



2ND ACAFP FOOD SAFETY CONFERENCE FOR AFRICA



12 - 14 DEC ACCRA, GHANA



African Union





2nd ACAFP Food Safety Conference for Africa

THEME: Towards a safer food supply for Africa

12th – 14th December 2023

Erata Hotel, Accra, Ghana

PROGRAMME

THE TIME INDICATED IS GHANA TIME (GMT+0)



Contents

<i>Note from President of ACAFP</i>	<i>1</i>
<i>Welcome Message from LOC Chair</i>	<i>2</i>
<i>ACAFP Board Members</i>	<i>3</i>
<i>ACAFP Continental Scientific Committee</i>	<i>3</i>
<i>Local Organizing Committee Chairs / Members</i>	<i>4 - 5</i>
<i>Official Opening & Goodwill Messages</i>	<i>6</i>
<i>Day One Sessions</i>	<i>6 - 10</i>
<i>Day Two Sessions</i>	<i>11 - 14</i>
<i>Day Three Sessions</i>	<i>15 - 16</i>
<i>African Union Interafrican Bureau for Animal Resources</i>	<i>18 - 19</i>
<i>Poster Presentations</i>	<i>20 - 21</i>





NOTE FROM PRESIDENT OF ACAFP

Joseph A. Odumeru Ph.D

Dear Delegates,

It is indeed a pleasure to welcome all delegates to the second ACAFP Conference on Food Safety in Africa scheduled for Dec 12 – 14, 2023 in Accra, Ghana. This is an in-person conference for 100 plus participants from Africa and around the world

including food safety professionals from industry, research, and academia; policy makers and regulators; food value chain actors such as farmers, processors, traders and consumers; students; development partners; and all persons interested in protecting the food supply. The conference will benefit Africa as a whole, as well as government departments, regulatory bodies, farmers, processors, traders, students, academia, researchers, other food safety professionals and the public. This will be the second biennial conference being organised by ACAFP and partners with the aim of improving food safety and quality in Africa. The immediate benefit will be learning together through knowledge exchange in key areas of food safety and nutrition which supports the AU's Malabo Declaration of Ending Hunger by 2025 as well as Sustainable Development Goal 2 of Zero Hunger by 2030. The ACAFP conference also provides avenues for networking with professionals outside of Africa to broaden the sources of talents (knowledge base) needed to address food safety issues.

Hosting an in-person Conference on Food Safety in Africa is one of the top goals and objectives of ACAFP and the Board of Directors of the organization are very happy to partner with African Union Commission (AUC), Food and Agriculture Organization (FAO) and International Association of Food Protection (IAFP) in hosting this important and valuable Conference on Food Safety in Africa. The conference theme is “Towards a Safer Food Supply for Africa” and 5 subthemes that address this theme. We are very confident that the excellent scientific and food safety policy-based content of the conference proceedings including technological advancements will contribute to the current and future Food Safety initiatives in Africa. We welcome delegates across the continent of Africa and outside the continent and exhibitors to participate in our second food safety conference in Africa. We look forward to your participation in the presentations, posters, and exhibition of food safety technologies and products, and exchange of scientific and policy related information on food safety in Africa.



Prof. Paa Nii Johnson

WELCOME MESSAGE

BY THE CHAIR OF THE LOCAL ORGANIZING COMMITTEE

Excellences, distinguished guest, delegates, colleagues, distinguished ladies and gentlemen, It gives me great pleasure as, Chairman of the Local Organizing Committee of the 2nd ACAFP Conference, themed “Towards a safer Food Supply for Africa”, from 12th to 14th of December, to welcome you to Accra.

This conference is being organized at the behest of the African Continental Association for Protection, an affiliate of the International Association of Food Protection. We will be welcoming between 100-150 participants from Africa and around the world that will include food safety professionals from industry, research, and academia as well as policy makers and regulators. Additionally, we expect the participation of food value chain actors, students, processors, consumers, and development partners.

As the Local Organizing Committee, we have taken all possible steps to ensure that all participants will enjoy their stay and have a memorable conference experience. I am very confident that this 2nd conference, on food safety issues in Africa, will rise to the occasion by coming out with far-reaching positive outcomes contributing to nutritious and safer food production, distribution, and consumption in Africa.

CONFERENCE SPONSORS



ACAFP BOARD MEMBERS



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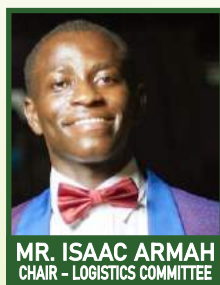


DR. IFEOLUWA
OLOTU ADEKOJA

ACAFP CONTINENTAL SCIENTIFIC COMMITTEE

- **Dr. Rose Omari (Chair)** - CSIR - Science and Technology Policy Research Institute, Ghana
- **Prof. Olusegun Adewale Obadina** - Federal University of Agriculture, Abeokuta, Nigeria
- **Dr. Ajesutomi. O. Abiodun-Solanke** - Federal College of Fisheries and Marine Technology, Nigeria
- **Prof. Kebede Amenu** - International Livestock Research Institute, Addis Ababa, Ethiopia
- **Prof. Charles Muyanja** - Makerere University, Uganda
- **Mr. Abdoulie Jallow** Food safety and Quality Authority, The Gambia
- **Dr. Blaise Ouattara** - Food Safety and Quality Officer Division, FAO Regional Office for Africa

LOCAL ORGANIZING COMMITTEE CHAIRS



LOCAL ORGANIZING COMMITTEE MEMBERS

Scientific committee members

- **Dr. Gloria Essilfie (Chair)** – Dept. of Crop Science, Univ. of Ghana,
- **Mr. Sylvester Asiamah** - Cargill, Ghana
- **Dr. Joycelyn Quansah** – Dept. of Nutrition & Food Science, Univ. of Ghana
- **Mrs. Faustina Atupra** - Food and Drugs Authority (FDA)
- **Dr. Rose Omari** - CSIR - Science and Technology Policy Research Institute, Ghana
- **Prof. Paa Nii Johnson** - CSIR- College of Science & Technology
- **Dr. Angela Parry-Hanson** -Dept. of Nutrition & Food Science, Univ. of Ghana
- **Dr. Bernard Darfour** - Ghana Atomic Energy Commission (GAEC)
- **Prof. Frederick Adzitey** - University for Development Studies (UDS)
- **Mr. Andrew Lartey** - Ghana Standards Authority (GSA)
- **Mrs Diana Ama Pokua Adu Dartey** - PCO- GeniusEvent & Services: Professional Conference Organizer



Finance committee members

- **Dr. Nicole Sharon Affrifah (Chair)** – Dept. of Food Process Engineering, University of Ghana
- **Mrs. Faustina Atupra** - Food and Drugs Authority
- **Mr. Andrew Lartey** - Ghana Standards Authority
- **Ms. Sylvia Baah-Tuahene** - CSIR-STEPRI/ Univ. of Ghana
- **Mr. Isaac Armah** - Quality Agrocommodities Ventures
- **Dr. Rose Omari** - CSIR - Science and Technology Policy Research Institute
- **Dr. Blaise Ouattara** - Food Safety and Quality Officer Division, FAO Regional Office for Africa
- **Dr. John Oppong Otoo** - African Union Interafrican Bureau for Animal Resources (AU-IBAR)
- **Ms. Dorothy Oppey** - Ghana Standards Authority
- **Mrs. Diana Ama Pokua Adu-Dartey** – Genius Events

Logistics committee members

- **Mr. Isaac Armah (Chair)** - Quality Agrocommodities Ventures
- **Mr. Sylvester Asiamah** - Cargill, Ghana
- **Dr. Gloria Essilfie** - Univ. of Ghana
- **Dr. Joycelyn Quansah** - Univ. of Ghana
- **Ms. Fati Saaka** - CSIR - Science and Technology Policy Research Institute
- **Mrs. Diana Ama Pokua Adu-Dartey** – Genius Events

Social media committee members

- **Dr. Bernard Darfour** - Ghana Atomic Energy Commission
- **Ms. Sylvia Baah-Tuahene** – University of Ghana / CSIR-Science and Technology Policy Research Institute

IMPORTANT NOTICE

Registration begins - Monday, 11th December, 2023 from 15:00 hours to 20:00 hours



DAY ONE – 12TH DECEMBER 2023

6:30 – 8:45	Registration of Participants
OFFICIAL OPENING SESSION 08:50 – 10:40 A.M. Moderator/MC: Ibrahim Kwame Asante Rapporteurs: Sylvia Baah-Tuahene and Priscilla F. Barnes	
8:50 – 9:00	Welcoming Participants (MC: Ibrahim Kwame Asante , CSIR-STEPRI, Ghana)
9:00 – 9:10	Prof. Joseph Odumeru , Welcome Remarks (ACAFCP President) (<i>virtual/recorded</i>)
9:10 – 9:15	Goodwill message by IAFCP (<i>virtual/recorded</i>)
9:15 – 9:20	Mr. David Phiri – (Special Adviser to the ADG/Regional Representative) Goodwill message by FAO
9:20 – 9:25	Goodwill message by Mr. Samuel Dery, Marketing Director-GB Foods
9:25 – 9:30	Prof. James Wabacha (African Union Interafrican Bureau for Animal Resources - AU-IBAR) Goodwill message by AUC
9:30 – 9:50	Dr. Bryan Acheampong (Minister for Food & Agriculture) Opening Address & Official opening of Conference
9:50 – 10:00	ACAFCP Food Safety Conference - Technical program at a glance (Prof. Paa Nii. T. Johnson , LOC Chair)
10:00 – 10:40	Keynote Presentation 1: Food Safety, Nutrition Security and Long-Term Health Outcomes in Africa: Implications for Research, Training and Practice (Prof Paul Amuna , Associate Professor of Public Health Nutrition, University of Health and Allied Sciences, Ho, Ghana)
10:40 – 11:00	Group Photo & Health Break



PARALLEL SESSION 1A (Room 1)

Moderator: Dr. Daniel Agbetiameh

Rapporteurs: Dr. Titilayo Ajayeoba

Theme 5: - Technological advances in food safety

Theme 2: - Integration of food safety with food and nutrition security in Africa

11:00 -11:20	Victor Ohileobo Dania Formulation of essential oils as biofungicides for the preservation of sweet orange (<i>Citrus sinensis L.</i>) against postharvest rot disease
11:20 – 11:40	Beatrice Boakyewaa Blay - Assessment of Aflatoxin M1 in processed and raw untreated milk obtained from selected locations in Accra, Ghana.
11:40 – 12:00	Nii Korley Kortei - Toxicogenic fungal profile, ochratoxin A exposure and cancer risk characterization through maize (<i>Zea mays</i>) consumed by different age populations in the Volta region of Ghana
12:00 – 12:20	James Owusu-Kwarteng - Evaluation of rapid molecular methods for detecting <i>Salmonella enterica</i> in red chili powder.
12:20 – 12:40	Augustine Domfeh - Trace metals contamination in varieties of cereal-based pediatric foods sold in parts of Accra, Ghana.
12:40 – 13:00	Innocent Pahla - Morphological and molecular characterisation of the parasitoid complex of <i>Liriomyza</i> leafminer (Diptera: Agromyzidae) species in small scale vegetable production sector of Zimbabwe.

PARALLEL SESSION 1B (Room 2)

Moderator: Dr. Gbenga Adedeji Adewumi

Rapporteur: Priscilla F. Barnes

Theme 1: - Innovative capacity-building approaches to food safety in Africa

Theme 4: - Food safety policies and regulations in Africa

Theme 3: - Implementing one health approach for food safety in Africa

11:00 – 11:20	Geoffrey A. Asalu - Health-related information on pre-packaged foods and beverages in Ghana: Prevalence and compliance with regulations.
11:20 – 11:40	Ekor Anyimah-Ackah - Understanding the Nexus of Food Safety and Nutrition Security: Analysis of fried sausage and Chicken Intake, Risk Attitudes, and Burden of Malnutrition among School-Going Children.
11:40 – 12:00	Vivian Geraldo Foli - Implementation of a basic GMP/HACCP system to improve the quality of smoked fish.
12:00 – 12:20	Nsah-ko Tchoumboue - Small scale food processing mills in Cameroon: Socio-economic and technical characteristics assessment
12:20 – 12:40	Sylvia Baah-Tuahene - Prioritising Ghana's aflatoxin policy implementation plan using P-IMA and multistakeholder approaches
12:40 – 13:00	Lillian Owembabazi - Joint Crop and Livestock clinics in Uganda: Contributing to food safety using a one health approach
13:00-14:00	Lunch
14:00 – 14:45	Plenary Presentation 1: Innovative programmes for advancing food safety in the formal and informal sectors in Ghana. Ms. Nana Akua Serwaa Yeboah , Head of Food Safety Coordination & Biosafety Unit, Food and Drugs Authority). Moderator: Dr. Gloria Essilfie Rapporteurs: Desmond Asante Karikari



14:45 – 15:30	<p>Plenary Presentation 2: FAO's Food safety program in Africa and its implementation in the context of AfCFTA Dr. Blaise Ouattara, Food Safety and Quality Officer, FAO Regional Office for Africa) (Virtual) Moderator: Dr. Joycelyn Quansah Rapporteurs: Akosua Kessewaa Essel</p>
15:30 – 15:40	Health Break
<p>PARALLEL SESSION 2A (Room2) Moderator: Dr. Daudu Oladipupo Abdulazeez Yusuf Rapporteurs: Ruth Mma Alando</p>	
<p>Theme 5: - Technological advances in food safety Theme 2: - Integration of food safety with food and nutrition security in Africa</p>	
15:40 – 16:00	Adenike Blankson - Microbial quality of <i>Citrullus colocynthis</i> (Melon) and <i>Glycine max</i> (Soya) seed protein concentrate-complemented breads
16:00 – 16:20	Olasunmbo Ajayi - Quality assessment and antimicrobial activity of edible oils on selected foodborne pathogens.
16:20 – 16:40	Priscilla F. Barnes - Quality Assessment of Palm Oils Sold in Accra and the Risk of Consumption of Palm Oils Adulterated with Sudan IV
16:40 – 17:00	Felix Kwashie Madilo - Development of lactic acid bacteria and yeast starter cultures for safety and improved sensory properties of aliha.
17:00 – 17:20	Frederick Sarpong - Browning pigmentation evolution and bioactive compounds assessment of coconut syrup production.
17:20 – 17:40	Jokodola Temilola Tolulope - Preliminary studies on prevalence of resistant <i>Campylobacter</i> pathogens in Ready-to-eat beef meat products

PARALLEL SESSION 2B (Room 1)

Moderator: Prof James Owusu-Kwarteng

Rapporteurs: Lillian Owembabazi

Theme 1: - Innovative capacity-building approaches to food safety in Africa

Theme 4: - Food safety policies and regulations in Africa

Theme 3: - Implementing one health approach for food safety in Africa

15:40 – 16:00 **Ruth Mma Alando** - Aflatoxin Management: An Integrated Approach for Enhancing Food Safety

16:00 – 16:20 **Marilyn Asiedu Sefa** - Food transformations: Navigating e-commerce's impact on food consumption

16:20 – 16:40 **Selasie Tsegah** - Microbial safety of street foods in Ghana: A systematic review

16:40 – 17:00 **Etorny Agbeko** - Commercial production of all-male Nile Tilapia, *Oreochromis niloticus* for food fish: the one-health approach.

17:00 – 17:20 **Abubakari Mohammed** - Out-of-home eating, dietary patterns and diarrhoea occurrence among Ghanaian female traders and farmers

17:20 – 17:40 **Francis Z. Taabia** - Mangrove oysters (*Crassostrea tulipa*) from selected estuarine sites in Ghana: mineral concentrations and health risk assessment of heavy metal contamination among women shellfishers.

17:40 – 19:00 **Welcome and Networking Cocktail**

End of Day 1



DAY TWO 13th December, 2023

08:30 – 09:25 **Plenary Presentation 3:** Continental Food Safety Initiatives

Dr. John Oppong Otto, Coordinator, Economics, Trade and Marketing Unit, African Union Interafrican Bureau for Animal Resources - AU-IBAR) (**virtual**)

Moderator: Prof. Olusegun Adewale Obadina

Rapporteurs: Selasie Tsegah

PARALLEL SESSION 3A

Moderator: Dr. Geoffrey A. Asalu

Rapporteurs: Innocent Pahla

Theme 5: - Technological advances in food safety

Theme 2: - Integration of food safety with food and nutrition security in Africa

09:25 – 09:45 **Joycelyn K. Quansah** - Antibiotic resistance characterization of *Escherichia coli* isolated from green leafy vegetables in Accra

09:45 – 10:05 **Desmond Asante Karikari** - Exposure Assessment of Some Heavy Metals (Arsenic, Lead, Cadmium, Mercury, Copper and Zinc) in Locally Produced Rice Sold in Accra Metropolis

10:05 – 10:25 **Titilayo Ajayeoba** - Evaluation of microbial, nutritional and sensory properties of cereal and legume blends of traditional weaning food (turn-brown).

PARALLEL SESSION 3B

Moderator: Dr. Etornyo Agbeko

Rapporteurs: Marilyn Asiedu Sefa

Theme 1: - Innovative capacity-building approaches to food safety in Africa

Theme 4: - Food safety policies and regulations in Africa

Theme 3: - Implementing one health approach for food safety in Africa

09:25 – 09:45	Sylvia Baah-Tuahene - Assessment of the food safety knowledge, attitudes and practices of maize and groundnut value chain actors in Ghana
09:45 – 10:05	Courage K. Besah-Adanu - Increasing Food Safety and Quality through Supply Chain building in Ghana – Experience made in the Honey Sector
10:05 – 10:25	Patricia Adoma and Francis Appiah - Effect of Different storage temperatures on quality of freshly squeezed juice from three varieties of pineapple
10:25 – 10:40	Health Break
10:40 – 11:40	<p>Keynote Presentation 2: From Farm to Fork: Transforming African Food Safety Together</p> <p>Dr. Irene Akpeokhai, Global Packaging Director, GB Foods, Spain (Virtual)</p> <p>Moderator: Dr. Nicole Sharon Affrifah</p> <p>Rapporteurs: Dr. Ekpor Anyimah-Ackah</p>
<p>PARALLEL SESSION 4A (Room 1)</p> <p>Moderator: Dr. Frederick Sarpong</p> <p>Rapporteurs: Vivian Geraldo Foli</p> <p>Theme 5: - Technological advances in food safety</p> <p>Theme 2: - Integration of food safety with food and nutrition security in Africa</p>	
11:40 – 12:00	William T. Lanier - Harvest-tenure Promotes Innovative Technologies, Practices, Tools to Reduce Loss and Preserve Safe Food Commodities
12:00 – 12:20	Jokodola Temilola Tolulope - Risks and levels of post-cooking incidence of Pesticide residues in Cowpea (<i>Vigna unguiculata</i>) in Ogun State



12:20 – 12:40	Kwabena Owusu Ansah Nutrient digestibility, growth and nitrogen balance of West African Dwarf Goats fed diets containing graded levels of biochar.
12:40 – 13:00	Akosua Kessewaa Essel - Dietary exposure levels of polycyclic aromatic hydrocarbons (PAHs) in street vended re-used frying oils
PARALLEL SESSION 4B	
Moderator: Prof Nii Korley Kortei	
Rapporteurs: Abubakari Mohammed	
<p>Theme 1: - Innovative capacity-building approaches to food safety in Africa</p> <p>Theme 4: - Food safety policies and regulations in Africa</p> <p>Theme 3: - Implementing one health approach for food safety in Africa.</p>	
11:40 – 12:00	Obadina Adewale Olusegun - Microbiological quality and safety assessment of kulikuli produced in selected locations in Ogun state Southwest, Nigeria
12:00 – 12:20	Gbenga Adedeji Adewumi - Evaluation of the bacterial diversity and safety assessment of ready-to-eat African salad sold in Lagos, Nigeria
12:20 – 12:40	Daudu Oladipupo Abdulazeez Yusuf - Evaluation of insect pest tolerance and oil quality in ethyl methane sulfonate (EMS) exposed groundnut (<i>Arachis Hypogaea</i> L.)
12:40 – 13:00	Lucy Asare - Technical design and safety evaluation of an ohmic chamber in the processing of brukina.
13:00 – 14:00	Lunch



14:00 – 15:00	<p>Plenary Presentation 4: WHO Global Strategy for Food Safety: Towards Stronger Food Safety Systems and Global Cooperation</p> <p>Ms. Lusubilo Witson Mwamakamba, Technical Officer for Food Safety, WHO Regional Office for Africa, Brazzaville. Congo) (Virtual)</p> <p>Moderator: Dr. Rose Omari</p> <p>Rapporteurs: Felix Kwashie Madilo</p>
15:00 – 16:00	<p>Poster Presentations (Refer to page 21 for poster titles)</p> <p>Moderator/Coordinators: Isaac Armah and Abubakar Mohammed</p> <p>Rapporteurs: Augustine Domfeh</p>
16:00 – 16:10	<p>Health Break</p>
16:15 – 17:00	<p>Plenary Learning Event: Evidence-based decision making in food safety using Multi Criteria Decision Analysis</p> <p>Mr. Isaac Briandt Gokah, Specialist, Regional Food Trade and Resilience, AGRA, Nairobi, Kenya) (Virtual)</p> <p>Moderator: Prof Paa Nii T. Johnson,</p> <p>Rapporteurs: Beatrice Boakyewaa Blay</p>
	<p>END OF DAY 2</p>



DAY THREE - 14th December 2023

PARALLEL SESSION 5: Virtual Presentations by Registered Participants

Moderator: Dr. Bernard Darfour, Ghana Atomic Energy Commission, Ghana

Rapporteurs: Fati Saaka

8:00 – 8:20 **Chibundu N. Ezekiel** - Snapshot mycotoxin profiling of Ready-to-Use Therapeutic Foods intended for severely and acutely malnourished children in Nigeria.

8:20 – 8:40 **Yinka M. Somorin** - Microbiological safety and antimicrobial resistance in fresh produce production in Africa

8:40 – 9:00 **Chibundu N. Ezekiel** - Fungal diversity and mycotoxins in rice produced in South-West, Nigeria is influenced by postharvest practices.

9:00 – 10:15 **Panel Discussion:** Ensuring food safety through increased collaboration among food safety stakeholders – Sharing good practices and lessons.

Moderator: Dr. Gloria Essilfie, University of Ghana

Panellists: Mrs Joycelyn Agyarkwa-Amusah (Food and Drugs Authority, Ghana),

Dr. Joycelyn Quansah (University of Ghana),

Dr. Rose Omari (CSIR-STEPRI, Ghana),

Dr. Margaret Mary Tohouenou (Nestle, Ghana),

Rev. Mrs. Georgina Filson Smith (Ginafil Food Processing & Entrepreneurial Development Training Industry, Takoradi, Ghana),

Mrs. Hilda Naa-Aku Adjei (Food Safety Educator)

Rapporteurs: Sylvia Baah-Tuahene & Kwabena Owusu Ansah

10:15 – 10:30

Health Break

PARALLEL SESSION 6 Virtual Presentations by Registered Participants**Moderator:** Sylvester Asiamah**Rapporteurs:** Lucy Asare

10:30 – 10:50	Ajesutomi O. Abiodun-Solanke - Waste to Wealth: Finding applicability for the use of orange (<i>Citrus sinensis</i>) peel as seafood preservatives
10:50- 11:10	Mary Funmilayo Oloyede - Nutrients and phytochemicals in Nigerian underutilized fruits and vegetables
11:10 – 11:30	Mathias Twizeyimana - Bacteria displaying antimicrobial activity against <i>Aspergillus</i> spp., a new approach in managing aflatoxin in maize grains.
11:30 – 12:10	Keynote Presentation 3: Global burden of Antimicrobial Resistance: monitoring and evaluation of ready-to-eat Vegetables. Prof. Olusegun Adewale Obadina , Federal University of Agriculture, Abeokuta, Nigeria) Moderator: Prof Frederick Adzitey & Andrew Larrey Rapporteurs: Ms. Dorothy Oppey
12:10 – 12:50	ACAFC Business Meeting - Presentation of Awards
12:50 – 13:30	Closing Ceremony Closing Remarks by - LOC Chair - AUC - ACAFC President - Government Official Moderator/MC: Ibrahim Kwame Asante, CSIR-STEPRI, Ghana Rapporteurs: Marilyn Yeboah & Selasie Tsegah
13:30 –14:00	Lunch & Departure
14:00 – 17:00	FREE TIME



GB FOODS

GBfoods is present in more than 50 countries in Europe and Africa. They include Spain, Italy, Germany, France, Belgium, the Netherlands, Sweden, Finland, Nigeria, Ghana, Algeria and Senegal, among others.

We are also proud of our well-known historical brands in each one of these countries, such as Jumbo, Gallina Blanca, Erasco, Gino, Liebig, Star, D&L, Grand'Italia and Blå Band, among others. Some of these dearly beloved brands have been in consumers' kitchens for more than 150 years, to the point where they are now an integral part of the local culture.





AFRICAN UNION INTERAFRICAN BUREAU FOR ANIMAL RESOURCES

African Union – Interafrican Bureau for Animal Resources (AU-IBAR) is a specialized technical office of the African Union Commission (AUC), headed by the Director who reports directly to the AUC through the Department of Rural Economy and Agriculture (DREA).

Established as the Interafrican Bureau of Epizootic Diseases (IBED) in 1951 to study the epidemiological situation of and commence the fight against rinderpest in Africa, the organization today bears the name African Union – Interafrican Bureau for Animal Resources (AU-IBAR). This name-change reflects its broader mandate, which is to support and coordinate the improved utilization of animals (livestock, fisheries and wildlife) as a resource for human wellbeing in the Member States of the African Union (AU), and to contribute to economic development, particularly in rural areas. AU-IBAR's main clients are the African Union (AU) Member States and the Regional Economic Communities (RECs) to which they belong.

Vision

An Africa in which animal resources contribute significantly to the reduction of poverty and hunger.

Mandate

To support and coordinate the utilization of animals (livestock, fisheries and wildlife) as a resource for human wellbeing in the Member States of the African Union and to contribute to economic development. The specific areas of the mandate are to:



1. Improve public and animal health through the control and possible eradication of transboundary animal diseases and zoonoses;
2. Improve the management of animal resources and the natural resource bases on which they depend;
3. Explore investment options and enhance competitiveness of African animal products;
4. Contribute to the development of relevant standards and regulations and enhance compliance by Member States;
5. Strengthen institutional capacity and support policy development and harmonization;
6. Disseminate information and knowledge on animal resources to Member States, Regional Economic Communities and other relevant institutions; and
7. Provide essential support to Member States with special needs or in emergency situations.



POSTER PRESENTATIONS

1. **Godswill Ntsomboh-Ntsefong** - Palm oil: A sustainable source of nutrition, health, and environmental benefits for Africa
2. **Akua Foriwaa Kwarteng** - Exploring the Nexus of Food Waste, Food Safety, and Nutrition Security: A Survey of Food Waste on Senior Members at KNUST-Kumasi, Ghana
3. **Nii Korley Kortei** - Aflatoxin M1 exposure in a fermented millet-based milk beverage 'brukina' and its cancer risk characterization in Greater Accra, Ghana
4. **Nii Korley Kortei** - Exposure and risk characterizations of ochratoxins A and aflatoxins through maize (*Zea mays*) consumed in different agro-ecological zones of Ghana.
5. **Lisa Vicky Boahemaa** - Physicochemical And Functional Characterization of Flour and Starch from Taro (*Colocasia Esculenta*).
6. **Rabiat Unekwu Hamzah** - Effect of Different Processing Methods on Phytochemicals and Proximate Composition of Leaves of *Pterocarpus mildbraedii*, *Adansonia digitata* and *Jatropha tanjorensis*.
7. **Sylvester Asiamah** - Exploring the trade-off of plastic packaging on food safety, its effects on health and the environment with a focus on regulation in Africa.
8. **Nii Korley Kortei** - Mycoflora, aflatoxins and antimicrobial properties of some Ghanaian local spices and herbs.
9. **Amarachukwu Anyogu** - Food safety issues associated with sesame seed value chains.
10. **Monica K. Kansiime** - Business models for agri-service provision with attention to creation of income opportunities for young people.
11. **Ndela Dominic Ngagmayan** - Effect of aflatoxigenic and non-aflatoxigenic strains of *Aspergillus flavus* on aflatoxin accumulation in groundnuts



12. **Yinka M. Somorin** - Microbiological safety and antimicrobial resistance in fresh produce production in Africa .
13. **Emmanuel D. Boamah** - Pre-and Post-harvest insect pests and mycotoxin contamination of yellow maize genotypes in Asante Mampong Municipality of Ghana
14. **Fasoyiro, S. B** - Enhancing Knowledge of Quality Processing and Food Safety Practices of Women cassava product (Garri) processors in Iwo, Osun State of Nigeria
15. **Stephen K. Kanten Monten** - Prevalence and phenotypic resistance of Salmonella enterica isolated from guinea fowl farms in one health concept
16. **Grace Idowu Mogaji** Phytochemical screening and antimicrobial activities of *Aframomum danielli* (aqueous and ethanolic) extracts







2ND ACAFP FOOD SAFETY CONFERENCE FOR AFRICA

Book Of Abstracts



12th - 14th DEC 2023 ACCRA, GHANA

Book of Abstracts

Message by the Scientific and Programme Committee

Africans suffer the highest burden of foodborne diseases worldwide with an estimated 137,000 deaths and over 91 million illnesses annually. This has huge ramifications on Africa's economy with estimated losses of \$16 billion in annual productivity. Food safety is a responsibility for all; therefore, this conference brings together food safety academics, researchers, practitioners, policy makers, health professionals, industry players, development partners and students to share and discuss pertinent food safety issues on the continent.

This is the second conference being organized by the African Continental Association for Food Protection (ACAFA), in partnership with the Africa Union Commission (AUC), Food and Agriculture Organisation (FAO) and the International Association for Food Protection (IAFP). The main theme of the Conference is "*Towards a safer food supply for Africa*". The conference presentations have been structured under five sub-themes namely, 1) Innovative capacity-building approaches to food safety in Africa; 2) Integration of food safety with food and nutrition security in Africa; 3) Implementing one health approach for food safety in Africa; 4) Food safety policies and regulations in Africa; and 5) Technological advances in food safety.

The conference will comprise three keynote presentations, four plenary presentations, one learning event, 44 technical oral presentations, 16 poster presentations and one panel discussion. The Call for Abstracts yielded an impressive response with over 180 abstracts submitted of which 86 were accepted for oral presentation and 50 for posters. It is unfortunate that all the authors whose abstracts were accepted cannot attend the conference due to various reasons including lack of travel support. We are however happy that, against all odds, you have successfully registered and are attending the conference in-person.

The abstracts for the oral and poster presentations have been compiled into this book of abstracts, which can be downloaded from the conference website. We encourage the presenters who wish to publish their papers in journals to do so, taking into consideration comments and suggestions that may be provided at this conference. The Scientific Committee has identified the underlisted journals for your consideration.

- African Journal of Food, Agriculture, Nutrition and Development
<https://www.ajfand.net/#gsc.tab=0>
- Food Safety and Risk <https://foodsafetyandrisk.biomedcentral.com/>
- Journal of Health, Population and Nutrition <https://jhpn.biomedcentral.com/>
- Journal of Food Safety <https://onlinelibrary.wiley.com/journal/17454565>
- Food Science and Nutrition <https://onlinelibrary.wiley.com/journal/20487177>
- Journal of Food Protection <https://www.sciencedirect.com/journal/journal-of-food-protection>
- Global Food Security <https://www.sciencedirect.com/journal/global-food-security>
- Frontiers in Sustainable Food Systems <https://www.frontiersin.org/journals/sustainable-food-systems/sections/agro-food-safety>
- BMC Nutrition <https://bmcnutr.biomedcentral.com/>
- Environmental health Insights <https://journals.sagepub.com/toc/ehia/9>
- One Health Outlook <https://onehealthoutlook.biomedcentral.com/>
- Food Control <https://www.sciencedirect.com/journal/food-control>
- Journal of Food quality and Hazards Control
https://jfqhc.ssu.ac.ir/index.php?&slct_pg_id=10&sid=1&slc_lang=en

We take this opportunity to thank all members of the Scientific Committee of the Local Organising Committee (LOC) as well as the ACAFP Continental Scientific Committee for working tirelessly to review all the abstracts and prepare this scientific programme.

We also thank other conference planning sub-committees and Prof. Paa Nii Johnson, Chair of the LOC and Prof Joseph Odumeru, ACAFP President for their coordinated efforts and leadership. We also thank all the invited distinguished speakers and presenters for taking the time to share with us their views, experiences, and expertise.

We look forward to welcoming you all to this conference and hope you still can exchange knowledge and build long-lasting memory during this event.

Dr. Rose Omari and Dr. Gloria Essilfie.

ABSTRACTS

Contents

ABSTRACTS FOR ORAL PRESENTATIONS.....	5
Formulation of essential oils as biofungicides for the preservation of sweet orange (<i>Citrus sinensis</i> L.) against postharvest rot disease	5
Assessment of Aflatoxin M1 in processed and raw untreated milk obtained from selected locations in Accra, Ghana.	6
Toxicogenic fungal profile, ochratoxin A exposure and cancer risk characterization through maize (<i>Zea mays</i>) consumed by different age populations in the Volta region of Ghana.	6
Evaluation of rapid molecular methods for detecting <i>Salmonella enterica</i> in red chili powder.....	7
Trace metals contamination in varieties of cereal-based pediatric foods sold in parts of Accra, Ghana.	8
Morphological and molecular characterisation of the parasitoid complex of <i>Liriomyza</i> leafminer (Diptera: Agromyzidae) species in small scale vegetable production sector of Zimbabwe	9
Health-related information on pre-packaged foods and beverages in Ghana: - prevalence and compliance with regulations.....	10
Understanding the Nexus of Food Safety and Nutrition Security: Analysis of Fried Sausage and Chicken Intake, Risk Attitudes, and Burden of Malnutrition among School-Going Children	11
Implementation of a basic GMP/HACCP system to improve the quality of smoked fish.....	11
Small scales food processing mills in Cameroon: Socio-economic and technical characteristics assessment.....	12
Prioritising Ghana's Aflatoxin Policy Implementation Plan using P-IMA and Multistakeholder Approaches	13
Joint crop and livestock clinics in Uganda: Contributing to food safety using a one health approach... ..	14

Microbial quality of <i>Citrullus colocynthis</i> (Melon) and <i>Glycine max</i> (Soya) seed protein concentrate-complemented breads	15
Quality Assessment and Antimicrobial Activity of Edible Oils on Selected Foodborne Pathogens	16
Quality Assessment of Palm Oils Sold in Accra and the Risk of Consumption of Palm Oils Adulterated with Sudan IV	16
Development of Lactic Acid Bacteria and Yeast Starter Cultures for Safety and Improved Sensory Properties of <i>Aliha</i>	17
Browning Pigmentation Evolution and Bioactive Compounds Assessment of Coconut Syrup Production	18
Preliminary Studies on Prevalence of Resistant <i>Campylobacter</i> Pathogens in Ready-to-Eat Beef Meat Products	18
Aflatoxin management: An integrated approach for enhancing food safety.....	19
Food transformations: Navigating e-commerce's impact on food consumption	20
Microbial safety of street foods in Ghana: A systematic review	21
Commercial production of all-male Nile Tilapia, <i>Oreochromis niloticus</i> for food fish: the one-health approach.	21
Out-of-home eating, dietary patterns and diarrhoea occurrence among Ghanaian female traders and farmers.....	22
Mangrove oysters (<i>Crassostrea tulipa</i>) from selected estuarine sites in Ghana: mineral concentrations and health risk assessment of heavy metal contamination among women shellfishers.....	23
Antibiotic Resistance Characterization of <i>Escherichia coli</i> Isolated From Green Leafy Vegetables in Accra.....	24
Exposure Assessment of Some Heavy Metals (Arsenic, Lead, Cadmium, Mercury, Copper and Zinc) in Locally Produced Rice Sold in Accra Metropolis	25
Evaluation of Microbial, Nutritional and Sensory Properties of Cereal and Legume Blends of Traditional Weaning Food (<i>Turn-Brown</i>).....	25
Assessment of the food safety knowledge, attitudes and practices of maize and groundnut value chain actors in Ghana	26
Increasing food safety and quality through supply chain building in Ghana – Experience made in the Honey Sector.....	27
Effect of Different storage temperatures on quality of freshly squeezed juice from three varieties of pineapple	28
Harvest-tenure Promotes Innovative Technologies, Practices, Tools to Reduce Loss and Preserve Safe Food Commodities.....	29
Risks and levels of Post-cooking incidence of Pesticide residues in Cowpea (<i>Vigna unguiculata</i>) in Ogun State	30
Nutrient digestibility, growth and nitrogen balance of West African Dwarf Goats fed diets containing graded levels of biochar.....	31
Dietary exposure levels of polycyclic aromatic hydrocarbons (PAHs) in street vended re-used frying oils	31

Microbiological quality and safety assessment of <i>kulikuli</i> produced in selected locations in Ogun state Southwest, Nigeria.....	32
Evaluation of the bacterial diversity and safety assessment of ready-to-eat African salad sold in Lagos, Nigeria.....	33
Evaluation of insect pest tolerance and oil quality in ethyl methane sulfonate (EMS) exposed groundnut (<i>Arachis hypogaea L.</i>).....	34
Technical design and safety evaluation of an ohmic chamber in the processing of <i>Brukina</i>	35
Snapshot mycotoxin profiling of Ready-to-Use Therapeutic Foods intended for severely and acutely malnourished children in Nigeria.....	35
Microbiological safety and antimicrobial resistance in fresh produce production in Africa	36
Fungal diversity and mycotoxins in rice produced in South-West, Nigeria is influenced by postharvest practices.....	37
Waste to Wealth: Finding applicability for the use of orange (<i>Citrus sinensis</i>) peel as seafood preservatives.....	38
Nutrients and Phytochemicals in Nigerian underutilized fruits and fruits.....	39
Bacteria displaying antimicrobial activity against <i>Aspergillus</i> spp., a new approach in managing aflatoxin in maize grains.....	40
Impact of soil pollution on food security and food safety	41
Foodborne Disease Hazards in Beverages Consumed in Ethiopia: A Systematic Literature Review.....	41
ABSTRACTS OF POSTER PRESENTATIONS	43
Palm oil: A sustainable source of nutrition, health, and environmental benefits for Africa.....	43
Exploring the Nexus of Food Waste, Food Safety, and Nutrition Security: A Survey of Food Waste on Senior Members at KNUST-Kumasi, Ghana.....	43
Aflatoxin M1 exposure in a fermented millet-based milk beverage ' <i>brukina</i> ' and its cancer risk characterization in Greater Accra, Ghana	44
Exposure and risk characterizations of ochratoxins A and aflatoxins through maize (<i>Zea mays</i>) consumed in different agro-ecological zones of Ghana.....	45
Physicochemical And Functional Characterization of Flour and Starch from Taro (<i>Colocasia Esculenta</i>)	46
Effect of Different Processing Methods on Phytochemicals and Proximate Composition of Leaves of <i>Pterocarpus mildbraedii</i> , <i>Adansonia digitata</i> and <i>Jatropha tanjorensis</i>	47
Exploring the trade-off of plastic packaging on food safety, its effects on health and the environment with a focus on regulation in Africa	47
Mycoflora, aflatoxins and antimicrobial properties of some Ghanaian local spices and herbs.....	48
Food safety issues associated with sesame seed value chains	49
Business models for agri-service provision with attention to creation of income opportunities for young people	50
Effect of aflatoxigenic and non-aflatoxigenic strains of <i>Aspergillus flavus</i> on aflatoxin accumulation in groundnuts.....	51

Food safety issues associated with sesame seed value chains	52
Pre-and Post-harvest insect pests and mycotoxin contamination of yellow maize genotypes in Asante Mampong Municipality of Ghana	53
Enhancing Knowledge of Quality Processing and Food Safety Practices of Women cassava product (Gari) processors in Iwo, Osun State of Nigeria.	53
Phytochemical screening and antimicrobial activities of <i>Aframomum danielli</i> (aqueous and ethanolic) extracts.....	54

ABSTRACTS FOR ORAL PRESENTATIONS

Formulation of essential oils as biofungicides for the preservation of sweet orange (*Citrus sinensis* L.) against postharvest rot disease

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Abstract

Sweet orange (*Citrus sinensis* L.) fruits are highly perishable and susceptible to rot disease which causes huge postharvest losses in its production. Currently, conventional fungicides are being used in the preservation against incidence of the disease, especially in the developing countries. However, the increasing awareness and concerns about consumer safety concerns has necessitated the urgent need for ecologically-safe approach in the management of fruits rot disease. Research is now being focused on essential oils (EOs) obtained from plants as eco-friendly alternatives to chemical fungicides for the control of plant diseases. This study investigated the antimicrobial activity of biofungicide formulations from the EOs of four botanicals, *Syzygium aromaticum*, *Azadirachta indica*, *Cymbopogon citratus* and *Ocimum gratissimum* as treatments against citrus fruit decay. The EOs were evaluated at five concentrations, 0, 250, 500, 750 and 1000 µg/mL against two fruit rot pathogens of *C. sinensis*, *Botrytis cinerea* and *Penicillium digitatum* in vitro and in vivo. The experimental design was a 5×4×2 factorial in a completely randomized design with three replicates. The EOs were extracted using hydro-distillation, while the phytochemicals were analyzed by thin layer chromatography and gas chromatography-mass spectrometry. It was observed that nanoemulsions prepared using ultra-sonification process exhibited the most effective antimicrobial activity relative to the pure EOs and macro emulsions. Comparatively, EO from *S. aromaticum* that was applied as nano formulation had the best preservative effect against citrus mold fungi amongst the test botanicals. This study shows that nanoemulsions are effective carriers of EOs by reducing their volatility and retaining bioactivity. This nanotechnology approach could be deployed as a synergy in the application of EOs for postharvest preservation of citrus fruits against the perennial ravages of rot-causing fungi.

KeyWords: Antimicrobial activity; *Citrus sinensis*; Essential oil; Hydrodistillation; Nanoemulsion; Postharvest

Assessment of Aflatoxin M1 in processed and raw untreated milk obtained from selected locations in Accra, Ghana.

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Abstract

Dairy products, especially milk, are one of the most vital sources of essential food nutrients globally. However, it is highly susceptible to Aflatoxin M1 (AFM1) contamination which poses a significant risk to its consumption. The objective of this study was to investigate the prevalence of Aflatoxin M1 and quantify its levels in a variety of milk popularly consumed in selected locations in the Greater Accra region of Ghana. The study was conducted between May and August 2022. Five random locations (Lapaz, Abeka, Kaneshie, Madina and Nima) were selected, and milk variants examined included Ultra High Temperature (UHT) milk (6 samples), Powdered milk (11 samples), Evaporated milk (7 samples), and Raw cow milk (56 samples). Aflatoxin M1 was determined using High Performance Liquid Chromatography with Fluorescence Detection (HPLC-FLD) following the methodology outlined in ISO 14501:2021. Results obtained were categorized based on exceeding Maximum Residue Limit (MRL) set by the European Food Safety Authority (EFSA) at 0.05µg/kg and the Ghana Standards Authority's (GSA) MRL at 0.5µg/kg. Out of 80 total samples evaluated, 32.5% (n=26) tested negative for Aflatoxin M1, while 67.5% (n=54) were positive, with AFM1 levels ranging between 0.054-1.56µg/kg. Amongst the four milk variants analyzed, UHT Milk, Powdered Milk and Evaporated milk, which are widely consumed in the Greater Accra region, were free from Aflatoxin M1 contamination and compliant with both local and international regulatory standards (M = 8, SD = 2.16). Conversely, raw unprocessed cow milk, particularly sourced from Madina and Nima, exhibited high levels of AFM1, with greater prevalence in samples collected between May and July. This study underscores the heightened vulnerability of raw unprocessed milk to Aflatoxin M1 contamination as compared to processed milk varieties.

KeyWords: HPLC-FLD; Aflatoxin M1; UHT; Maximum Residue Limit

Toxicogenic fungal profile, ochratoxin A exposure and cancer risk characterization through maize (*Zea mays*) consumed by different age populations in the Volta region of Ghana.

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Abstract

Maize (*Zea mays*) is an important staple food crop for most Ghanaians. Maize is mostly contaminated by fungal species and particularly mycotoxins. This work aimed to identify and quantify the incidence of fungal infection and exposure to Ochratoxin A (OTA) as well as the health risk characterization in different age populations due to maize consumption in the Volta region. Maize samples were plated on Dichloran Rose Bengal Chloramphenicol (DRBC) agar, and Oxytetracycline Glucose Yeast Extract (OGYE) agar. All media were prepared in accordance with the manufacturers' instructions. The plates were incubated at 28±2°C for 5-7 days. High-Performance Liquid Chromatography connected to a fluorescence detector (HPLC-FLD) was used to analyze the ochratoxin A (OTA) levels in maize. Cancer risk assessments were also conducted using models prescribed by the Joint FAO/WHO Expert Committee on Additives (JECFA). Maize samples collected from the Volta region contained fungal population between the range of 3.08 to 4.58 log₁₀ CFU/g. Eight (8) genera were recorded belonging to *Aspergillus*, *Trichoderma*, *Penicillium*, *Fusarium*, *Saccharomyces*, *Mucor*, *Rhodotorula* and *Rhizopus*. The species diversity includes *A. flavus*, *A. niger*, *T. harzianum*, *P. verrucosum*, *F. oxysporum*, *Yeast*, *F. verticillioides*, *Rhodotorulla sp.*, *A. fumigatus*, *R. stolonifer*, *M. racemosus* species. Additionally, the ochratoxins level contained in the samples were very noteworthy and ranged from 1.22 to 28.17 ug/kg. Cancer risk assessments of OTA produced outcomes also ranged between 2.15- 524.54 ng/kg bw/day, 0.03–8.31, 0.0323, and 0.07-16.94 for cases/100,000 person/yr for Estimated Daily Intake (EDI), Margin of Exposure (MOE), Average Potency, and Cancer Risks respectively for all age categories investigated. There was very high mycoflora load on the maize sampled from the Volta region, likewise the range of mycotoxins present in the maize grains, suggesting the potential to pose some adverse health effects with the populace of the Volta region.

KeyWords: Maize; fungi; Ochratoxin A; Risk assessment; Cancer; Toxicogenic fungi

Evaluation of rapid molecular methods for detecting *Salmonella enterica* in red chili powder

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Abstract

Salmonella enterica, among other *Salmonella* species, is a leading cause of foodborne illnesses and presents significant economic and public health burden in both developed and developing countries. Although generally reliable, cultural methods for detecting *Salmonella* in food samples is labor intensive, expensive and takes between 5 and 7 days to complete. There is therefore the need for rapid, reliable and accurate methods for detecting *Salmonella* in food samples in order to safeguard public health and prevent economic losses. This study, therefore, sought to evaluate the performance of four rapid molecular methods, i.e., qPCR, ANSR™, VIDAS-SLM and GENE-UP *Salmonella* assays for detecting low levels of *Salmonella* in red chili powder. Red chili powder was inoculated with a five-strain cocktail of lyophilized *Salmonella enterica* at low (~0.05 CFU/g) and high (~0.5 CFU/g) levels. The samples were enriched in Tryptone Soy Broth (TSB) and Buffered Peptone Water (BPW), and incubated for 24h. The enriched samples were used for ANSR, GENE-UP and qPCR tests. Also, enriched samples were subcultured into Tetrathionate Brilliant Green and Rappaport–Vassiliadis (TT/RV) broths and incubated for additional 24h. The samples were then prepared for qPCR, subcultured into M-broth for VIDAS assay, or streaked onto selective agar plates. After incubation, typical *Salmonella* isolates were screened on TSI and LIA slants and confirmed with biochemical tests, serology, and qPCR. When the rapid molecular methods (ANSR, GENE-UP and qPCR) were performed directly from primary enrichment (TSB or BPW) samples, *Salmonella* detection rates were significantly low compared to FDA-culture method. However, after TT/RV enrichment, qPCR and VIDAS-SLM showed *Salmonella* detection rates that did not differ from FDA-culture method ($\chi^2 < 3.84$). The results show that secondary enrichment improved *Salmonella* detection in red chili powder. Optimization of the ANSR, GENE-UP and qPCR procedures for use with chili powder without secondary enrichment is necessary.

KeyWords: rapid screening, conventional culture, VIDAS-SLM, *Salmonella*, qPCR.

Trace metals contamination in varieties of cereal-based pediatric foods sold in parts of Accra, Ghana.

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Abstract

Dietary intake is a potential route of babies' exposure to trace metals contamination. Cereal-based pediatric foods on the Ghanaian market can be susceptible to contamination as they are mostly

produced on small scales by individuals with little or no knowledge of food safety. This study ascertained trace metals quality of fifty (50) cereal-based pediatric foods composed of maize, rice, millet, wheat, and mixed cereals, from major sales outlets on the Ghanaian market. The samples were acid-digested ($\text{HNO}_3 + \text{H}_2\text{O}_2$) and analyzed using Atomic Absorption Spectrometry (AAS). Concentration (mg/kg) of trace metals were 0.87–34.74 (Fe), 1.0 indicated potential health risk to baby within the studied age groups with cadmium as the predominate cause. These initial findings show that some locally produced cereal-based pediatric foods on the Ghanaian market can present a route of trace metals contamination and therefore warrant periodic investigations to safeguard public health.

KeyWords: Pediatric Cereal-based foods; Contamination; Cadmium; Lead

Morphological and molecular characterisation of the parasitoid complex of *Liriomyza* leafminer (Diptera: Agromyzidae) species in small scale vegetable production sector of Zimbabwe

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Abstract

The parasitoid complex of *Liriomyza* (Burgess) leafminers (Diptera: Agromyzidae) in small scale horticultural production in Zimbabwe was investigated through morphometrics and molecular characterisation. The present study re-evaluated the discriminative ability of some traditional morphological characters, such as antennae, wing venation, abdominal patterns and thoracic micro setae. Additionally, electron micrographic methods for separating different species were conducted. Three DNA-based taxonomic identification methods including MegaBLAST for identifying BLAST hits based on the amplified Cytochrome c oxidase I (COI) fragments using LCO1490-HCO2198 primers, sequence identification in barcode of life data system, and maximum likelihood phylogenetic analysis using RAxML 7.0.4 inferred from COI par sequence using a p-distance model were used. Morphological identification recovered six parasitoid biotypes (three *Diglyphus*, one *Clostercerus*, one *Hemiptarsenus*, and one *Opius*). Blasting of biotype COI sequences in the National center for biotechnological information database identified four of the sampled sequences as identical with other sequences of the world whilst two did not match. Biotypes two, three, six, and seven were 94, 93, 96, and 95 % identical to *D. isea*, *D. isea*, *Hemiptarsenus varicornis*, and genus *Opiinae*. Analysis of genetic distances revealed evolutionary divergence between biotype sequences and related known species using the COI gene. However,

phylogenetic analysis revealed results that were not incongruence to morphology and blast results possibly due to homoplasticity and species complexes in Hymenoptera. The present study revealed occurrence of native parasitoids in Zimbabwe that can be used in designing programmed biocontrol of leafminers.

KeyWords: Parasitoid morphology, Molecular identification; Zimbabwe

Health-related information on pre-packaged foods and beverages in Ghana: - prevalence and compliance with regulations.

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Abstract

Food labels convey information on the nutritional content, health and safety of food products. Thus, evidence on evaluation of food label information is useful for regulating the industry to ensure consumer safety and protection. This study describes health-related label information on foods and beverages in selected retail shops in Accra and assesses their compliance with Food and Drugs Authority (FDA) regulations. A cross-sectional survey of in-store pre-packaged products was conducted, involving photographing labels of unique food/beverage products. The food label data were analysed descriptively using Stata version 16.1. About 2.3% of the 351 products sampled were not labelled. Almost all products (92%) had ingredient information; 68.8% had nutrition declarations, and 17.8% featured nutrition claims. Almost 7% included health claims. Among products with nutrition declarations (n=263), 12.7% displayed front-of-pack (FOP) labels; Guidelines Daily Allowance was the prevailing FOP label. More than 30% of pre-packaged foods did not comply with FDA labelling standards. For instance, 19 % of products did not comply with expiry dates, 18.2% had no storage or cooking instructions and 6.3 % did not comply with ingredient list standards. An analysis of food categories showed that fruits and vegetable-based pre-packaged foods had the highest compliant rate (90.0%); beverages had the lowest compliance rate (61.0%). About 90% of foods complied with nutrition claims guidelines and 84.2% complied with health claims. There is a high prevalence of nutrition information on food labels; also, high compliance with health-related food labelling standards. However, a small proportion of pre-packaged products were unlabelled do raise safety concerns. Strengthened regulation is needed for consumer protection and safety.

KeyWords: Food label; Health-related information; Pre-packaged foods; Consumer protection

Understanding the Nexus of Food Safety and Nutrition Security: Analysis of Fried Sausage and Chicken Intake, Risk Attitudes, and Burden of Malnutrition among School-Going Children

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Abstract

Ultra-processed meat consumption, and obesity and overweight have been linked to increased cancer risk. This study aimed to assess the nutritional composition, consumption patterns, risk attitudes, and perception of fried sausage and chicken, as well as the burden of malnutrition, among school-aged individuals. A cross-sectional observational study was conducted in basic and secondary schools, Winneba, involving 467 participants aged five to nineteen years. Proximate nutritional composition analysis was performed using the Association of Official Analytical Chemists methods. Consumption patterns were assessed through a one-week dietary recall survey, and risk attitudes and perception were evaluated using a Likert survey. Prevalence of obesity, overweight, and thinness were determined using World Health Organization models. Fried chicken demonstrated higher levels of total ash, crude fat, and crude protein compared to fried sausage, indicating differences in mineral and macronutrient content. Females spent an average of C2.80 (SD=2.16) per day on sausage, while males spent C3.27 (SD=2.71); for chicken, females spent C4.17 (SD=2.96) and males spent C4.06 (SD=3.20). Consumption of chicken was higher, with 96% of individuals consuming it compared to 91% for sausage. The t-test revealed significant differences in money spent between sausage and chicken ($t(782)=-5.80, p=0.000$). Individuals displayed higher willingness to accept food safety risks for minimally processed meat (chicken) compared to ultra-processed meat (sausage) ($t(913)=4.02, p=0.000$), and perceived higher risk associated with ultra-processed meat (sausage) ($t(931)=6.81, p=0.000$). The average weekly intake of sausage was lower compared to chicken ($t(823)=-296, p=0.003$), indicating different consumption patterns. The results reflect an increase in overweight (31.4%) and obesity (11.4%) compared to global figures. The study provides insights into the nutritional composition, consumption, risk attitudes, and perception of fried sausage and chicken among school-aged individuals. The findings also underscore the increasing prevalence of overweight and obesity, furnishing age, gender, and school factors to support comprehensive strategies to mitigate the associated health risks. This research contributes to bridging the gap between food safety and nutrition security, supporting evidence-based strategies to improve dietary choices and public health outcomes.

KeyWords: Childhood nutrition; Dietary behavior; Health risk perception; Nutritional awareness; Food policy

Implementation of a basic GMP/HACCP system to improve the quality of smoked fish

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Abstract

For several years, fish smoking has been the widely adopted processing method among artisanal fish smokers within several coastal zones in many parts of West Africa including Ghana. However, several issues about the biochemical and microbiological contaminants remain, mainly because of the suboptimal unhygienic fish handling during the processing. To help address the problem, we developed and implemented a basic GMP/HACCP food safety system at two local fish smoking facilities to assess the effectiveness of improving the quality of smoked fish. For this, the traditional fish smoking process was evaluated and gaps in the process flow were identified for applying critical controls based on the Codex Alimentarius logic sequence. After applying the corrective measures, fish were sampled and analysed for physicochemical and microbiological quality and the data was compared with that of the traditional process before the interventions. Analyses of variance of the mean values were done using the SPSS statistical tool to assess the efficacy of the intervention. The results show that the application of GMP/HACCP did not affect the physical properties of the smoked fish although improvements in fish quality indices such as the peroxide value, total volatile base nitrogen and histamine levels were observed. Decreases in microbial load of smoked fish were observed after the implementation of safety practices such as the single use of potable water, wearing of safety apparel, drying, and cooling of smoked fish under nets, and the provision of waste disposal bins, leading to the non-detection of coliforms and *E. coli* in the final product. The results of this study show that sensitization and assisting fish smokers to observe basic GMP/HACCP procedures could be relevant for improving the microbial and overall quality of smoked fish.

Keywords: Fish smoking; GMP/HACCP; physicochemical; microbiological quality

[Small scales food processing mills in Cameroon: Socio-economic and technical characteristics assessment](#)

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Abstract

The processing of food products remains a major problem for food security in Africa. The quality of processed products hygienically and nutritionally could depend on the types of machines, the methods used and the operator's health. This work falls in line with the quest to optimize the quality of food consumed by the African population. The objective of this work is to study and evaluate the socio-economic and technical characteristics of grinding mills in Cameroon. For this purpose, a survey was conducted on 100 randomly selected grinding mills distributed over 22 quarters in Dschang town. With respect to the survey, direct measurements and observations were also carried out. The collected data on the survey sheets was entered and codified using Microsoft Excel 2021. The descriptive analyses were performed using SPSS 21.0. The main results of this work were as follows: women are more involved in the food processing activity. Although it is an activity that requires a lot of physical strength, it is directly associated with cooking, which is the prerogative of women in the African society. 56.7% of respondents solely depend on the processing of food products against only 43.3% who see this activity as a source of passive income. Technically, the survey revealed that 92.6% of millers possess Hammer mill machine and Flattener mill machine to grind dry foodstuffs and wet foodstuffs respectively. Machine capacities vary from millers to millers, but the highest values are 30 kg per hour and 10 kg per hour for dry and wet foodstuffs, respectively. Whatever the machine's type, they are made from metals and iron materials that could have negative effects on food quality. The lifespan of those machines' ranges from 5 to 7 years. In terms of prospects, the design of these local machines should be improved by providing the manual for operation.

Keywords: Food processing; food hygiene; hammer mill machine; flattener mill machine; metals, iron contamination

Prioritising Ghana's Aflatoxin Policy Implementation Plan using P-IMA and Multistakeholder Approaches

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Abstract

Food safety is essential for public health and international trade. A major food safety concern in Ghana and many African countries is aflatoxin contamination in food and feed. Aflatoxins are harmful toxins produced by certain species of fungi that grow naturally in foods. These fungi infect food products on the farm or during storage under favourable conditions such as high temperature, high moisture, and pests. Exposure to aflatoxins causes acute and chronic health problems such as liver cancer, immune suppression, and stunting. CSIR-STEPRI led the development of the national policy for aflatoxin control in food and feed, which was approved by the Cabinet in December 2021. During the development of the policy, several stakeholders were involved. The P-IMA framework was used to generate a set of evidence-based Sanitary and Phytosanitary priorities that will give the best return on investment. It involved seven stages: compilation of the information dossier, the definition of the choice set, the definition of decision criteria and weights, construction

of information cards, review of information cards, derivation of quantitative priorities and validation. The results showed that strengthening the capacity of value chain actors in pre- and post-harvest aflatoxin management for market access ranked best with a score of 72.25 considering the benefits that might accrue over the various decision criteria such as improving income, public health, agriculture production, post-harvest losses, employment, and food and nutrition security. It was established that effective management of aflatoxin requires multi-stakeholder approaches. Through extensive stakeholder involvement and consultation, the critical investment options for aflatoxin management were identified, prioritised, validated, and used as evidence-based justifications for project development. An investment option that is ranked low does not presuppose it is not crucial for implementation; it means it does not come first, given limited resources and funders' preferred investment areas.

Keywords: aflatoxin, policy implementation, P-IMA, multistakeholder, Ghana

Joint crop and livestock clinics in Uganda: Contributing to food safety using a one health approach

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Abstract

Uganda's crop-livestock clinics, which bring together crop and livestock officers to provide advice to farmers using a One Health approach to service delivery (i.e., integrated, cross-sectoral), have emerged as a promising strategy for addressing issues that inherently link the health of plants, animals, humans, and the environment. These include food safety issues such as; mycotoxins, zoonoses, misuse of pesticides and animal health drugs (including AMR), as well as food, soil and water borne diseases. The current study examines the role of joint clinics in promoting food safety standards using empirical research and case studies. The study investigated knowledge exchange, capacity building, and collaboration among officers, leading to improved agricultural practices and reduced food safety concerns. Joint clinics play a crucial role in educating farmers on safe handling of agricultural chemicals, considering factors like Pre-Harvest Intervals and livestock withdrawal periods. This promotes the production of safe crops and animal products that meet quality and safety standards. Additionally, the paper examined challenges and opportunities in establishing joint crop and livestock clinics, emphasizing the importance of interdisciplinary cooperation. The study highlights the need for joint clinics in enhancing food safety through One Health efforts. These clinics effectively managed zoonotic illnesses, such as rabies through routine vaccinations, and timely detection and containment of diseases like African swine fever and trypanosomiasis. They enhance farmers' knowledge of agricultural chemical safety and ensure proper handling in pest management. The paper advocates for increased investment and maintenance of collaborative

clinics, as well as integrating One Health principles into agricultural policies and practices. The paper emphasizes the importance of multidisciplinary expertise to capitalize on joint clinics for comprehensive risk management, knowledge sharing, and effective control measures, ultimately improving overall food safety standards. This can be achieved through the innovative model of joint crop and livestock clinics.

Keywords: Joint crop and livestock clinics; one health; food safety

Microbial quality of *Citrullus colocynthis* (Melon) and *Glycine max* (Soya) seed protein concentrate-complemented breads

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Abstract

A long self-life ensures food gets to consumers without ingestion of biohazards. This is critical in the quest for maintaining public health. Mould spoilage and ropiness are the main problems in the production of bread and may pose public health concerns due to the presence of toxins. This comparative study was carried out to determine the microbial quality of thirteen samples (n=13) of composite breads made from graded levels (2%, 4%, 6%, 8%, 10% and 12% protein) of melon seed protein concentrate (MESPC-B), soya seed protein concentrate (SSPC-B) and 100% wheat bread (control). Microbial quality was determined by aerobic plate count, biochemical tests, morphological identification and microscopy after 24 hours of storage at 5⁰C and 26-30⁰C±.2. Results obtained were compared to a standard microbial limit. In ambient condition, all loaves spoilt after day 3. The microbial load of all refrigerated soya breads were observed to be statistically higher than MESPC-B, control and beyond the standard limit by day 6 despite maintaining freshness. However, 10% and 12% MESPC-B had the longest shelf-life in this study. Four species of bacteria were isolated which included *Bacillus spp*, *Enterococcus spp.*, *Streptococcus spp.*, and *Lactobacillus spp*. For fungi, *Aspergillus spp*, *Penicillium spp*, *Rhizopus stolonifer*, *Saccharomyces cerevisiae* and *Mucor pusillus* were isolated. But Yeast and *Bacillus subtilis* had the highest frequency of occurrence in refrigerated samples against *Mucor pusillus* and *B. subtilis* in ambient condition. The total Aerobic Bacteria Count (ABC) in melon and soya loaves ranged from 2.6x10⁷-5.6x10⁷cfu/g and 1.5x10⁷-1.0x10⁸cfu/g, for fungi count (FC) 1.0 x10³-8.0 x10⁴cfu/g, 1.0x10³-1.2x10⁵cfu/g respectively at 26-30⁰C±.2. At 5⁰C, the control, MESPC-B and SSPC-B had ABC ranging from 1.0x10⁷-1.2x10⁸cfu/g, 1.0x10⁷- 2.4 x10⁸cfu/g, 3.3x10⁷-1.62x10⁸cfu/g and FC of 2x10³-1.28x10⁵cfu/g, 1.0x10³-7.0x10⁴cfu/g and 1.0x10³-5.7x10⁴cfu/g, accordingly. The results showed that melon supplemented breads could keep longer than the unsupplemented bread at 5⁰C.

Keywords: Melon bread; soya bread; microbial quality; protein concentrate

Quality Assessment and Antimicrobial Activity of Edible Oils on Selected Foodborne Pathogens

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Abstract

A recent shift towards the use of oils to treat diseases because of their proposed antimicrobial activity has been made. An investigative study on the quality (moisture, iodine, fatty acid, saponin, and alkaloids values) of edible (olive, coconut, palm, and soybean) oils and antimicrobial activity were carried out on three important foodborne pathogens (*Staphylococcus aureus*, *Escherichia coli*, and *Klebsiella pneumoniae*). Four dilutions of edible oils were prepared (undiluted; 1:1; 1:10; and 1:20 oil: ethanol) and impregnated into the discs, using standard methods. Moisture content ranged from (0.05±0.02 to 0.65±1.01 %), with olive oil and coconut oil being the lowest and highest respectively. Saponification value ranged from (38.78±6.02 to 95.76±6.15 mg KOH/g). The iodine value ranged from (15.64±0.02 to 24.2±0.02 gI₂/100g). The free fatty acid value was 1.33±0.04 to 9.10±0.48%. Peroxide value ranged from (24.00±0.00 to 51.67±5.8 mEq/kg). Selected edible oils tested positive for alkaloids, phenols, flavonoids, and saponin except for palm oil, which was negative for saponin. The range of inhibition for olive oil was (8.0±0.0 to 13.5±2.1 mm) for *E. coli* (8.0±0.0 to 9.5±0.7 mm) for *K. pneumoniae* and (7.0±0.0 to 9.0±0.0 mm) for *S. aureus*; The range of inhibition for coconut oil was (8.0±0.0 to 9.5±0.71 mm) for *E. coli* (8.0±0.0 to 9.5±0.71 mm) for *K. pneumoniae* and (7.8±0.0 to 9.0±0.0 mm) for *S. aureus*. The range of inhibition for soya oil was (9.0±0.0 to 11.5±0.1 mm) for *E. coli* (8.0±0.0 to 9.0±0.0 mm) for *K. pneumoniae* and (7.5±0.0 to 9.0±0.0 mm) for *S. aureus*. Palm oil had no inhibitory effect against the isolates tested in this study. The undiluted oils (olive, coconut, and soybean) had more inhibitory effects than diluted ones since they exhibited the greatest inhibitory effect, especially on Gram-negative *E. coli* and *Klebsiella pneumoniae*.

Keywords: Antimicrobial activity; edible oils; foodborne pathogens screening.

Quality Assessment of Palm Oils Sold in Accra and the Risk of Consumption of Palm Oils Adulterated with Sudan IV

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Abstract

Adulteration of Ghanaian palm oils with Sudan IV has been reported over the years and regulations have been put in place to check the practice. This study assessed the quality of palm oils in Accra and the associated risks from consuming palm oils containing Sudan IV. Thirty-five unbranded crude palm oils randomly sampled from seven open markets and five branded palm oils from supermarkets in Accra were analyzed for concentrations of Sudan dyes using the HPLC/MS and for some physicochemical properties. A consumer survey of two hundred and twenty-three adults on family palm oil consumption patterns and body weights also provided information for one hundred and ninety-seven children. To identify the level of risk of Sudan IV in palm oils per day and for 16 years, the ratio of the lower bound benchmark dose of 150 mg/Kg (from the literature on animal studies) to the average exposure values from the consumer survey was used (margin of exposure approach). Sudan IV was detected in 1 out of 5 (20%) of the branded oils (0-0.2 mg/Kg) and 13 out of 35 (37%) (0-0.42 mg/Kg) of the unbranded oils at average concentrations of 0.04 mg/Kg and 0.17 mg/Kg, respectively. Iodine values of branded (25.73-29.99 mg/L) and unbranded (23.39-27.24 mg/L) oils were below the Codex standard (50-55 mg/L). The average body weight of adults (65.4 Kg) and children (32.5 Kg) helped to estimate their exposure to Sudan IV. Consumption of 1.88 g- 42 g of palm oil per day is of low public health concern (MOE \geq 10000) to adults and children in the short term. However, consumption of the same quantity over sixteen years can be of high public health concern (MOE <10000). Despite the regulations, branded and unbranded palm oil are adulterated, and stricter measures are needed to minimise the menace.

Keywords: Adulteration; Food safety; Quality; Risk; Sudan IV

Development of Lactic Acid Bacteria and Yeast Starter Cultures for Safety and Improved Sensory Properties of *Aliha*

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Abstract

Aliha is a maize-based spontaneous fermented beverage produced and consumed in Ghana. It is characterized by inconsistencies in the quality of the final products. However, starter culture inoculation could control and improve the fermentation process, safety, sensory and nutritional properties of the beverage. *Lb. plantarium* HBUAS2210, *Strep. diacetylactis* AAUGM-12 and *Pichia kudriavzevii* CY902 were selected based on their excellent probiotic and technological properties from the previous study. Their co-existence as combined starters and the safety of their final fermented products were analyzed. All the three strains selected co-existed well as they maintained a constant growth rate within 24 h. There was a sharp decline in pH within 24 h of fermentation (5.0-3.0) with a steady decline from 24 h to 48 h (3.70-3.50) across the majority of the treatments. There were sharp accelerations of total titratable acidity of starter inoculated media of more than 400% (0.28-2.11) across the fermented media with *Lb. plantarium* + *S. diacetylactis* + *P. kudriavzevii* recording the highest (2.11) within 24 h. However, *Pichia kudriavzevii* recorded the highest viability (61.67 cfu/ml) when it was combined with *Lb. plantarium* and *S. diacetylactis* for 24 h which is the expected period of fermentation. Even though, the counts (cfu/ml) of all the

starter culture fermented *Aliha* produced were largely within the standard limit, *Lb. plantarium* HBUAS 2210 + *Pichia kudriavzevii* CY902 fermented *aliha* was the safest. The sensory parameters of 24 h starter fermented *aliha* were highly preferred to that of spontaneous and 48 h fermented *aliha*. The panellists placed the highest values on the taste and aroma of the *Strept. diacetylactis* + *P. kudriavzevii* and overall acceptability of *Strept. diacetylactis* fermented *Aliha* than the rest of the sensory parameters. Indeed, the high acid recorded in this study was expected as high lactic acid improves the safety, shelf-life, and organoleptic properties of the final beverage.

Keywords: Beverage; Starter culture; Food safety; Sensory properties; Microorganisms

Browning Pigmentation Evolution and Bioactive Compounds Assessment of Coconut Syrup Production

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Abstract

The study sought to understand the colour formation in coconut syrup production by modelling the kinetics of colour evolution. This was achieved by processing coconut sap at 105 ± 5 °C and taking samples intermittently for analyses. Among the models tested, the exponential model gave the best fit with the highest coefficient correlation (R²) values of 0.84903-0.9798 and lowest values in Chi-square (χ^2) of 3.14×10.4-6.789 and root mean square error (RMSE) of 8.17305-0.1784. It was obvious that heating time correlated positively with both browning reactions such that an increase of 15.16 and 2.44 folds were observed in enzymatic and non-enzymatic browning index, respectively. The second-order polynomials satisfactorily described the browning reactions better than Weibull's model. An increase in bioactive compounds was observed at the end of processing time which strongly correlated with a* and b* color and enzymatic browning reactions revealing the nature of the dependency among them.

Keywords: Exponential model; Enzymatic reaction; Coconut; Colour; Syrup

Preliminary Studies on Prevalence of Resistant *Campylobacter* Pathogens in Ready-to-Eat Beef Meat Products

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Abstract

There is a current rise in demand for Ready-to-Eat (RTE) foods including meat. RTE meat is a high-risk food, recognized as a vehicle for food poisoning and foodborne diseases which is of great concern to food safety and public health. The use of synthetic antimicrobials in animal care has led to the emergence of resistant strains of pathogens in RTE foods, meat inclusive and “Antimicrobial resistance” in the global silent pandemic. This study therefore evaluated the presence of *Campylobacter* in undercooked beef meat and its products, the characterization and sensitivity to synthetic antimicrobial agents following CLSI standards. Isolation, phenotypic identification and molecular characterization of suspected *Campylobacter* strains were carried out. The disk diffusion method was used for antimicrobial susceptibility testing. The total genomic DNA of cultivated isolates was purified using a Zymo Research Fungal/Bacterial DNA kit. The phenotypic characterization of *Campylobacter* isolates was done using biochemical methods. Molecular characterization was carried out using conventional PCR to detect *Campylobacter* species isolated from the beef meat samples using universal 16S rRNA *Campylobacter* species primers. Sixteen presumed *Campylobacter jejuni* strains were identified phenotypically namely: *Campylobacter jejuni* subsp. *jejuni* strain ATCC 33560, *Campylobacter jejuni* strain YH003, *Campylobacter jejuni* strain CJ004CC45, *Campylobacter jejuni* strain CJ517CC45, *Campylobacter jejuni* strain 4031, *Campylobacter jejuni* subsp. *jejuni* strain MTVDSJC20, *Campylobacter jejuni* strain CJ015CC464, *Campylobacter jejuni* strain C109, *Campylobacter jejuni* strain CFSAN 096301, *Campylobacter jejuni* strain CFSAN 093260, *Campylobacter jejuni* subsp. *jejuni* strain CLB104, *Campylobacter jejuni* strain CJ088CC52, *Campylobacter jejuni* subsp. *jejuni* strain 00-0949, *Campylobacter jejuni* strain C109, *Campylobacter jejuni* strain THJ097, *Campylobacter jejuni* subsp. *jejuni* strain DO133e and *Campylobacter jejuni* strain FDAARGOS 262. *Campylobacter* species/strains are present in ready-to-eat beef meat products. The *Campylobacter* strains were insensitive to antimicrobial agents and regarded as resistant strains except *Campylobacter jejuni* strain THJ097.

Keywords: Antimicrobial resistance; *Campylobacter*; Ready-to-Eat; Foodborne

Aflatoxin management: An integrated approach for enhancing food safety

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Abstract

Public health consequences of contaminated food cannot be underestimated. Foodborne diseases are an important cause of morbidity and mortality globally, and as a result, food safety cannot be taken for granted. Aflatoxins, naturally occurring substances produced by *Aspergillus* fungi, present a significant challenge in Ghana. Aflatoxin contamination occurs at various stages of the

crop value chain, affecting food safety and livelihoods. Despite ongoing research and innovations in aflatoxin control, Ghana has yet to effectively manage this growing problem. This research highlights the lessons learnt from aflatoxin sensitization and extension efforts in Ghana and underscores the importance of an integrated approach for enhancing food safety. By addressing the knowledge gap surrounding mycotoxins, enhancing access to necessary facilities, and promoting the adoption of decontamination techniques like nixtamalization, Ghana can take significant strides in reducing mycotoxin contamination in staple foods, safeguarding public health, and enhancing food safety. Recognizing the urgency to address this issue, mixed data from various stakeholders have been collected and important lessons have been evaluated. Lessons learned from aflatoxin sensitization in Ghana encompass several key areas such as: good Agricultural Practices (GAPs), post-harvest management and value chain interventions, risk communication and awareness creation and policy and regulatory frameworks. The valuable feedback obtained from aflatoxin sensitization and extension efforts in Ghana highlight the value of an integrated approach in tackling food safety challenges. By combining, GAPs, post-harvest interventions, risk communication, and supportive policies, Ghana can make significant strides in reducing aflatoxin contamination and enhancing food safety.

Keywords: Aflatoxin management; post-harvest interventions; risk communication; integrated management; mycotoxins

Food transformations: Navigating e-commerce's impact on food consumption

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Abstract

This study explores the impact of e-commerce on reshaping conventional dining practices in an era characterized by the rapid integration of technology into everyday life and its consequent impact on consumer behavior. Using a sequential explorative approach, a survey was conducted with 150 residents of Osu and 26 consumers from selected eateries using a multistage cluster and purposive sampling technique, respectively. In addition to the descriptive analysis, regression and correlation models analyzed the impact of online food applications and delivery services on consumption behavior. The results show that 84% of the total sample was aware of some smartphone applications (food apps) in Ghana, “glovo food” was the most popular (75 %). They mentioned that the glovo food app was used to order foods from eateries that were delivered to their locations. In addition, 61% of the respondents frequently visited grocery shops, which affected their food consumption behaviors. It was concluded that both respondents and participants who knew about some mobile food applications were more likely to see changes in their food consumption patterns. Qualitative exploration sought to uncover the intricate interplay between technological affordances, personal preferences, cultural influences, and societal norms as well as how these factors collectively shape the adoption and usage of eateries’ delivery and takeout services. This study demonstrates how technology and society structures co-evolve, interact, and change one other in a dynamic interplay by placing these topics within the context of structural theory. In conclusion, this study offers a thorough examination of how e-commerce and eating

habits interact, with a focus on participant's worries about food safety and hygiene. By providing information that not only enriches scholarly discourse but also contributes to a wider discussion on how technology is changing essential parts of human life, such as how food is consumed.

Keywords: Eateries; e-commerce; sequential explorative approach; smartphone applications; food apps

Microbial safety of street foods in Ghana: A systematic review

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Abstract

There has been a steady rise in the consumption of street foods in Ghana due to its convenience and how it serves as a source of income for many people. However, along with the steady rise are also several incidences of food safety issues owing to microbial contamination. A systematic search carried out on the databases PubMed and Scopus identified 19 articles that would help identify the average microbial count ranges in street foods all over Ghana over the past decade. The search strategy and terms applied included (Microbial Contamination* OR Microbial Quality* OR microbial load* OR safety assessment*) AND (Ready to Eat food* OR Street Food*). The foods analyzed in the articles include khebab, yogurt, fruits, sobolo, and Tuo Zaafi. The results indicate that microbial counts such as fecal coliforms (2.65 - 2.85 log cfu/g), *E. coli* (0.2 - 6.3 log cfu/g), Norovirus (3.69 log cfu/g) and *Salmonella sp* (0.38 - 2.27 log cfu/g) are all above the recommended upper levels set by various food standard organizations across the world. These counts are likely due to unhygienic practices during processing and preparation. This calls for action by various stakeholders. It is suggested that public education and training on food safety and hygiene for street food vendors should be intensified. Also, the enforcement of food safety policies and laws set by regulatory bodies in Ghana must be intensified.

Keywords: Food Safety, Microbial Contamination, Ghana

Commercial production of all-male Nile Tilapia, *Oreochromis niloticus* for food fish: the one-health approach.

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Abstract

The Tilapiine are among the most cultured, consumed (rich-proteins) and economically valuable freshwater fish globally. Commercial farming of tilapia warrants all males (monosex) production

through fry treatment using synthetic androgen (hormone) receptors such as 17-alpha Methyltestosterone (17 α -MT). Various debates range on the impact of this hormone on the fish, the aqua culturist, the ecosystem and the fish consumer's health. This study was conducted to review the recent status and trajectory effects of 17 α -MT hormone for all-male Nile tilapia production using the one health approach. Random interviews (personal and virtual) involving tilapia hatchery operators and secondary data were deployed. Experimental set-up, field observations and expert opinion were used for validation of the study. Results from this study indicate that oral administration of 17 α -MT hormone is the most dominant treatment for all-male tilapia production. It enhances higher phenotypic male production rate between 85% to 97%. Experimental trial indicates that water quality was not compromised as most parameters were within acceptable limits for freshwater fish health. The study reveals misapplication and over-dose of the hormone by most fish farms. This may lead to residual effects after withdrawal period. Accidental inhalation, prolong handling and consumption of post treated fingerlings could cause potential respiratory tract infection and bioaccumulation effects in aqua culturist and consumers, respectively over long exposure. The 17 α -MT treated Tilapia escapee could alter freshwater fish stock biodiversity and productivity. Arguably, in the aquaculture industry the merits of the hormonal treatment of Nile tilapia are enormous for food security. This study suggests precautionary use of 17 α -MT at a recommended dose of 60 mg per kg feed with adherence to safety protocols for sustainable commercial production of all male tilapia. It is pragmatic to have further studies for broader dialogue on tilapia safety for informed policy direction via one health.

Key words: Tilapia production, 17-alpha Methyltestosterone, fish food safety, one-health

Out-of-home eating, dietary patterns and diarrhoea occurrence among Ghanaian female traders and farmers

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Abstract

Foods prepared out of the home are often associated with poorer nutrition and health outcomes. One common health concern associated with out-of-home foods is incidences of foodborne diseases including diarrhoea. Diarrheal diseases continue to be issues of public health concern in Ghana. This study used quantitative data from a sample of female traders and farmers in selected communities in Ghana to analyse their dietary habits and how it affects the incidence of diarrhoea amongst them. A multistage sampling method was used to sample respondents from Hansua farming community and Techiman market in Bono East and Madina and Kaneshie markets in the Greater Accra region. Statistical techniques used include frequency distributions and backward stepwise logistic regression. Out of 524 respondents, one in five reported experiencing diarrhoea. Nearly 30% of respondents consumed out-of-home food daily, while 14.5% rarely indulged in out-

of-home dining. The average dietary diversity score for women was 4.75 and 50.27% of women ate from five or more food groups on a 24-hour recall data. In the final logistic regression model, which included factors such as eating out, the source of drinking water, and the level of education as predictors, the study did not identify any statistically significant relationship between frequent consumption of out-of-home food and the likelihood of contracting diarrhoea. Women with a secondary level of education were 2.98 times (95% C.I. [1.09, 8.15]) were more likely to contract diarrhoea compared to those with no formal education. Those who ate fruits were 4.26 times (95% C.I. [1.84, 9.72]) more likely to suffer diarrhoea. Though no significant relationship was found between frequency of eating out-of-home food and diarrhoea, fruit intake and diarrhoea occurrence were related. Consequently, it is advisable to enhance educational efforts on proper hand and fruits washing before eating. The practice of eating minimally processed fruits hawked in the markets could be a potential source of pathogens and hence should be well regulated. Women traders also need to be encouraged to reduce their frequency of dining out, as it may have broader health implications for them.

Keywords: diarrhoea; dietary pattern; principal component analysis (PCA); regression

Mangrove oysters (*Crassostrea tulipa*) from selected estuarine sites in Ghana: mineral concentrations and health risk assessment of heavy metal contamination among women shellfishers.

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Abstract

Oysters may be rich sources of dietary nutrients for women shellfishers in Ghana. We aimed to determine the mineral concentrations of oysters from three estuarine sites and the potential health risk of heavy metal contamination through oyster consumption among women shellfishers. A total of 915 oysters from the Densu, Narkwa, and Whin estuarine sites (n=305/site) were analyzed for mineral and heavy metal concentrations by atomic absorption spectrometry; spectrophotometry was used for phosphorus. We calculated the mean±SD concentrations (mg/kg wet weight) of 17 minerals by site and used ANOVA to compare the means across sites. The Hazard Index was calculated to evaluate the potential health risks of heavy metal exposure to women shellfishers through consumption, with >1 indicating a potential health risk. The overall mineral concentrations were Ca: 2698±3216, Cr: 0.453±0.413, Co: 0.064±0.110, Cu: 2.0±1.8, Fe: 126±111, Mg: 937±559, Mn: 1.7±1.7, Ni: 0.776±0.858, P: 3470±5416, K: 4282±4567, Se: 5.4±6.0, Na: 6924±4822, and Zn: 82±71. The heavy metal concentrations were total-As: 0.102±0.132, estimated inorganic-As: 0.025±0.033, Cd: 0.037±0.039, Pb: 0.032±0.037, and Hg: 0.038 ± 0.083. Only one oyster sample exceeded the regulatory maximum limit for one heavy metal, Hg. The Narkwa oysters had greater heavy metal concentrations than the Whin and Densu oysters, P<0.001. The mean Hazard Index for

oyster consumption among women shellfishers across the three sites ranged from 0.04 to 0.13, indicating little to no potential health risk of heavy metal contamination with current level of consumption. Oysters from the three estuarine sites in Ghana are rich in essential minerals and have low heavy metal levels. Oyster consumption may be promoted to increase nutrient intakes in estuarine communities, along with regular monitoring for heavy metal contamination.

Keywords: Oysters, Women shellfishers, Mineral concentrations, Heavy metal concentrations.

Antibiotic Resistance Characterization of *Escherichia coli* Isolated From Green Leafy Vegetables in Accra

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Abstract

Escherichia coli, an indicator of recent faecal contamination and the potential presence of enteropathogens in foods, has often been associated with leafy greens consumed raw or minimally processed. While studies have reported the microbiological quality of fruits and vegetables in Ghana, there is limited knowledge on the antibiotic resistance characterization of *E. coli* associated with leafy greens and their public health significance. The study presents the phenotypic profile and genotypic antibiotic resistance determinants of *E. coli* isolated from green leafy vegetables. Faecal coliforms (n=325) isolated from four indigenous and two exotic green leafy vegetables (n=91) in a previous study from farms and markets in Accra were screened for *E. coli* using biochemical tests. The antibiotic resistance profile of selected *E. coli* isolates (n=61, from 61 vegetables) to 11 antibiotics using the Kirby-Bauer disk diffusion susceptibility test. PCR was used to detect the presence of integrons, specific resistant genes associated with ampicillin (*Bla*-CTX-M, *Bla*-SHV, *Bla*-TEM), sulfisoxazole (*Sul1*, *Sul2*, *Sul3*), tetracycline (*TetA*, *TetB*, *TetC*) and streptomycin (*StrA*, *StrB*) in the *E. coli* isolates and plasmids sequenced using the illumina sequencing technology. The *E. coli* isolates were resistant to two or more of the antibiotics used and 82% of isolates were multi-drug resistant. Most isolates exhibited resistance to ampicillin (95%), sulfisoxazole (90%) and tetracycline (64%). The genes *StrA* (62.30%), *StrB* (81.97%), *TetA* (39.93%), *TetB* (9.84%), *Bla*-CTX-M (93.44%), *Bla*-TEM (70.51%) and *Bla*-SHV (70.5%) were present in the *E. coli* isolates whilst *Sul1*, *Sul2*, *Sul3* and *TetC* were absent. Integrons were absent while plasmid was present in 76% of *E. coli* isolates. Nucleotide sequencing of large plasmid from six isolates revealed they harbour tetracycline, beta-lactam, streptomycin, sulfonamide, trimethoprim and quinolone-related genes. Consumption of green leafy vegetables contaminated with these antibiotic-resistant *E. coli* can cause foodborne illness with increasing treatment failure and complications leading to mortality.

Keywords: Green leafy vegetables; *E. coli*; Antibiotics; Resistant genes

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

Rice is the second-most consumed cereal in Ghana. However, human activities such as mining and excessive use of agrochemicals in some farming areas have the potential to pollute rice with heavy metals, and compromise food safety. The objective of this study was to assess the levels and risk of heavy metals in locally produced rice sold in Accra Metropolis. Also, the quantity and consumption pattern of rice in Accra was surveyed using a structured questionnaire. A total of 385 consumers consented to participate in the survey. Information collected included sex, age, and body weight as well as frequency and quantity of rice consumed. Children's consumption information was collected from parents or caregivers. Thirty samples of local rice (uncooked) were sampled from markets and analyzed for heavy metals (arsenic, lead, cadmium, mercury, copper, and zinc) using ICP-MS. Exposure assessment was conducted using the U.S. EPA method. The estimated intake, carcinogenic and non-carcinogenic risk were determined. Survey results showed participants weighed between 60 and 69 kg, and consumed an average of 496.36 g of rice per week and 221.67 g of rice per day. Children consumed an average of 58.33 g of rice per day and 142.43 g of rice per week, and they weighed between 21 and 30 kg. The concentrations of heavy metals in all the rice samples were below the upper limit permitted by Codex. However, the consumption of local rice was found to be associated with carcinogenic and non-carcinogenic hazards in both adults and children from the outcome of the risk assessment. Exposure to arsenic, lead, and cadmium were of primary concern for the children while for the adults, it was arsenic and lead. The health risks of exposure to heavy metals should be publicized and education intensified to protect public health.

Keywords: Rice; Heavy metals; Exposure; Arsenic; Carcinogenic

Evaluation of Microbial, Nutritional and Sensory Properties of Cereal and Legume Blends of Traditional Weaning Food (*Turn-Brown*)

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Abstract

Turn-brown is a locally-made infant formula usually administered by nursing mothers in Nigeria, but there is no information on the nutritional composition, potential microbial contamination and the shelf-life, hence, the preparation is usually subjective. This study aims to determine the growth of aflatoxigenic fungi (AF) and the nutritional quality of freshly prepared turn-brown. The effect of two factors: composition of turn-brown and processing (roasted, fermented) (Babcock commercial turn-brown - standard sample A; unfermented high protein content - sample B, unfermented high carbohydrate content - sample C; fermented high protein content - sample D, unfermented high carbohydrate content - sample E), and ogi (sample F) were evaluated bi-weekly for eight weeks. Sensory evaluation was carried out to evaluate consumers' preference for the formulated turn-brown samples. Data obtained from the nutritional evaluation were subjected to analysis of variance. Samples A - C were lower and significantly different ($p \leq 0.05$) from the other samples with regards to percentage of crude fat and crude fibre at 0-2 weeks. At weeks 4-8, the crude fat and moisture of samples C and D were lower and significantly different from samples A and B. Crude protein was not significantly different in all samples except for sample F. For the anti-nutritional significantly low. From week 4, proximate and micronutrient parameters gradually reduced over composition, the tannins, saponin and trypsin inhibitors varied within the samples A-E while sample F was the storage period but the vitamins were not statistically significant throughout the storage period. The fungi species isolated at week 4 in samples B and C were sequenced and identified as *Aspergillus flavus*. The sensory evaluation showed that samples B and C were more preferred. Proper roasting, standardized packaging and appropriate labelling showing the composition and expiry dates must be encouraged in the processing of *turn-brown*.

Keywords: *Turn-brown*; nutritional composition; microbial contamination

Assessment of the food safety knowledge, attitudes and practices of maize and groundnut value chain actors in Ghana

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Abstract

Aflatoxins have been reported in maize and groundnut products from Ghana, as evidenced by recent alerts from the European Union's Rapid Alert System for Food and Feed. This negatively

impacts food security and international trade. Assessing the knowledge, attitudes, and practices (KAPs) of value chain actors about aflatoxins is important in understanding the potential risks to food safety and implementing effective strategies to mitigate aflatoxin contamination throughout the production process. A cross-sectional study was conducted to evaluate the food safety KAPs of maize and groundnut value chain actors in Accra, Tamale, and Techiman. A total of 579 actors participated in the study. Semi-structured questionnaires were administered through face-to-face interviews and responses scored to determine the level of KAP. Respondents who scored $\geq 70\%$ of the maximum possible score were categorized as having good food safety knowledge, practices and positive attitudes. Respondents generally had insufficient food safety knowledge (77.4%), attitudes (65%), and poor food safety handling practices (95.9%). Majority of the actors significantly had low levels of formal education, with 41.8% never receiving formal education. Only 19% of the actors were knowledgeable about aflatoxins; however, 97.41% of actors could recognize aflatoxigenic moulds on grains from picture aids. Majority of respondents believed moulds infest grains due to improper drying, poor storage conditions, wet weather during harvest, and long storage duration. In addition, a significant proportion (91.8%) also believed that mould-infested grains were unsafe for humans and animals and most (60%) threw away mouldy grains with a few (16%) giving them to animals, washing off the moulds (10.2%) or giving them to grain processors (7.4%). In view of the poor food safety KAP scores of the value chain actors, there is a pressing need to educate them on the health, economic implications of their operational practices and self-regulating their operations for aflatoxin control.

Keywords: aflatoxins, attitude, groundnuts, knowledge, maize, practices

Increasing food safety and quality through supply chain building in Ghana – Experience made in the Honey Sector

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Abstract

Beekeeping is an important means of alternate income for people especially in the rural areas of Ghana. However, honey quality varies substantially. From honey of high to inferior quality or even heavily adulterated honey, everything is available. Especially in the local open market honey is mostly sold in reused bottles of questionable hygiene, and usually without any label or any traceability. Only very few beekeepers are involved in honey processing and use new containers which are properly labelled. The project “Make Ghanaian Honey fit for Export”, co-funded by Tentamus QSI GmbH in Germany, together with the Federal Ministry for Economic Cooperation and Development, facilitated through the GIZ and Tentamus' TCF², covered this challenge in a wholistic approach by targeting the entire honey supply chain. The aim was to enable Ghana to

produce honey that meets the specifications for export to Europe and at a quantity that would attract international buyers. Several steps were taken along the supply chain. They include assessment of current situation of honey quality in Ghana at farm gate; training of beekeepers on beekeeping and harvesting techniques; formation of regional beekeeper associations; training of processors and exporters on quality parameters and regulations; and meetings with national agencies, FDA, GSA, CSIR-FRI, MoFA, National Beekeeper Associations, and relevant NGOs to identify options for ensuring honey quality. The project clearly shows that an integrated approach including all stakeholders along a supply chain is crucial to create a lasting impact. Beekeepers at the training courses were highly engaged and learnt for example how to produce quality honey by harvesting only certain parts of the comb containing honey and no brood. The local associations are taking over their responsibilities to manage their members to keep their good reputation. The national agencies are treating honey with very high priority as well and are discussing future policies.

Keywords: Honey; supply chain; authenticity; quality, export

Effect of Different storage temperatures on quality of freshly squeezed juice from three varieties of pineapple

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Abstract

Globally, mankind has become more health conscious of what they eat and drink and this has caused the high demand for natural fruit juice. However, the old challenge of short shelf life of such products (pineapple juice) still persists. This research sought to evaluate effect of different storage temperatures on the quality of freshly-squeezed juices from three pineapple varieties: Smooth Cayenne (SC), MD2, and sugarloaf (SL). A 7x2 factorial experiment in CRD comparing the quality of juices stored under $2^{\circ}\text{C}\pm 1$ and $5^{\circ}\text{C}\pm 1$ in three replications was conducted. Results showed that pH was significantly higher in juices stored under $2^{\circ}\text{C}\pm 1$ than in $5^{\circ}\text{C}\pm 1$. Total soluble solids in the three varieties was in the order of $\text{SC} > \text{SL} > \text{MD2}$ under both storage temperatures. Temperature did not influence the mean color, flavor, texture, and aroma rankings. The color of SC and MD2 juices was mostly better liked than SL juice. The taste of 100% SC and 100% SL stored under $2^{\circ}\text{C}\pm 1$ was preferred over the same juices stored under $5^{\circ}\text{C}\pm 1$. Aerobic Plate Count in all juices stored under both temperatures were within the Ghana Standard Authority (GSA) APC standards for fruit juices (1.0×10^5 Cfug). Mould counts were higher than the GSA standard (1.0×10^4 Cfug), but yeast counts were within acceptable GSA standards (1.0×10^4 Cfug). *E. coli* O157, *Salmonella*, and *Listeria* spp were not detected in any of the juices throughout the study. Although both storage temperatures could keep juices wholesome, $2^{\circ}\text{C}\pm 1$ had a more positive influence on consumption quality and overall acceptability than $5^{\circ}\text{C}\pm 1$ storage. In conclusion,

fresh pineapple juices prepared under aseptic conditions and stored under low temperature ($2^{\circ}\text{C}\pm 1$) could maintain quality and extend shelflife beyond the industry's 6 days.

Keywords: Physico-chemical, sensory, microbial, *Salmonella* and *Listeria spp*

Harvest-tenure Promotes Innovative Technologies, Practices, Tools to Reduce Loss and Preserve Safe Food Commodities

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Abstract

Across the African Union (AU), drylands are a huge and fragile ecosystem that are home to a large and often hungry population. Insufficient access to mechanized postharvest technologies leads to poor harvest handling practices, high postharvest food/feed commodity and input loss (PHL), and low glut prices. Innovative technologies like mobile grain storage safely preserve grain with Integrated Pest Management (IPM). Elsewhere, surplus exporting regions of the world practice IPM to optimize sun and ambient air drying in-field, prevent mould and theft, so scarce transport resources have time to haul surplus commodities like grain. On-farm vented, raised and metal mobile storage enables IPM which monitors non-residual fumigation tools versus biological enemies that control stored grain insect pests. The result of combining IPM with vented, raised and metal mobile storage in the AU, is Harvest-tenure. Harvest-tenure maximizes grower rights to practice processing surplus grain nutrition at-market for profit. A trial in Ghana organized and compared qualitative data from the AU and elsewhere to unwrap PHL, carbon emissions and off-the-shelf mobile Harvest-tenure. The trial applied three qualitative comparison methods: 1. Evaluate the value of PHL by organizing and reviewing research data; 2. Trialling Harvest-tenure to observe how Ghana's warehouse agribusiness reacted to grower's practicing aggregation, storing and processing without warehouses; and 3. Identify the prejudice that limits practices like Harvest-tenure. The trial indicates that, unlike warehouses, the cost of mobile Harvest-tenure decreases, as capacity increases; over the time that Harvest-tenure reduces PHL; and optimizing drying of crops standing in-field allows growers to manage moisture for price appreciation. On-farm wide-opening roofs offer growers Harvest-tenure with the flexible capacity to store grain loose or in sack/bag and inventory multiple types simultaneously. Unlike warehouses that stack sacks/bags, Harvest-tenure enables non-residual fumigation and biological tools. At-market, growers who also trade learn floors that are raised above the ground mitigate abiotic problems like floods, wildfires and relocating Harvest-tenure is cost-effective as the raised floors are conically shaped so gravity reduces cleaning requirements. Harvest-tenure also employs gravity to do the

work of primary processing to bowls, pails and sacks. The qualitative comparison trial illuminated how prejudice ignores the PHL which corresponds to warehouses. This prejudice for warehouses exacerbates PHL, hunger, carbon emissions and imports. In addition, measuring, monitoring and quantifying mould postharvest will progress development to address causes, extent and impact – the metrics of the PHL that correspond to warehouses. Scaling up Harvest-tenure illuminates technologies, IPM practices, and tools that connect input-production to the yield of nutrition which pays growers to preserve safe food commodities on the drylands.

Keywords: agribusiness, grain, postharvest loss, harvest-tenure, nutrition.

Risks and levels of Post-cooking incidence of Pesticide residues in Cowpea (*Vigna unguiculata*) in Ogun State.

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Abstract

Cowpea (*Vigna unguiculata*), commonly identified as “beans”, is frequently consumed plant-based protein source mainly grown in West African countries including Nigeria. It is an affordable substitute for more expensive animal proteins. Cowpea (*Vigna unguiculata*) is higher in the amino acids lysine and phenylalanine when compared with cereal grains. It also has additional health-promoting dietary elements such vitamins, minerals, and antioxidants that are essential in preventing diseases, as well as low fat and high fiber levels. A peculiar challenge of cowpea production relates to the storage of the harvested crops in accordance with good agricultural practices. Pesticides are potentially toxic to humans and can have both acute and chronic health effects, depending on the quantity and ways in which a person is exposed. They fall into a number of chemical classes, including carbamates, pyrethroids, organochlorines, and organophosphates; which accumulate in the food chain and are bio-accumulative in addition to being poisonous and linked to a variety of risks to human health. This study evaluated the presence of pesticide residues in Cowpea (*Vigna unguiculata* [Linn] Walp) variety “drum beans” after cooking. Ten samples of Drum beans (100g each) were collected from different stores with Ota market (Ogun State), processed and analyzed for presence and levels of pesticide residues using Gas Chromatography with flame Ionization Detection (GC-FID). Four of the ten samples evaluated showed incidence of pesticide residues as high as 0.079mg/kg. based on the Maximum residue level (MRL) of pesticide in food, which is 0.01mg/kg, this place consumers at great risk of food poisoning and diverse health challenges.

Keywords: Pesticide residue; Cowpea; GC-FID; Beans.

Nutrient digestibility, growth and nitrogen balance of West African Dwarf Goats fed diets containing graded levels of biochar

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Abstract

A 4x4 Latin square trial was conducted to ascertain the effect of Rice husk biochar on Nitrogen (N) utilization, growth and nutrient digestibility of four (4) male yearling West African Dwarf goats averaging 10.66 ± 0.77 Kg in weight. Four *Brachiaria mulatto II* (BM) based diets were formulated for the trial as follows; BM + concentrate without RHB (T1); BM + concentrate with 30 g/kg RHB (T2); BM + concentrate with 60g/kg RHB (T3) and BM + concentrate with 90 g/kg RHB (T4). Experiment comprised four periods of 21 days (14 days feed adaptation and 7 days urine and fecal collection). BM and concentrates were offered simultaneously at 700g and 250g respectively. BM contained 90.58% DM, 2,676.64 Kcal/kg ME, 8.32% CP, 8.47% EE, 5.14% Ash, 30.86% Fiber and 81.51% NDF. Concentrates were isocaloric (3299.47-3456.33 Kcal/Kg ME) and isonitrogenous (14.45-16.64 %CP) with 89-90.38% DM, 6.16-7.36 % Ash, 5.52-7.62 % EE, 6.14-9.42 % fiber and 61.54-72.54% NDF. RHB inclusion did not affect feed intake. Daily gain was highest (63.45g/day) for T2 followed by T3. All diets resulted in a positive N balance. RHB inclusion affected Fecal (g), excreted (g/day) and absorbed (relative to % N intake) N. N retention relative to N intake was highest (61.36%) for T4 and lowest (52.64%) for T3. CP digestibility was highest (69.52 %) for T3 followed by T4 and least (55.92%) for T1. The highest DM digestibility (53.00%) and least NDF digestibilities were recorded for goats on T4. CF (58.5%), CP (69.52%) and NDF (59.89%) digestibilities were highest for T2. OM (57.87%) and ME (60.66%) digestibilities were highest for T1 followed by T4. Results from the trial emphasize the potential of biochar as a feed additive for ruminants since its inclusion led to positive N balance and improved nutrient digestibilities and growth performance of goats.

Keywords: Retention, rice husk, daily gain, Brachiaria

Dietary exposure levels of polycyclic aromatic hydrocarbons (PAHs) in street vended re-used frying oils

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Abstract

Polycyclic aromatic hydrocarbons, PAHs, are a major class of environmentally hazardous organic compounds formed by the incomplete combustion or pyrolysis of organic matter. PAHs are of major public health concern due to their known or suspected carcinogenicity, mutagenicity, and toxicity. Oral route has been identified as one of the main sources of exposure to PAHs for non-smokers. This study sought to evaluate the prevalence of PAHs in used cooking oils from street food vendors in KNUST and its environs. The PAH levels in the used oil samples were analysed using High Performance Liquid Chromatography with a fluorescence detector. A structured questionnaire was administered to the vendors to determine the repeated cycles of the oils, of which 70% food vendors reported more than 5 frying cycles for the oils. Maximum concentration of individual polycyclic aromatic hydrocarbons ranged from 6.06 µg/kg (benzo (k) fluoranthene) to 95.02 µg/kg (naphthalene). Naphthalene recorded the highest mean value (36.16 µg/kg). Benzo(a)pyrene (BaP), and Dibenz(a,h)anthracene (DahA), the most potent carcinogens, had mean and maximum concentrations of 4.33µg/kg ;10.83µg/kg and 3.42µg/kg ; 9.23µg/kg respectively. The high values recorded can be attributed to repeated use of the oils for deep frying at high temperatures, coupled with the pyrolysis of the foods as this favours PAH formation. These values exceed the acceptable limit of 2µg/kg for total PAHs in oils and fats for human consumption. Discarding oils after single use can significantly reduce PAH levels, thus improving the safety of street food for its consumers.

Keywords: Polycyclic aromatic hydrocarbons, re-used frying oil, street food vendors, carcinogens, exposure

Microbiological quality and safety assessment of *kulikuli* produced in selected locations in Ogun state Southwest, Nigeria

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Abstract

Kulikuli, a popular snack derived from groundnut (*Arachis hypogea*), is particularly prone to contamination by a wide variety of microorganisms. This research aimed to assess the microbiological quality of commercially available *Kulikuli* and also survey its traditional processing practices so as to identify the possible cause of contamination (physical, chemical and biological) at different processing stages. Samples at processing stages were collected from four processors and sixteen street vendors in four selected towns in Ogun State. Samples prepared in

the laboratory served as the control. Microbiological, chemical and physical assessments of samples were carried out using standard procedures. Microbial isolates were identified using morphological, biochemical and molecular methods. Chemical analysis was carried out using Kirk and Sawyer method. Mycotoxins of health concern were also analyzed using (UHPLC/TOFMS) method. Baseline assessment score sheet were used to obtain information about vending and processing area, handling practices and process control. All data obtained were analyzed using Statistical Package for Social Sciences Version 17.0. The total bacterial counts in *kulikuli* ranged from 1.10 ± 0.08 to 2.30 ± 0.08 Log₁₀ CFU/g. The fungal count ranged from 0.50 ± 0.01 to 3.00 ± 0.07 Log₁₀ CFU/g. Physical contaminants detected during processing stages of *kulikuli* included stones, human/rodent hair and extraneous vegetable matter. In the street vended *kulikuli*, cadmium ranged from 0.01 to 1.03 mg/kg, arsenic ranged from 0.10 to 12.05mg/kg. High levels of AFB1 (162 µg/ kg), FB1 (154 µg/kg), AFB2 (59 µg/kg), and FB2 (57 µg/kg) were recorded in the samples. The result of the microbiological, chemical and physical hazards analysis shows that contamination during the processing and vending of *kulikuli* occur as a result of poor food handling practices, inadequate sanitation practices and exposure to contaminated environment.

Keywords: Food safety; Food hygiene; *Kuli-kuli*

Evaluation of the bacterial diversity and safety assessment of ready-to-eat African salad sold in Lagos, Nigeria

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Abstract

In this study, the bacterial diversity and safety assessment of African salad, locally known as *abacha*, was done using polyphasic approach by combining culture-independent molecular techniques with culture-based genotypic typing methods. Microbiome profiling by 16S rRNA gene amplicon illumina sequencing revealed 52255, 36077 and 57060 reads of bacteria with 474, 538 and 364 OTUs from *abacha* samples, ALC, ALE and ALW, respectively. In total, the most abundant Phyla in ready-to-eat (RTE) *abacha* were *Proteobacteria*, *Firmicutes*, *Actinobacteria* and a very few unclassified phyla, while at the species level Enterobacteriaceae group, *Acinetobacter pittii* group, *Weissella confusa* group, *Acinetobacter baumannii*, *Enterobacter_uc* (unclassified), *Staphylococcus sciuri* group, FMZ_s (not assigned a name yet), *Streptococcus gallolyticus* group, *Bacillus*, *Staphylococcus saprophyticus* group and other related species were identified. Cultured bacterial strains found include *Staphylococcus simulans*, *Bacillus weidmannii*, *Lactobacillus hokkaidonensis* and *Phreatobacter oligotrophus*. The combination of high-throughput illumina sequencing platform and culture-dependent genomic approach has enabled a broader description of the bacterial composition and diversity of *abacha*, as well as, identification of numerous low abundance bacteria that may constitute safety and quality issues, regarding freshly prepared RTE *abacha*. Conclusively, this study indicated that the bacterial composition of *abacha* is significantly more diverse than earlier reported and confirmed the occurrence of bacteria with pathogenic traits and unknown functions. There is, therefore, a great need for food processors

and consumers to adopt hygienic practices to minimize risks of transmission of foodborne pathogens through *abacha* and other related RTE foods. Education of food handlers and the general public on food safety measures, effective Hazard Analysis Critical Control Point (HACCP) application and Good Manufacturing Practices (GMP) implementation is also imperative.

Keywords: African salad; bacterial diversity; safety assessment; polyphasic; Nigeria

Evaluation of insect pest tolerance and oil quality in ethyl methane sulfonate (EMS) exposed groundnut (*Arachis hypogaea* L.)

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Abstract

Arachis hypogaea L. is a multipurpose legume crop widely cultivated in sub-Saharan Africa. Several species of groundnut field insect pest are responsible for substantial yield losses. Hence, the study aimed at evaluating EMS induced groundnut genotypes for insect pest tolerance and oil quality. The seeds of four groundnut genotypes, SAMNUT26, SAMNUT25, SAMNUT24 and ICG4412 collected from the institute for Agricultural Research, Zaria, Nigeria were treated with various concentration of EMS (0.0%, 0.1%, 0.2%, 0.3% and 0.4%) for 6 hours before sowing. The experimental bags were laid out in Complete Randomized Design with three replicates each. Data were collected on Agro-morphological parameters and insect infestation rate of each genotype. Mutant seeds were characterised for oil, following standard procedures. The result of plant height at maturity showed that the tallest plant for SAMNUT25 and SAMNUT26 was recorded in 0.30% concentration with the value of 44.43 and 45.63cm, respectively while for SANUT24 and ICG4412 was obtained in 0.10 % with the value of 51.17 and 50.13cm, respectively. SAMNUT24 had the highest average number of pod per plant (26.33 pods) and seed per plant (2.39 seeds) at 0.10% and 0.20% concentration, respectively. Highest weight of pod (2.08g) and 100 seeds (54.34g) were recorded at 0.30% of SAMNUT26 and at 0.10% of SAMNUT24, respectively. For oil yield, 0.20% treated seeds of SAMNUT 25 had the maximum oil yield (39.34%). Significant variations were observed in number of insects among the genotypes and concentrations at different weeks. Lowest insect populations among the mutants were observed at 14th weeks of evaluation, with different genotype having least insect infestation at different concentration. EMS is an effective mutagen in reducing insect pest of groundnut especially in SAMNUT25 (0.2% EMS). The right concentration of EMS could be exploited for further improvement of the crop against other pests.

Keywords: Insect Infestation; EMS; Groundnut Oil; SAMNUT25; Improvement

Technical design and safety evaluation of an ohmic chamber in the processing of *Brukina*.

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Abstract

Brukina, a West-African functional drink, is made from fermented milk and millet agglomerates. It has health-promoting components, making it beneficial for humans and possibly contributing to the prevention or treatment of disease. However, the distribution and sales of *brukina* are influenced by consumer perceptions of the product's safety and its perceived linkage to foodborne illness. Due to the viscous and particulate nature of *brukina*, traditional pasteurisation technologies may have to be applied at high intensities to achieve appropriate microbial lethality, which affects the nutritional and textural properties of the product. Ohmic Heating is an alternative heating technology that inactivates microorganisms within shorter periods by passing an electric current through the food. This study aims to fabricate a batch-process ohmic heating equipment using locally sourced materials to evaluate the technological efficiency of prepared *brukina*. Four samples were prepared: *brukina* made from conventionally heated milk (CHM), conventionally heated *brukina* (CHB), ohmic heated milk (OHM), and ohmic heated *brukina* (OHB). The D-values of *E. coli* ATCC 25822 in *brukina* for 60°C, 65°C and 72°C were 5.09, 3.48, and 2.40 minutes, respectively. At $P \geq 0.05$, the titratable acidity, pH, and viscosity of samples treated with ohmic heating and conventional heat treatment were statistically equivalent. There were no detections of *Salmonella* or *E. coli*, the number of *Staphylococcus aureus* was within the acceptable range - 4 Log CFU/g. The shelf-life of the sample was determined using the Arrhenius model and Minitab version 17 regression stability studies. *Staphylococcus aureus* colonies, pH, and free fatty acid profiles were measured during a 5-point shelf-life study. At 5 °C, the estimated time for the beverage to be considered microbiologically safe was 7 days. Ohmic heating is a suitable alternative for the pasteurisation of milk for processing *brukina* and for *brukina* product pasteurisation.

Keywords: Ohmic heating; emerging technologies; dairy foods; pasteurisation; *Brukina*

Snapshot mycotoxin profiling of Ready-to-Use Therapeutic Foods intended for severely and acutely malnourished children in Nigeria

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Abstract

Ready-to-Use Therapeutic Foods (RUTF) are nutrient mixtures primarily designed under strict requirements for the therapy of severe acute malnutrition (SAM) in children. These foods are regarded as restricted foods, not intended for children below 5 years of age, and are given as prescribed by a doctor or nutritionist. RUTFs contain low moisture, high energy and are nutrient dense, and they could have different cereal or legume ingredient base. To date, there is sparse information on the spectrum of mycotoxins in RUTFs globally. Therefore, this study applied a robust liquid chromatography tandem mass spectrometric method to determine mycotoxins in 41 RUTF samples from northern Nigeria. A total of 16 mycotoxins including aflatoxin B₁, citrinin, deoxynivalenol, enniatins, alternariol monomethylether, moniliformin, setrigrmatocystin, zearalenone and their derivatives were detected the samples. Enniatin B was the most occurring mycotoxin with 73% incidence, whereas citrinin had the highest mean concentration of 43 µg/kg. RUTF samples with mixed grain-base contained more mycotoxins compared to the pastes made from only peanuts as ingredient base. Although the samples with aflatoxins contained levels below the 5 µg/kg recommended by the Codex Alimentarius, the diversity of mycotoxins in the samples may warrant large-scale mycotoxin surveillance studies to ascertain the safety of such foods for this highly vulnerable population.

Keywords: Aflatoxins, Children, Citrinin, Food safety, Malnutrition, Therapeutic foods

Microbiological safety and antimicrobial resistance in fresh produce production in Africa

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Abstract

Fresh produce, consisting of fruits and vegetables, is increasingly recognized and promoted as an essential component of a healthy diet. Since fresh produce is minimally processed and consumed raw for the most part, humans may be infected with antimicrobial-resistant bacteria through fresh produce consumption. Fresh produce consumption has increased significantly in Africa in recent decades, and they represent a significant vehicle for the transmission of pathogenic and antimicrobial-resistant bacteria to humans. This poses a risk to public health, a risk which is often underappreciated in many countries. This study conducted a comprehensive overview of the current status of pathogenic- and antimicrobial-resistant bacteria in fresh produce in Africa and examined relevant factors contributing to the microbial contamination of fresh produce. The most commonly reported pathogenic bacteria associated with fresh produce supply chains in Africa include *Salmonella* spp., *Escherichia coli*, *Listeria monocytogenes*, and *Staphylococcus aureus*. Pathogens with resistance to multiple antibiotics classes such as aminoglycosides, cephalosporins, penicillins, and amphenicol have been isolated in fresh produce, with some of the resistance markers being plasmid-borne. Authors conducted a recently completed analysis of selected fruits and vegetables from home gardens and retail markets in Oyo State, Nigeria, and showed the presence of pathogens with phenotypic and genotypic antimicrobial-resistance markers. Several sources of contamination with pathogens and antimicrobial-resistant bacteria have been identified during production such as irrigation water, faecal contamination, and soil amendment/organic manure; processing such as washing; distribution such as storage equipment and transport vehicles; retail such as handling; and cross-contamination during food preparation. Recommendations on how to support stakeholders in taking appropriate steps to improve the safety of fresh produce along the value chain in Africa are proposed.

Keywords: Food safety; mycotoxins; pesticides; *Salmonella*; sesame seeds; value chain

Fungal diversity and mycotoxins in rice produced in South-West, Nigeria is influenced by postharvest practices

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Abstract

In Nigeria, rice is processed through the conventional and improved postharvest process chains, and inadequate drying and poor storage practices predispose rice to contamination by fungi and mycotoxins. This study determined the impact of conventional and improved postharvest practices on fungi and mycotoxin contamination in rice processed in South-West, Nigeria. A total of 100 rice samples were collected along the postharvest processing stages (winnowing, drying and milling, and storage for 30 and 60 days). Fifty (50) samples were produced by conventional postharvest practices and stored in jute bags whereas the other 50 were produced using improved postharvest practices and stored in GrainPro bags. Moisture content, fungal load and diversity, and mycotoxin profile of the rice samples were determined by the oven-drying to constant weight method, culture-based isolation and molecular identification methods, and liquid chromatography tandem mass spectrometry, respectively. The moisture levels were higher, but not significantly different, in rice processed and stored conventionally than in rice from the improved process chain. After 60 days storage, the mean viable fungal count was significantly ($p < 0.05$) higher in conventionally processed rice stored in jute bags compared to rice from the improved process chain in GrainPro bags. Three hundred and one (301) fungal isolates were recovered from samples of both process chains and identified as 20 genera and 48 species. *Aspergillus niger* chemotype producing fumonisins was recovered. Sixteen (16) mycotoxins were detected in rice, and zearalenone was most prevalent in the conventional and improved process chains. The mean concentrations of total aflatoxin, nivalenol and zearalenone were significantly ($p < 0.05$) higher in rice from drying till 60 days storage of the improved chain compared to the conventional chains. In conclusion, conventional postharvest practices reduced mycotoxins during pre-storage processing of rice, while GrainPro bags were good at limiting viable fungal growth and mycotoxins in storage.

Keywords: GrainPro bags; moulds; mycotoxins; postharvest practices; rice processing

[Waste to Wealth: Finding applicability for the use of orange \(*Citrus sinensis*\) peel as seafood preservatives](#)

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Abstract

The demand for minimally processed seafood that has its quality and nutritional properties after storage is increasing. Since to reduce or eliminate pathogens is the foremost priority, the current trends in food processing are focusing on the use of natural compounds (plant extracts), which are considered as safe alternatives and satisfy the consumer preferences for more “green foods. The usefulness of citrus peel especially in catfish processing was evaluated in this study with the sole purpose of adding value and providing alternatives. 40kg of averagely sized (250g) catfish was collected. The fish was gutted and properly washed. This was divided into two equal parts with one part treated without preservative and the other treated as follows. Fresh oranges were bought, washed thoroughly; they were peeled and sorted appropriately, ready for use. The washed fish was soaked in the peel solution for 1 hour, allowed to drain, shaped and loaded in the smoking kiln. The fish was cooked and smoke dried until dryness is achieved after a constant weight was noticed. The fish was allowed to cool, packaged into appropriate material and thereafter stored for 112 days. The data obtained during these processes were analysed using descriptive statistics. Citrus peel was found to improve the drying rate of the fish and efficiency of the smoking process. The catfish treated with orange peel was found to retain the post processing quality the most after 112 days storage. The organoleptic quality of the product, though rated fair, can however be more researched into for the best quantity and processes to produce the most desired output. Recently, there has been a renewed interest in natural product research due to the failure of alternative drug discovery methods to deliver many lead compounds in key therapeutic areas.

Keywords: Waste, Wealth, Orange Peel, Seafood Preservative

Nutrients and Phytochemicals in Nigerian underutilized fruits and fruits

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Abstract

Fruits and vegetables are naturally rich in nutrients and antioxidants. Biochemical and *in vitro* studies of antioxidants in fruit and vegetables indicated that they could provide protection against several health problems. The consumption of fruits and vegetables are at the food chart base of the majority and are regarded as vital in balanced diets across the globe. Underutilized fruits and vegetables are often viewed as insignificant because they are less important than staple crops and agricultural commodities in terms of global production and market value. They are not only being neglected, underexploited, or ignored by elites and farmers but also agricultural researchers in Nigeria. However, they constitute those plant species that occur as life support species in extreme environmental conditions and threatened habitats, having genetic tolerance to survive under harsh conditions and possessing high qualities of nutritional and health importance. This paper discusses selected underutilized and threatened fruits and vegetables species of the Southwestern Nigerian, their habits, distribution, nutrients and phytochemicals for the purpose of fostering their awareness,

popularity, consumption and full exploitation of their industrial potentials. These underutilized and threatened fruits and vegetables if embraced can meet the nutritional, food security and industrial needs in Africa.

Keywords: Antioxidants; nutrients; neglected underutilized and threatened vegetables.

Bacteria displaying antimicrobial activity against *Aspergillus* spp., a new approach in managing aflatoxin in maize grains

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Abstract

Aflatoxins are naturally occurring toxins produced by fungi in the genus *Aspergillus*, with the main species being *A. flavus* and *A. parasiticus*. The management of aflatoxins relies primarily on the use of best cultural practices and in some cases the use of the biological control consisting of atoxigenic strains of *Aspergillus* spp. to inhibit the toxigenic strains through competition. At AgBiome, we have built a core collection of over 100,000 fully sequenced microbes from diverse environments and employ both the microbes and their sequences in the discovery of new biological products for disease and pest control. To identify isolates from our collection with the ability to reduce aflatoxin in maize, a total of 533 diverse bacterial strains were screened using a high-throughput assay (48-well assay). Bacterial strains that exhibited pathogen inhibition had their inhibiting activity confirmed using the Flask Assay and were later tested for their ability to reduce the aflatoxin in maize grains. Strains with best growth inhibition and reduction of aflatoxin were tested in the greenhouse and field trials in Uganda. From the field trials, three bacterial strains AFS000009 (*Pseudomonas chlororaphis*), AFS032321 (*Bacillus subtilis*), AFS024683 (*Bacillus velezensis*) demonstrated aflatoxin concentrations (ppb) values that were significantly lower than those of inoculated control, they reduced aflatoxin by 63.4, 69.4, and 73.4%, respectively. The identification of biological products with high efficacy in inhibiting *Aspergillus* spp. growth combined with reducing the aflatoxin content will provide a valuable alternative to control strategies used in mitigating aflatoxin contaminations.

Keywords: Antimicrobial; biological control; aflatoxin; *Aspergillus*

Impact of soil pollution on food security and food safety

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Abstract

Soil pollution is a hidden reality and one of the main threats to global soils and the ecosystem services provided by them, including the production of safe and sufficient food, compromising global food security, food safety and human health. Soil pollution is a growing global concern in every region today, especially in Africa, where food security remains a central concern. Anthropogenic activities, such as industrialization, urbanization and intensification of agriculture, are the primary drivers of soil pollution as chemicals used or generated in the processes become potential soil contaminants when released into the environment. Soil contamination with such toxic substances reduces food security by reducing crop yields due to high toxic levels of contaminants. It poses significant food safety and health hazards when crops take up these contaminants, ultimately reaching consumers through the food chain. Urgent soil remediation is essential to combat soil pollution and ensure resilient food systems, abundance of nutritious and safe produce for present and future generations. Driven by this need, our paper provides a comprehensive analysis of the impact of soil pollution on food security, food safety and human health. It proposes solutions based on case studies of the best available techniques to mitigate the effects. Addressing the issue of soil pollution requires a holistic approach that integrates scientific research, policy interventions and public awareness campaigns to limit the accumulation of contaminants beyond established levels. It is also essential to limit pollution from agricultural sources by the global implementation of precision agriculture techniques, promoting organic farming practices, and adopting efficient waste management strategies to mitigate soil contamination in order to guarantee human health and wellbeing, a healthy environment and an abundance of nutritious and safe food.

Keywords: Anthropogenic Activities; Soil Contamination; Food Chain; Human Health

Foodborne Disease Hazards in Beverages Consumed in Ethiopia: A Systematic Literature Review

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Abstract

Diseases associated with consuming unsafe foods and beverages present significant threats to public health. A Systematic Literature Review (SLR) was undertaken to identify the current evidence on beverage-borne hazard occurrences in Ethiopia from 2000 to 2021. Key words were defined and combined into appropriate syntaxes, with searches done in PubMed, ScienceDirect, and Google Scholar databases. Titles and abstracts were screened independently by two reviewers in Rayyan®. Structured quality assessment criteria were based on relevance and quality. Data from a total of 118 eligible publications were considered in the quantitative analyses, with 539 records extracted into spreadsheets. Excluding alcoholic beverages, 514 records on beverages included cow and camel milk (58%), drinking water (28%), and fruit juices (13%). The review found hazards of significant public health importance, including both biological (n=469) and chemical (n=70) hazards. Bacteria were the biological hazards most frequently reported (94%), which included *Escherichia coli* (21%), *Staphylococcus* spp. (22%), and *Salmonella* spp. (11%). The evidence on contamination of drinking water highlights the importance of applying One Health approaches to food safety interventions. These findings will be helpful in identifying and prioritising the riskiest commodities as well as gaps in data. The SLR was an activity under Feed the Future's EatSafe: Evidence and Action Towards Safe, Nutritious Food (EatSafe) program, which seeks to increase consumer demand for improved food safety in traditional food markets.

Keywords: beverage, food safety, hazards, one health, public health,

ABSTRACTS OF POSTER PRESENTATIONS

Palm oil: A sustainable source of nutrition, health, and environmental benefits for Africa

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Abstract

Palm oil is a valuable source of nutrition and health benefits for African populations. Its unique fatty acid composition, which is high in saturated and monounsaturated fats, makes it a versatile cooking oil that can withstand high heat and provide essential nutrients. However, there is growing concern about the environmental impact of palm oil production, particularly in terms of deforestation, biodiversity loss, and greenhouse gas emissions. In this presentation, we will explore the nutritional and therapeutic advantages of palm oil, its fatty acid composition, and how it can contribute to better health and nutrition in Africa. We will also discuss the importance of sustainable palm oil production practices, including zero-burning policies, reforestation efforts, and land management strategies that protect biodiversity and ecosystems. By addressing both the health and environmental benefits of palm oil, we will show how its production and consumption can contribute to a safer and more sustainable food supply for Africa.

Key Words: Palm oil; Nutrition; Health; Sustainability; Africa

Exploring the Nexus of Food Waste, Food Safety, and Nutrition Security: A Survey of Food Waste on Senior Members at KNUST-Kumasi, Ghana

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Abstract

Food waste is a global challenge affecting food security, environmental sustainability, and public health and thus has received increased attention due to its huge negative impact on the world's economy and the environment. Therefore, this research aimed to understand the factors

contributing to food waste by delving into the intricate relationship between food waste and the integration of food safety with food and nutrition security among senior members at Kwame Nkrumah University of Science and Technology (KNUST), Kumasi. Importantly, the study underscored the potential for coordinated efforts to simultaneously address food waste reduction, enhance food safety practices, and promote nutrition security. A total of 277 respondents were interviewed using a mixed-methods approach, and food waste at eateries was measured. The results showed that, averagely, 30% respondents disposed of about 2% each of their morning and mid-morning meals, as well as lunch. About 20.3% discarded 5-6% of their evening meal, and about 27.8% discarded 3-4% of their snacks or desserts. Measurements at a popular eatery determined the wastages for the three most popular meals (*banku*, rice, and yam) to be 3.90%, 2.80%, 2.42%, respectively, translating into GHC423, GHC279, and GHC237 daily. The major factors explaining food waste among respondents were large meal sizes due to overestimation of hunger, poor taste of foods from eateries, and limited awareness of food safety guidelines. The results indicated a complex interplay between food waste, safety concerns, and nutritional priorities among senior members at KNUST. It can, therefore, be concluded that although some reasons for discarding food were beyond the eaters' control, food wastage had notable financial and socio-economic repercussions on the university community.

Key Words: Food waste; Food safety; Nutrition security; Food security; Economic impact; Meal disposal; Socio-economic repercussions; Wastages; Food safety guidelines; Overestimation of hunger

Aflatoxin M1 exposure in a fermented millet-based milk beverage '*brukina*' and its cancer risk characterization in Greater Accra, Ghana

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Abstract

Brukina is a millet-based fermented milk product consumed as a beverage in Ghana. It is however prone to aflatoxin M1 (AFM1) contamination, posing a serious health challenge for low and middle-income countries in subtropical regions. This study, aimed at evaluating AFM1 levels and cancer risks associated with the beverage, sampled commercial *brukina* (n=150) from different

locations of the Greater Accra Region of Ghana. AFM1 levels were measured with High-Performance Liquid Chromatography (HPLC) connected to a Fluorescence Detector (FLD). Cancer risk assessments were also conducted using models prescribed by the Joint FAO/WHO Expert Committee on Additives (JECFA). Out of the 150 samples analysed for AFM₁, 80/150 (53%) tested positive between the range of 0.00±0.001-3.14±0.77µg/kg. Cancer risk assessments of AFM₁ produced outcomes which ranged between 0.64- 1.88 ng/kg bw/day, 0.31- 9.40, 0.0323, and 1.94x10⁻³- 0.06 for cases/100,000 person/yr for Estimated Daily Intake (EDI), Hazard Index (H.I), Average Potency, and Cancer Risks respectively for all age categories investigated. It was concluded that the consumption of *brukina* posed adverse health effects to the majority of the age categories in the different locations of Greater Accra Region, since the calculated H.Is were greater than one (>1). Therefore, contamination of *brukina* with AFM₁ should be considered a high priority in public health and Ghana's cancer risk management actions.

Key Words: AFM₁; fermented milk; *brukina*, mycotoxins; Accra, Ghana; HPLC-FLD

Exposure and risk characterizations of ochratoxins A and aflatoxins through maize (*Zea mays*) consumed in different agro-ecological zones of Ghana.

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Abstract

Mycotoxin contamination of foodstuffs is a serious food safety concern globally, as the prolonged ingestion of these toxins has the tendency to worsen the risk of hepatocellular carcinoma. This study aimed at estimating ochratoxin A (OTA) and aflatoxin (AF) levels in maize samples, which were above international (European Food Safety Authority, EFSA) and local (Ghana Standards Authority, GSA) standards. Health risks associated with the consumption of maize (n=180) sampled from six (6) regions representing the different agro-ecological zones of Ghana were also assessed. OTA and AF were measured using High-Performance Liquid Chromatography with a Fluorescence detector. Out of the 180 samples analysed for total aflatoxins (AF_{total}), 131/180 tested positive, with 127 (70.50%) exceeding the limits of EFSA and ranged between 4.27-441.02 µg/kg; while for GSA, 116 (64.44%) of samples exceeded this limit and ranged between 10.18-

441.02 µg/kg. For OTA, 103/180 tested positive and 94 (52.22%) of samples between the range 4.00-97.51 µg/kg exceeded the tolerable limit of EFSA, whereas 89 (49.44%), in the range of 3.30-97.51 µg/kg exceeded the limits of GSA. Risk assessment values for total aflatoxins (Aftotal) ranged between 50-1150 ng/kg bw/day, 0.4-6.67, 0-0.0323 aflatoxins ng/kg bw/day and 1.62-37.15 cases/100,000 person/yr for Estimated Daily Intake (EDI), Margin of Exposure (MOE), Average Potency, and Cancer Risks respectively. Likewise, ochratoxin (OTA) values were in the ranges of 8.6×10^{-3} -450 ng/kg bw/day, 0.05-2059.97, 0-0.0323 ochratoxins ng/kg bw/day and 2.78×10^{-4} -14.54 cases/100,000 person/yr. Consumption of maize posed adverse health effects in all age categories of the locations studied since the calculated MOE values were less than 10,000.

Key Words: Ochratoxin A; Aflatoxins; Ghana; Toxigenic fungi; Maize; Cereals; HPLC-F

Physicochemical And Functional Characterization of Flour and Starch from Taro (*Colocasia Esculenta*)

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Abstract

Amid the persistent global challenge of food security, diversification of food sources emerges as a crucial strategy. Overreliance on a limited spectrum of staple crops has hindered progress, highlighting the potential of integrating underutilised species like taro. Taro, a tuberous perennial plant, offers a wealth of digestible carbohydrates and essential micronutrients like phosphorus, iron, and calcium. However, its moisture content restricts widespread consumption. Taro corms are processed into flour to mitigate post-harvest losses and enhance utilisation. However, this necessitates understanding taro flour's physicochemical and functional traits. This study evaluated two taro varieties—KA/019 and BL/SM/16—from the CSIR-Plant Genetic Resource Research Institute (PGRRI), Bunso. The analyses involved examination of the yield of flour from the two varieties as well as the physicochemical and functional characteristics of the flour and starch. Significant differences in proximate composition are observed between the two varieties, except for fibre and energy. KA/019 yields more flour (76%) than BL/SM/16 (50%) due to higher moisture content (7.43%). Both varieties contained significant amounts of calcium and phosphorus levels, but lower copper and manganese concentrations. Taro flour's increased colour results from heightened phenolic compounds (anthocyanins) in corms. Moreover, both varieties feature higher amylopectin than amylose content—89.17% for KA/019 and 89.29% for BL/SM/16. Corm-to-flour processing significantly influences taro's bioactive profile. In conclusion, taro flour's attributes render it suitable for the food industry, addressing food security while considering safety.

Diversification through underused crops like taro contributes to a resilient food system. Harnessing such resources can help mitigate both food security and safety concerns on a global scale.

Key Words: Taro; Physicochemical; Food security; Flour; Starch

Effect of Different Processing Methods on Phytochemicals and Proximate Composition of Leaves of *Pterocarpus mildbraedii*, *Adansonia digitata* and *Jatropha tanjorensis*

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Abstract

Leaves contain a range of phytochemicals minerals and vitamins, but they are easily perishable if not properly handled. Processing transforms perishable leaves into stable foods, improve their shelf life and makes them fit for ingestion. The purpose of this study is to determine how different processing methods affect the phytochemical and proximate constituents of the leaves of *Pterocarpus mildbraedii*, *Adansonia digitata* and *Jatropha tanjorensis*. Standard analytical methods were used to determine the phytochemical contents of the leaves while the official methods of AOAC were used to analyze the leaves for proximate constituents. The results of the phytochemical screening of the leaves of *P. mildbraedii*, *A. digitata*, *J. tanjorensis* indicated the presence of alkaloids, tannins, saponins, phenols and flavonoids. Proximate analysis showed a high crude protein of 24.16 ± 0.60 % and 22.31 ± 0.26 % in the blanched and boiled *P. mildbraedii* respectively. Ash content was found to be high in sun-dried *J. tanjorensis*. Mineral analysis revealed that Ca, Mg and Fe were significantly high in air-dried and boiled *A. digitata*. Vitamin C content was found to be highest amongst other vitamins analyzed in air-dried *A. digitata*. The air-dried and boiled samples of *A. digitata* were found to be the two most effective samples in terms of their phytochemical constituents, therefore, air drying and boiling are good processing methods in preserving the nutritional content as well as their phytochemical constituents.

Keywords: *Pterocarpus mildbraedii*; *Adansonia digitata*; *Jatropha tanjorensis*; minerals; Proximate composition.

Exploring the trade-off of plastic packaging on food safety, its effects on health and the environment with a focus on regulation in Africa

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Abstract

Plastic use is a major food safety and health concern worldwide, and Africa is no exception. Africa has been recorded as the second largest plastic user in the world after Asia. Plastics used in packaging hot food can be considered a chemical hazard because of its potential to release chemicals into the food. They can also be considered physical hazards when plastics disintegrate into particles small enough to be inhaled or consumed. These pose a risk of physical injury to the consumer. Plastics can be considered biological hazards when plastic particles travel from an unhygienic area onto food transferring microorganisms in the process and potentially causing the consumer to fall ill. Plastic use is also a major environmental concern in Africa. This is evident in the plastic waste mounds that are collected each year from city drainage systems clogging gutters and water channels and subsequently causing major floods during the rainy seasons. Single-use plastics have become a convenience to food vendors in packaging street food posing a risk of chemical transfer. In response to this, several African countries have implemented regulations and taken some initiatives to curb the level of plastic use and mitigate its negative impact on health and the environment. The way plastics are used in Africa for food packaging can be considered a huge compromise to food safety. The purpose of this study is to create an awareness of the shockingly unregulated areas of plastic manufacturing bringing the attention of law enforcers in various countries in Africa. By creating awareness, effective implementation and enforcement of policies that oversee the use and manufacturing of plastics in the Africa. This would ensure a long-term success of reducing plastic use, subsequently promoting safer options for food packaging.

Key Words: Plastic packaging; environmental and health effects; regulation

[Mycoflora, aflatoxins and antimicrobial properties of some Ghanaian local spices and herbs](#)

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Abstract

Fungi are significant contaminants and destroyers of spices. This study aimed at determining the mycoflora, mycotoxins, contaminants, and antimicrobial properties of some local spices; dawadawa (*Parkia biglobosa*), nutmeg (*Myristica fragrans*), turmeric (*Curcuma longa*), aniseed (*Pimpinella anisum*), oregano (*Ocimum basilicum*) and clove (*Syzygium aromaticum*). Fungal culturing, identification, and enumeration were done with Dichloran Rose Bengal Chloramphenicol (DRBC). High-Performance Liquid Chromatographer with a Fluorescence detector (HPLC-FLD) was used to determine the aflatoxin levels in all spices. Mueller-Hinton Agar, chloramphenicol, normal saline, and extract were used with *Salmonella typhi*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, *Streptococcus mutans* to determine the antimicrobial activity of the spices (extracts). Twelve (12) fungal species belonging to seven (7) genera were recorded from the spices. The genera were predominantly; *Aspergillus*, *Fusarium*, *Rhizopus*, *Penicillium*, *Mucor*, *Trichoderma*, and *Rhodotorula*. Aflatoxins were detected in dawadawa only. Antimicrobial activity of the extracts had effective inhibition against the microbes investigated.

Keywords- Spices; fungi; mycotoxins; aflatoxins; antimicrobial; herbs; Ghana

Food safety issues associated with sesame seed value chains

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Abstract

Sesame (*Sesamum indicum* L.) seeds are an important export product in major producing countries, predominantly in Africa and Asia, and contribute to socio-economic development through job creation and foreign exchange earnings. In recent years, major food safety incidents involving microbial and chemical contamination of imported sesame seeds and sesame seeds products have been reported. Foodborne hazards pose a potential risk to consumer health and hinder international trade due to increased import controls, recalls, and withdrawals of food products. This study investigated the literature to understand the microbiological and chemical hazards contaminating

sesame seeds and sesame seed products. *Salmonella* constituted a significant microbial hazard in sesame seeds and has been associated with several disease outbreaks globally. *Salmonella* contamination constituted a significant barrier to trade in sesame seeds between African countries and the European Union. Despite being an important issue in sesame seeds, there is currently a limited understanding of what point in the value chain, *Salmonella* contamination occurs. Furthermore, the presence of mycotoxins and pesticides above regulatory limits in retailed sesame seeds and products is a growing concern. There are significant data gaps on the prevalence of microbial and chemical hazards in sesame seeds in producing countries. Eliminating foodborne hazards in sesame seeds and sesame seed products requires urgent attention from all stakeholders and suggestions for improving the safety of these foods will be presented.

Keywords: Food safety; mycotoxins; pesticides; *Salmonella*; sesame seeds; value chains

Business models for agri-service provision with attention to creation of income opportunities for young people

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Abstract

Young people are critical to future economic development and key to achieving the UN Sustainable Development Goals by 2030. However, with 66 million unemployed youth worldwide and 145 million young workers living in poverty, this potential is not being realized. Building capacity of young people in agri-service provision provides a scalable solution to creating income opportunities for them, while generating multiple sector-wide benefits, including imparting knowledge to value chain actors, increasing productivity and incomes for smallholder farmers, and improving food safety. We reviewed experiences and success factors for engaging young people to provide producer-oriented agricultural services and provide case studies of inclusive and sustainable business models. A desk review was conducted to appraise current youth initiatives and business models which included over 50 cases with over 60 organizations in Africa and Asia. Piloting and adapting three business models in Uganda and Kenya – aggregator-driven, industry-driven, and semi-autonomous agripreneur - that involved supporting 163 young people by delivering training and mentorship in a range of technical areas (diagnosis and management of plant health problems, integrated pest management, safe use and handling of pesticides, spray services provision), and support to access business development services. The results of pilot models in Kenya and Uganda showed that the trained young people had started generating profit through offering advice to farmers and providing spray services at a fee and selling of inputs on

commission. Advice given was mainly on sustainable plant health management, use of bio-protection products and safe pesticide use. Overall, the collective efforts of the young people resulted in training 4328 farmers, and spray services to an estimated total of 576 acres of agricultural land in Kenya and Uganda over a 4-months period, and average individual earning of \$22-40 per month. Earnings are expected to increase as relationships with community adults develop. The key lesson from this study is while all models provided benefits for young people, aggregator-driven model in which young people are embedded in aggregator agribusinesses, in addition provided social connections that enabled young people offer services. Facilitating social capital development by linking young people to suitable adults, business development services, and coaching them on social skills are key for sustainability.

Key words: Business models; capacity-building; food safety; income; young people.

Effect of aflatoxigenic and non-aflatoxigenic strains of *Aspergillus flavus* on aflatoxin accumulation in groundnuts

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Abstract

Groundnuts and its products pose significant health risks to consumers due to their exposure to infections by *Aspergillus flavus*, a fungal pathogen known for its ability to produce aflatoxins, potent carcinogenic and hepatotoxic compounds. This study aimed to investigate the response of groundnut genotypes to infection by aflatoxigenic and non-aflatoxigenic isolates of *A. flavus* and subsequent aflatoxin accumulation. Various cultural techniques were employed to characterize *A. flavus* as either aflatoxigenic or non-aflatoxigenic. The selected aflatoxigenic or non-aflatoxigenic isolates were then utilized in an invitro seed colonisation (IVSC) experiment, involving three groundnut genotypes known for their susceptibility levels to *A. flavus*. The study measured disease incidence, severity, and aflatoxin accumulation in the groundnuts. The results demonstrated significant differences ($P < 0.001$) between the genotypes regarding the occurrence and intensity of both aflatoxigenic and non-aflatoxigenic *A. flavus* infections. The non-aflatoxigenic isolate exhibited higher incidence and severity values than the aflatoxigenic isolate. Notably, there was no aflatoxin accumulation in the groundnut genotypes inoculated with non-aflatoxigenic isolate, indicating its potential as a biocontrol agent. Conversely, inoculation with the aflatoxigenic isolate led to the accumulation of aflatoxin B1 and G1 in all groundnut genotypes. Aflatoxin B2 was not detected in the resistant genotype ICGV03401, while it was present at higher levels in the

susceptible genotype Manipinta compared to the resistant genotype L027B. These findings highlight the superior resistance of ICGV03401 to fungal infection and aflatoxin accumulation compared to L027B and Manipinta. Based on the results, further investigation into the non-aflatoxigenic isolate identified in this study could be conducted to explore its potential as a biocontrol agent against aflatoxin contamination.

Keywords: Groundnuts; *A. flavus*; susceptibility level; biocontrol agent; aflatoxin

Food safety issues associated with sesame seed value chains

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Abstract

Sesame (*Sesamum indicum* L.) seeds are an important export product in major producing countries, predominantly in Africa and Asia, and contribute to socio-economic development through job creation and foreign exchange earnings. In recent years, major food safety incidents involving microbial and chemical contamination of imported sesame seeds and sesame seeds products have been reported. Foodborne hazards pose a potential risk to consumer health and hinder international trade due to increased import controls, recalls, and withdrawals of food products. This study investigated the literature to understand the microbiological and chemical hazards contaminating sesame seeds and sesame seed products. *Salmonella* constituted a significant microbial hazard in sesame seeds and has been associated with several outbreaks globally. *Salmonella* contamination constituted a significant barrier to trade in sesame seeds between African countries and the European Union. Despite being an important issue in sesame seeds, there is currently a limited understanding of what point in the value chain, *Salmonella* contamination occurs. Furthermore, the presence of mycotoxins and pesticides above regulatory limits in retailed sesame seeds and products is a growing concern. There are significant data gaps on the prevalence of microbial and chemical hazards in sesame seeds in producing countries. Eliminating foodborne hazards in sesame seeds and sesame seed products requires urgent attention from all stakeholders and suggestions for improving the safety of these foods will be presented.

Keywords: Food safety, mycotoxins, pesticides, *Salmonella*, sesame seeds, value chain

Pre-and Post-harvest insect pests and mycotoxin contamination of yellow maize genotypes in Asante Mampong Municipality of Ghana

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Abstract

Insect pest infestation and mycotoxin contamination of maize grain are of grave concern worldwide due to huge economic losses and the impact of the toxins on human and domestic animals. This study identified the type and abundance of insect pests and levels of mycotoxin in yellow maize grain on the field and at harvest during the major and minor cropping seasons of 2019. Five yellow maize genotypes, Abontem, Honampa, Aburokokoo, Ahoodzin, GH2354 and a check Obatanpa, were used for the study. The experimental design was a randomized complete block. Two nitidulid beetles, *Carpophilus dimidiatus* (Fab) and *Carpophilus marginellus* (Mots) and a silvanid beetle, *Cathartus quadricollis* (Guerin Meneville), were collected from experimental plots at 60-90 days after sowing (DAS). The population of *Carpophilus* species peaked at 70 DAS but decreased from 80-90 DAS. Compared to the other maize genotypes, Obantapa and Aburokokoo recorded the largest numbers of both *C. dimidiatus* and *C. marginellus*. They differed statistically ($P < 0.05$) from the remaining maize genotypes at three sampling dates in two cropping seasons. *C. quadricollis* aggregation was observed at 80 DAS, peaked at 90 DAS and remained so till harvest. *Sitophilus zeamais* and *C. quadricollis* numbers were observed to be higher on genotypes with a low number of ear husks and short husk tip lengths in the minor season than in the major season after harvest. Aflatoxin and fumonisin were detected in the grains of yellow maize genotypes sampled for testing. However, their levels in both seasons were below the acceptable levels of 15 ppb and 4 ppm, respectively. The insect pests identified on the field and at harvest are known to enhance the spread of mycotoxins in maize grain. The implementation of an effective monitoring regime at the late-milk and early-dough stages to detect insects that predispose maize grain to infection is recommended.

Keywords: Aflatoxin contamination; fumonisin; infestation; yellow maize

Enhancing Knowledge of Quality Processing and Food Safety Practices of Women cassava product (Gari) processors in Iwo, Osun State of Nigeria.

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Abstract

In spite of the volumes of reports available on inexpensive improvements in village-scale gari processing, women processors are yet to get updated on the public health hazards and food safety implications of their procedures. The Food Science and Technology programme of Bowen University embarked on a Pilot Study of the level of Food Safety awareness and identification of hazards and critical control points of the unit operations in the local gari process 'plant'. This is a community extension service since many literate and illiterate sectors patronise these village-scale gari women processors. A twenty-garification-point local Gari plant, divided into four processing units located at Oluwo New Market area of Iwo, Osun State, Nigeria, was visited. Quality Processing and Food Safety Practices (QP&FSP) questionnaires were distributed and filled out by twenty-four adult women in attendance. The ages of the trainees are between 21 and 75 years; 70.6 per cent of them have no formal education, while 29.4 per cent completed primary school. About 47.1 percent had no formal training in food processing, while 52.9 percent had trained only ten years earlier in food safety. Their method of operation is at variance with standard procedures. The trainer explained to them the approved processing method and identified critical control points for food safety. While the trainees agreed to put the training into practice, they confessed that a lack of funds might hinder achieving a hundred percent success. Trainers identified Occupational (high heat, smoky flames due to wood fire), Microbial, and Environmental (free-flowing sludge from dewatered pulp) hazards. Training Impact Assessment (TIA) shall be carried out within three months of the initial visit to evaluate the Compliance Level of the processors.

Keywords: Cassava; Gari; women processors; Food Safety Hazards

Phytochemical screening and antimicrobial activities of *Aframomum danielli* (aqueous and ethanolic) extracts

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Abstract

Phytochemicals are biologically active compounds that are present in various parts of medicinal plants such as spice. *Aframomum danielli* spice is used in ethno-medicine for the treatment of

several ailments and as a traditional food preservatives. Safety of synthetic chemicals used in food preservation has led to the use of organic compounds from medicinal plants such as *Aframomum danielli*. The seed of *Aframomum daniellii* were subjected to hot (aqueous and ethanolic) extraction for 48 h. Phytochemical (qualitative and quantitative) and antimicrobial screening of the two extracts were investigated using standard methods. The qualitative phytochemical screening of the extracts yielded positive results for saponin, tannin, diterpenes, terpenoid, coumarin, quinone, alkaloid, cardiac glycosides, charcones, phenols, and protein while flavonoid and steroid were absent in aqueous extract. The quantitative phytochemical screening indicated 2.49%, 1.025% (saponins), 4.25 mg/g GAE, 8.34 mg/g GAE (tannin), 1.20%, 6.40% (alkaloid), 2.88%, 3.06% (total phenol) and 0.00, 6.80mg/g QE (flavonoid) for aqueous and ethanolic extracts respectively. Antimicrobial activities results ranged from 0.00 to 16.17 mm (*Staphylococcus aureus*), 6.67 to 15.33 mm (*Escherichia coli*), 0 to 14.67 mm (*Pseudomonas aureus*), and 8.67-12.67 mm (fungi). There was significant ($p < 0.05$) difference in the antimicrobial activities of both extracts for *Staphylococcus aureus*, *Escherichia coli* and *Pseudomonas aeruginosa* while the extract activities had no significant ($p > 0.05$) difference on fungi organism. The antimicrobial activities also show relatively high inhibitory effect of ethanolic extract against standard laboratory bacterial (*Esherichia coli* and *Pseudomonas aeruginosa*) compared with the aqueous extract. Meanwhile, aqueous extract had higher inhibitory zone for fungi tested at higher concentration. The outcome revealed that both extracts can be used as preservative against food spoilage pathogens in food industry.

Keywords: Phytochemical; *Aframomum danielli*; Antimicrobial activities.