyze the survey results. Results showed residential houseowners have high awareness of the social and ecological values of trees and green spaces with average RII of 0.7244. On the other hand, the majority of houseowners have low awareness of national building regulations and guide on the plantation of trees and vegetation with average RII of 0.4068, thus resulting in high non-compliance. Among the categorized reasons for non-compliance, the overwhelming majority of the surveyed respondents agreed that socio-economic drivers contribute significantly to non-conformity with an average RII of 0.868. Respondents were uncertain on political drivers of uncontrolled building, hence, respondents exhibit moderate average RII of 0.612. The study advocates for sensitization on building regulations with special attention on provisions on greenery conservation, reducing the permit process time, punishing physical and development planning official corruption, and rewarding officials whose local communities are developing sustainably.

**Keywords:** *building regulations, greenery, planning, houseowners, urbanization*

## Adoption and impact of sustainable land and water management practices on maize yield in West Mamprusi District, Ghana

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### Abstract

Sustainable land and water management practices (SLWM) are technologies applied to raise land quality. Due to land degradation especially in Northern Ghana, the government of Ghana has been promoting the use of SLWM practices through various projects to combat land degradation, increase soil fertility and crop production. Despite these efforts, adoption of SLWM practices is still low. Even though, some studies have been conducted on SLWM practices, few have assessed the influence of adoption on crop yields. This study analyzed the factors that influence the decision of farmers to adopt SLWM practices and the impact of such adoption on maize yield using primary data from 203 maize farmers in the West Mamprusi District. The Poisson regression model was used to analyze farmers' decision to adopt SLWM practices use of organic manure, tree planting, bush fire control, crop rotation, growing of cover crops and contour bunding. The Endogenous Switching Regression model was used to determine the impact of SLWM practice on maize yield, and Propensity Score Matching (PSM) model results provided a robustness check for and reliability of the results. Organic manure had the highest level of adoption by maize farmers, and the main determinants of adoption were farming experience, access to credit, membership of FBO, farm size, and training. Adoption of SLWM practices has significant impact on maize yield. Government, through the Ministry of Food and Agriculture and the Environmental Protection Agency has to educate and train farmers about the potential benefits SLWM practices so as to increase adoption and crop yield. Farmers must be encouraged to join or form new farmer groups to improve their access to input and credit and experience-sharing.

**Keywords:** sustainable land, water management practices, soil fertility, adoption, impact, maize yield

## Viability and market potential of coconut briquette as an alternative sustainable energy: Evidence from Ghana

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### Abstract

Coconut husk is usually perceived as waste in the study area. A business model by IWMI suggested the use of this 'waste' for an environmentally friendly product, coconut briquette as charcoal. As an alternative product to traditional charcoal, use of coconut briquette could help minimize environmental problems caused by traditional charcoal production and also provide a more convenient product for households. This study sought to investigate the prospects of coconut briquette as a small-scale business venture in Kumasi. Specifically, the study estimated the market potential of the coconut briquette and analysed the financial viability of coconut briquette. The study population was all households in Kumasi Metropolis who use either traditional charcoal or other energy sources for cooking and heating. A major briquetting company, ZAACOAL, was also consulted. A multi-stage sampling technique was used to select 384 respondents from 19 communities. Wolfe's market potential formula was used to estimate the market size of the product and the CBA method for assessing project viability was used to analyse the financial viability of the product. The estimated market size for the product in the study area was GH¢451,699,243 per annum. The computed viability indicators, NPV, BCR and FRR at 25% discount rate were GH¢93,750, 1.073 and 52.93% respectively, implying a viable investment and thus a prospect for the production of coconut briquette in the study area. Generally, the study recommended that more potential investors can invest in the coconut briquette business because the product has a large market share at the study area.

**Keywords:** *financial Viability, market potential, briquetting, clean energy, cost-benefit analysis*

# Ghanaian consumers: Considerations for environmental sustainability in purchase decisions

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## Abstract

Greenwashing remains a legitimate concern despite growing global calls for policy directions geared towards more sustainable human and business practices. Greenwashing describes businesses and organisations seeking to position themselves as sustainable or environmentally friendly through omissions, exaggerated claims, or falsehoods. An actionable policy framework for a green claims guide is crucial to forestall any possible ramifications of deceptive green marketing in Ghana. This study reports on consumers' awareness of green issues and how this affects their purchasing decisions. The study's objective was to explore the factors influencing the lack of conversion of Ghanaian consumers' perception of sustainability into their purchase decisions as an example of Environmentally Responsible Behaviour (ERB). Qualitative and quantitative data were collected using household (customer) questionnaire surveys, key informant interviews, and a review of relevant documents. The survey findings suggest that although 72% of consumers were familiar with the concept of sustainability, only 28% made any personal efforts toward environmental protection. Results revealed that despite growing evidence proving that most consumers in Ghana are aware of green issues, only 19% considered the green attributes before making a purchase decision. Just 40% of the consumers are willing to pay higher for a green product. The study recommended adopting a policy framework to regulate green claims to protect consumer interests. Marketing practitioners and their regulatory bodies must set an agenda for a green claim guide to be regarded as a matter of urgent national policy or, better still, lead the charge through industry self-regulation. Consumers must also take personal responsibility to arm themselves with knowledge on promoting responsible consumption and production.

**Keywords:** consumer awareness, environmentally responsible behavior, green marketing, SDG 12, sustainability

# Quantifying the carbon footprint of a multi-specialist hospital in Ghana and opportunities to go green

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## Abstract

A carbon footprint is the amount of carbon dioxide released into the atmosphere as a result of the activities of a particular individual, organization, or community. Research undertaken by Health Care Without Harm indicates the global carbon footprint of the healthcare sector is estimated at 2 gigatons of CO<sub>2</sub>e which is equivalent to the annual greenhouse gases produced by 514 coal power plants and if the global healthcare sector was a country, it would have been the fifth-largest emitter of greenhouse gases in the world. This supports the need to mitigate emissions from the healthcare sector in each country. In the healthcare sector, there has been a slow acceptance to take responsibility and mitigate greenhouse gas (GHG) emissions produced as a result of healthcare activities. This study quantified the carbon footprint of a multi-specialist hospital in Ghana and identified how the hospital can reduce its adverse impacts on the environment including achieving carbon neutrality. The total emissions from both direct and indirect sources of CO<sub>2</sub>e quantified based on the Greenhouse Gas Protocol accounting standards, resulted in 465.79 tonnes of CO<sub>2</sub>e for the year 2021. Regarding the major sources of greenhouse gas emissions from the hospital, the study revealed electricity consumption, generation of electricity from the backup power plant, and the hospital fleet of vehicles as the sources of greenhouse gas emissions. The electricity consumption from the national grid contributed the most to emissions at 55.94% from the hospital's operations followed by the generation of electricity from an onsite power plant at 39.24%, diesel-powered vehicles at 3.62%, and petrol-powered vehicles contributing 1.21% of the total GHG emissions of the hospital. The study further gives recommendations on proper utilization of waste, generation of energy from 100% renewable sources, green procurement, and attaining EDGE certification as some of the ways the hospital can reduce its adverse impact on the environment.

**Keywords:** *greenhouse gases, carbon emissions, carbon footprint, climate-smart healthcare*

## Assessment of water quality of the Pra Estuary (Ghana)

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### Abstract

The Pra estuary of Ghana is prone to heavy metal pollution due to illegal mining activities which has adverse implications for the well-being of aquatic wildlife and humans. The aim of this study was to assess heavy metal (As, Cu, Cr, Ni and Zn) concentrations in the Pra estuary water and physicochemical parameters (turbidity, total suspended solids, color, total hardness, and alkalinity) as well as their implications for aquatic life and human health. A total of 15 water samples were collected along five (5) transects from upstream (freshwater end) to downstream (brackish water end) in the Pra estuary. The mean metal concentrations (mg/L) in the estuary were as follows: Ni ( $0.62 \pm 0.28$ ) > Cu ( $0.13 \pm 0.006$ ) > Cr ( $0.08 \pm 0.003$ ) > Zn ( $0.06 \pm 0.02$ ) > As (below detection limit). Cu, Ni, color, turbidity and TSS concentrations were not in compliance with the United States Environmental Protection Agency (USEPA) guidelines for aquatic life, indicating potential adverse ecological effects. The concentrations of Cr and Ni exceeded the World Health Organisation (WHO) guidelines, making the water unsafe for drinking. Based on the Nemerow's Pollution Index, Cr, Cu and Ni were the major pollutants among the measured metals. The study recommends continuous monitoring of the Pra estuary and regulation of illegal mining activities to ensure the sustainability of the estuary.

**Keywords:** Water quality; Pra estuary; heavy metals; Nemerow's pollution index



## Perception and willingness to pay for coconut briquette (sustainable energy)

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### Abstract

The study investigated the perception and the determinants of coconut briquette among charcoal users in Ghana. The study population was all households in Kumasi Metropolis who use either traditional charcoal or other energy sources for cooking and heating. A multi-stage sampling technique was used to select 384 respondents from 19 communities. Mean score formula and Craggs' double hurdle regression were used to assess respondents' perception of the use of coconut briquette and identify factors influencing respondents' willingness to pay for the product respectively. The overall perception index on the use of coconut briquette was 4.032, signifying that, generally, respondents agreed to the positive perception of acceptance and use of the coconut briquette. About 76% of the respondents had a mean WTP of GH¢ 3.443/kg with an average premium of GH¢1.443 relative to the traditional charcoal of GH¢ 2/kg. Using the Cragg's double hurdle model, the factors that influence respondents' decision to adopt the product were identified as location and the perceptions that the product does not cause pollution and as it been an additional income for women and fresh coconut sellers. However, factors that affected the estimated mean WTP were; sex of the household head, years of formal education, use of traditional charcoal and the perception that the product does not taint walls or kitchenware. Leveraging on the positive perception and a high premium (Price) for the clean energy, we encourage that more potential investors should invest in the coconut briquette business because of the positive consumer attitudes at the study area. Finally, this paper contributes to the literature by focusing on the perception and the factors that influence users' willingness to pay for coconut briquettes which currently, has rarely been researched and documented in the clean energy literature.

**Keywords:** Cragg's double hurdle, willingness to pay, consumers' perception, clean energy, determinants

# Climate change adaptation and organisational sustainability: insights from industrial and organisational psychology

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## Abstract

The human dynamics of organisational sustainability is one of the most important issues amidst the climate change crisis. The anthropogenic nature of climate change clearly indicates the importance of psychological science in mitigating and adapting to climate change. The sustainability of our planet is inextricably linked to human behaviours, psychological and social processes. Most industrial and organisational psychologists and organisational theorists agree that an ecologically sustainable future (work, workplace and workforce) depends on increase in environmentally responsible behaviours. The United Nations Sustainable Development Goal 12 (responsible consumption and production) recognizes the critical role of organisational sustainability in efforts aimed at ensuring resource production and utilization efficiency. However, there are few studies on the why and how industrial and organisational psychology can contribute to organisational sustainability amidst the climate change crisis within the Ghanaian working environment. This paper illustrates how psychological principles and theories can be applied to understand climate change adaptation, environmental protection, and ecological sustainability and how this may enhance our knowledge in organisational sustainability. We argue that organisations should (a) leverage on social group norms (b) appeal to intrinsically motivate workers to “live tomorrow today” (thus valued long-term environmental goals and outcomes) and (c) frame climate change adaptation in terms of knowledge management to survive. We provide a conceptual framework useful for climate change adaptation and mitigation, and implications for future research.

**Keywords:** climate change, environment, Ghana, organisational psychology, sustainability

## An optimisation approach to planning a 3-course meal for an adult male

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### Abstract

The foods we consume provide nourishment for our bodies. Therefore, diets that provide the required or recommended nutrients are essential. A diet refers to a variety of foods people consume. However, meeting this need has posed several dietary-related problems. The cost of a diet is one of the many factors constraining consumers from purchasing nutritious diets. As such, there is a need for a mathematical approach that proposes diets that meet nutrient needs at the least cost. Diet optimisation is a tool to address complex dietary problems. This work aimed to develop a least-cost 3-course meal for an adult Swiss male that meets the daily dietary recommendations for selected nutrients, using ingredients from the UDSA database. A mixed integer linear programming approach was used to solve the optimisation problem. First, ingredients common to Switzerland were linked to the ingredient list from the USDA (United States Department of Agriculture) database to link nutrient composition and their corresponding cost. The objective function was then defined to minimise cost subject to minimum and maximum recommended dietary adequacies for an adult male. The nutrients specified were calcium, carbohydrate, cholesterol, energy, fat, fibre, iron, potassium, protein, and sodium. The equation was then solved using the Python programming language to obtain a list of ingredients. These ingredients were then further developed into a 3-course meal prototype. The algorithm selected 15 ingredients from the list of ingredients, at a minimum cost of 3.4CHF, with optimised values for the defined minimum and maximum nutrient requirements. Therefore, it was possible to obtain the least cost 3-course meal using diet optimisation.

**Keywords:** mixed integer linear programming, diet optimisation, objective function, constraint, variables

## A first-principle study of the electronic properties and mechanical stability of lead-free halide inorganic double perovskite Cs<sub>2</sub>InAgX<sub>6</sub> (X =F, Br, Cl, I)

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### Abstract

Perovskite materials have a general formula AB<sub>2</sub>X<sub>6</sub>, where A = monovalent cation, B = trivalent, X is an anion. The mechanical and electronic properties of some Pb free double perovskite material of form Cs<sub>2</sub>InAgX<sub>6</sub>, (X =F, Br, Cl, I) have been studied computationally. We performed an *ab initio* computational study of its electronic structure adopting the local density and generalized gradient approximations for the exchange-correlation potential. All the perovskite material were found have face centered cubic structures in conformity with reports in the literature. For the Cs<sub>2</sub>InAgCl<sub>6</sub> material, the relaxed ground state showed that the lattice parameter a is 10.39797Å for X= Cl, a is 10.88989 Å for X = Br; a is 9.0133 Å for X = F and a is 11.5385 Å for X = I. Examination of the mechanical properties suggests that all material were possibly stable, but the phonon dispersion curves showed that Cs<sub>2</sub>InAgCl<sub>6</sub> is the most stable of the perovskite material studied.

**Keywords:** *free double perovskite material, mechanical stability, photovoltaic cells, Cs<sub>2</sub>InAgX<sub>6</sub>*

## Sensory qualities of indigenous green leafy vegetables

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### Abstract

Ghana has a variety of indigenous green leafy vegetables which are used for food and medicinal purposes. These vegetables form part of various Ghanaian delicacies. They are used in meal preparations such as soups, stews, or salads. Even though a variety of these vegetables exist in Ghana they are underutilized due to their high perishability. There is also scanty information on what their sensory quality characteristics are and how they can be preserved over time. To achieve this, an ethnographic study was conducted at 6 major markets in Greater Accra to enquire from vegetable traders the quality indices of

the vegetables, their handling and preservation methods. This information was used to guide the development of a quality grading system for the sensory attributes of some selected vegetables over a period of time. Discussions with the traders revealed that different handling methods were practiced like, storing in an aerated area, or sprinkling water on them. They mentioned that the shelf life of most of the vegetables was between 2-3 days. The important sensory qualities that attracted their customers were appearance and texture. Kontomire, alefu, ayoyo, bitterleaf, borkorborkor, dandelion, gboma and kenaf, were used for the shelf life and quality testing. The leaves were graded based on their shape, colour and texture and stored under different conditions. Generally, when the leaves were stored on an aerated flat surface with periodic sprinkling of water they maintained their quality longer for approximately four days. The main factors that influence loss of sensory qualities and shelf life of indigenous leafy vegetables is moisture content of the vegetable and temperature of the storage environment. The important sensory qualities of green leafy vegetables are based on appearance and texture.

**Keywords:** leafy vegetables, indigenous, underutilized, medicinal, sensory qualities

## Baseline lipid profile of pregnant women enrolled in an interventional study

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### Abstract

Improving nutrition and health outcomes of pregnant women is an important agenda in achieving SDGs 2 and 3. Therefore, nutrition and health education cannot be overemphasized. This study determined the background characteristics and serum lipid profile in pregnant women attending antenatal clinics in Accra. A total of 206 pregnant women age 18 and above, 20 to 26 gestations were recruited into nutrition counseling programme. Age, gestational age, education, occupation, body mass index, marital status and blood pressure were assessed. Blood samples were collected for total cholesterol, high-density lipoprotein, low-density lipoprotein and triglycerides. Using SPSS version 26, continuous variables reported as means  $\pm$  SD, categorical variables in frequencies and percentages. Lipid chemistry was compared to standard. The mean age, gestational age and BMI of participants were  $28.39 \pm 5.00$ ,  $22.47 \pm 2.31$  and  $27.88 \pm 5.06$  respectively. Majority were married (n=90, 43.7%), and employed (n=137, 66.5%). Educational level varied but majority completed Senior High School (n=128, 62.1%). Blood pressure reading showed that majority (n=179, 86.9%) had normal pressure

(120/80mmHg) and age and BMI were also significantly associated with blood. Our data indicated that the lipid chemistry of the participants, triglyceride ( $1.60 \pm 0.51$ ), HDL ( $1.61 \pm 0.42$ ), LDL ( $3.18 \pm 1.29$ ) were all lower than standard values of (0.30- 1.70), (1.03- 1.55), (below 1.8 - 4.1) respectively. Its only total cholesterol ( $5.52 \pm 1.32$ ); that was slightly above the standard (3.00- 5.30. Age and gestational age are significantly associated with total cholesterol ( $P > 0.05$ ). The need to improve education among women and most importantly pregnant women to reduce their weight and also eat healthily is a step in the right direction to improve pregnancy outcomes.

**Keywords:** baseline, women, lipid profile, BMI, blood pressure

## Automating phytoplankton identification in Ghanaian Estuaries: A machine learning approach

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### Abstract

Phytoplankton are microscopic plants which play an important role in marine ecosystems as they occupy the base of the food web. Some phytoplankton species are harmful, capable of causing massive fish kills and serve as indicators of water quality. In Ghana, there have been instances of massive fish kills along the coast. Although this situation may be exacerbated by the increase in artisanal and small-scale mining activities that severely affect estuaries, the occurrence of phytoplankton in Ghanaian estuarine systems have not been adequately studied. Conventional methods of phytoplankton identification such as the use of taxonomic keys present many challenges as it is laborious and time consuming. Rapid identification of phytoplankton in marine ecosystems is crucial for their management. The aim of this study was, therefore, to develop a novel approach for rapid and accurate identification of phytoplankton species in three Ghanaian estuaries namely, the Pra, Densu and Volta estuaries. This approach involved bimonthly sampling of phytoplankton over a period of fourteen months from the studied estuaries and the use of a machine learning (ML) algorithm YOLOv5 (You Only Look Once) to automate their identification against a large dataset, i.e., the Phytoplankton Microscopic Dataset 2019 (PMID2019), which contains 10,819 phytoplankton microscopic images of 24 different

categories (species). With a mean average YOLOv5 model precision of 87.5-95.8%, this study shows that the ML approach is a rapid and accurate method of identifying a wide range of phytoplankton species from the studied estuaries in real-time and could be applied to studies of phytoplankton in other estuaries.

**Keywords:** Phytoplankton, Estuaries, Fish kills, YOLOv5, Machine Learning (ML) algorithm.

## Determination of physiochemical, proximate and mineral composition of fresh tomatoes and tomato paste on the Madina market

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### Abstract

Tomato is among the most popularly produced and used vegetable crops worldwide. Due to its high perishability, tomatoes are processed into a wide range of tomato products which include tomato paste. Tomato paste are consumed in many homes and are a good source of readily absorbable lycopene and antioxidants. These antioxidants have anticancer properties and known to fight against oxidative stress hence very beneficial to human health. However, preservation methods used in processing results in nutrient and quality losses. The purpose of this study was to determine the proximate composition of four commonly purchased tomato paste on the Madina market and compare to the nutritional composition of fresh tomatoes. Nine (9) different brands were identified and four (4) brands which included Gino (G), Kivo (K), Leap (L) and Tasty tom (T) were selected based on a questionnaire survey. Three (3) of each selected brand and two (2) different varieties of fresh tomatoes were purchased and used for the analyses. Means and standard deviation were computed for quantitative variables using Minitab version 19. One way Analysis of variance (ANOVA) was used to compare the differences in proximate, physiochemical and mineral of the samples. Pairwise comparison of samples was completed using the Tukey's HSD test at P0.05 level. Proximate, physiochemical and mineral composition analysis conducted on the four tomato paste brands and fresh tomato revealed that fresh tomatoes has significantly ( $p < 0.05$ ) higher moisture content (Roma VF:  $92.05 \pm 0.09\%$ , Beefsteak:  $92.50 \pm 0.04\%$ ;  $p = 0.00$ ) than the four tomato paste. However, it had the least crude fiber (Roma VF:  $1.53 \pm 0.14\%$ , Beefsteak:  $1.69 \pm 0.05\%$ ), ash (Roma VF:  $1.47 \pm 0.06\%$ , Beefsteak:  $1.10 \pm 0.01\%$ ;  $p = 0.00$ ), Carbohydrate (Roma VF:  $5.85 \pm 0.15\%$ , Beefsteak:  $5.81 \pm 0.05\%$ ;  $p = 0.00$ ) and protein content compared to the tomato paste. Sodium (Roma VF;  $13.66 \pm 0.10\text{mg}$  and Beefsteak;  $16.43 \pm 0.27\text{mg}$ ) and iron content (Roma VF;  $2.39 \pm 0.40\%$  and Beefsteak;  $3.6 \pm 0.12\%$ ) of the fresh tomato was significantly lower compared to that in fresh tomato. There were significant differences in sodium and iron content amongst all four tomato paste brands (G, K, T and L). Also, the tomato paste recorded significantly higher total

sugar content relative to that of fresh tomatoes. No significant difference was observed with regards to the total carotenoid content of both fresh tomato and tomato paste with and exception of Kivo and Leap. Deductively, proximate compositions of the tomato paste were significantly higher than the fresh tomato excluding moisture content and crude fat. With the exception of the Leap tomato paste which had no protein content, all the other tomato pastes (G, K and T) were significantly in higher amount of protein relative to the fresh tomatoes. These findings were similar to the sodium composition analyzed. The physiochemical composition for total solids, total sugars and Brix content of the tomato pastes were significantly higher than the fresh tomatoes however, pH and total carotenoids of the tomato pastes were not distinctively higher than the fresh tomatoes.

**Keywords:** Tomato, paste, fresh, physiochemical,

## Determination of Nitrogen mineralization potential for Ferric Lixisol under both upland and lowland condition in an incubated study

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### Abstract

Knowing the Nitrogen mineralization potential ability of a given soil prevents overfertilization, which can lead to ground water contamination and other negative effects on the soils. A study was conducted to determine the influence of biochar compost as a soil amendment on nitrogen mineralization rates of a Ferric Lixisol under flooded and upland conditions. Ferric Lixisol was sampled from Northern Ghana and the soil was amended with biochar compost at the rates of 0 kg N/ha, 40 kg N/ha, 80 kg N/ha and 120 kg N/ha and were incubated at two different moisture regimes viz. at field capacity and at flooded condition at room temperature (28 °C). Sampling was done at 2 week intervals to determine the mineral N (NH<sub>4</sub><sup>+</sup>-N and NO<sub>3</sub><sup>-</sup> N) content for a period of 12 weeks. Mineralization values fitted the first order mineralization model of  $N_{min} = N_o[1 - \exp(-kmt)]$  where  $N_{min}$  is the cumulative amount of N mineralized at time t,  $N_o$  is the potentially mineralizable N and km is the mineralization rate constant for the flooded soil and not for the upland soil. With increase in biochar compost level, the gross N mineralized also increased under the flooded condition. N mineralizable potential ranged from 84.53ugN/g soil to 219.64 ugN/g soil at the end of the incubation period. No significant difference existed between the N mineralized at 40 kg N/ha and at 80 kg N/ha of applied biochar compost. Soil with the high rate constants had the least mineralizable potential. Similar trends were observed for ammonification and nitrification for the flooded soil. N immobilization occurred when soil was amended



with 80 kg N/ha during the second month of the incubation studies. For the upland condition, with increase in biochar compost application there was no corresponding increase in the gross N mineralized. Range for the N mineralized occurred was from 199.8 ugN/g to 212.4 ugN/g soil. Highest N mineralization occurred when 80 kg N/ha of biochar compost was applied. Immobilization also occurred in the eight week for all upland treatments. This study shows that within the growing period of rice under flooded condition, N mineralization that occurred (15 – 25 kg N/ha) could benefit the crop grown.

**Keywords:** Ferric Lixisols, Nitrogen, mineralization, potential

## Climate change and environmental sustainability

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### Abstract

Consistent changes in the earth and climatic features in different seasons of the year has prompted this interdisciplinary study into climate change in an attempt to have deeper knowledge of these changes and subsequently proffer solutions to its damaging effects on the environment. It also intends to consolidate the numerous advantages of these changes to make the earth a safe place to live in, devoid of contemporary airborne health challenges. Changes in climatic features show slight drift from its pattern in past decades. Some are observed to have caused hazards such as flood and sea level rise due to thermal expansion of the ocean which in-turn causes damage to the environment and made people live in risk prone areas, thereby endangering their lives. Natural endowments if properly managed would not cause damage to the earth, rather, they add value to human activities in different regions. High level technology when properly applied in the construction of water runoff systems and drainage will prevent flooding. Also, these endowments can be harnessed to generate energy for domestic and industrial uses that would cater for the influx of people into urban areas over the time and enable them engage in activities that enhance their quality life. Fundamentally, change in climate is attributed directly and indirectly to human activities that alters the composition of the global atmosphere. This worsens the environmental conditions, thus, creating social menace. Energy generated due to climatic change can also be used for development rather than depending on hydrocarbon energy sources. This enhances cleaner and safer environment with less tolerance for occupational hazards as a result of influx of hydrocarbon gases. The faster the climate change, the greater the

risk of damage to the environment with attendant decline in ecosystem and extinct of some species.

**Keywords:** Climate change, climatic features, health challenges, human activities, safe environment

## **A systematic review of linear programming techniques as applied to diet optimisation and advancement**

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### **Abstract**

The foods we consume provide nourishment for our bodies. Therefore, diets that provide the required or recommended nutrients are very important. However, meeting this need has posed several dietary-related problems. To add to these problems, there is increasing advocacy for sustainable diets to meet these recommended nutrient requirements but with environmental considerations. Sustainable diets must meet nutritional requirements and be affordable, acceptable, and environmentally friendly. Meeting the requirements of a sustainable diet in dietary problems are classified as complex because of all the dimensions that must be satisfied. Researchers have studied the application of the linear programming tool in addressing these dietary problems. The review exercise aimed at exploring the extent of the use of mathematical approaches towards addressing dietary problems using the systematic review method. A systematic approach was adopted for the exercise. The major search engines used were Scopus, PubMed, and other electronic means of acquiring data based on selected keywords. Duplicated articles were also excluded and accounted for as one. Articles obtained were scrutinised thoroughly, and titles were reviewed before passing them for data analysis. Total number of articles obtained from the search activity was 247. Fifty were retained after the criteria for inclusion were applied to them. Out of the 50 articles retained, only two studies used goal programming and non-linear generalised mathematical approaches to address dietary problems. Aside from these two, all other studies used the linear programming approach, focusing on one of two constraints, making it impossible to meet the multi-criteria factors of a sustainable diet. As such, many researchers are proposing an extension of linear programming, multi-objective optimisation. Goal programming and weighted sum are multi-objective approaches that can meet multi-defined goals. The methods can be explored to address sustainable dietary problems.

**Keywords:** linear programming, diet optimisation, objective function, constraint, variables

## A dendritic reusable nanostructured substrate for the detection of volatile organic compounds in air

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### Abstract

Volatile organic compounds (VOCs) are released into air mainly from industrial activities, explosives, glossy materials and dye production. These compounds have been identified as highly toxic in nature having both short and long-term adverse impact on human health. As a result, a simple yet robust detection assay for their monitoring and control is in demand. In this work, a dendritic Au nanoarchitecture has been fabricated via H<sub>2</sub>O<sub>2</sub> induced aggregation of citrate stabilised gold nanoparticles (AuNP). The Au dendrites were immobilized onto a stainless-steel sheet to form a field deployable surface enhanced Raman spectroscopic (SERS) substrate. This new substrate offers the advantages of ease in handling, long term stability and convenience in transport in cases of field measurement and analysis. The caged nature of the fabricated dendritic Au nanoarchitecture created numerous hotspots which significantly enhanced the sensitivity of the substrate for SERS detection. The developed SERS substrate was then used for the detection of 0.1 mM toluene vapour in air.

**Keywords:** Organic, volatile, detection, compounds

## Defining sesame, and the lignan profiles of sesame seeds prospected from Kpembe in Northern Ghana

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### Abstract

Sesame (*Sesamum indicum* L. Pedaliaceae) is one of the oldest oil seed crops thought to have originated in Africa. The demand for sesame seed has grown rapidly, and the planting area of sesame has almost doubled in the last twenty years in Africa, including Ghana. Sesame seed contains approximately 45 - 50% oil, 25% protein, tocopherols, phytosterols, vitamin B1, and dietary fibre. They are also an excellent source of phosphorous, iron, magnesium calcium, manganese, copper, and zinc. In addition to these important nutrients, sesame seeds contain unique lignans such as, sesamin, sesamolin, sesamol and sesaminol. The lignan profile of sesame seeds is becoming one of the key selection factors for sesame as food since it influences its health benefits. Ghana is an emerging sesame growing country where sesame growers currently rely on wild, hunted, and open market planting seeds. Sesame seeds sold on the Ghanaian market are mixed coloured and do not attract premium market value. It also puts its lignan and nutritive value in ambiguity. In this study, we collected sesame from Kpembe in Northern Ghana and segregated it into seed fractions based on pericarp colour and further analysed these fractions for lignans with assistance from a collaborative institutional material transfer agreement between University of Ghana and Suntory Foundation for Life Sciences, Kyoto, Japan. The data provides insight into how the biochemical status of a seed can be distinct. Differences in the lignan profiles observed in single seeds from non-uniform-coloured seeds suggests that the biochemical activity of lignan metabolism is not necessarily synchronized in each individual sesame seed.

**Keywords:** Sesame, lignans, seed quality

## The emerging greenhouse technology: A reliable controlled growing environment to achieve improved yields and profits

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### Abstract

Sustainable agriculture and food systems have been topical in recent times due to the call to end hunger, achieve food security and improve nutrition. In Sub-Saharan Africa, there are shortfalls in vegetable harvests despite great efforts by farmers. Food demand far outstrips availability, and this has resulted in food insecurity and malnutrition throughout the region, including Ghana. Food shortage arguably is caused by factors such as the over reliance on rainfall, insect pests and diseases infestations, lack of technology, high cost of planting materials or agricultural inputs, and financing. The complexity of inadequate food requires a holistic and coordinated approach to meet the local demand for vegetables. To meet consumer preferences for clean vegetables, farmers abuse pesticides which subsequently contaminate farm produce and render them unsafe, while also polluting water bodies. Ghana is compelled to rely on the importation of some vegetable crops from neighbouring countries. The immediate intervention has been the introduction of the greenhouse technology which takes care of: food safety, sustainable production, and cost-effectiveness. The greenhouse technology has the potential to enhance resource use efficiency, increase productivity and quality of food. The technology is attractive to the youth, adaptable to urban spaces and makes use of marginal lands

**Keywords:** greenhouse, vegetables, agro-technology