FOOD SAFETY, MICROBIOLOGY AND MYCOTOXIN MITIGATION

Impact of Fermentation on the Microbiological and Phytochemical Properties of Functional Foods Juiced together for a Healthy Beverage

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Abstract 1

The microbiological and phytochemical properties of functional foods (garlic, turmeric, bitter kola, neem leaf, jute leaf and pineapple) juiced together and fermented for 5 days was compared with the one not fermented. Garlic (*Allium sativum*), ginger (*Zingiber officinate*), bitter kola (*Garcina kola*), turmeric (*Curcuma longa*), lime (*Citrus aurantifolia*), neem leaf (*Azadirachta indica*) and onion (*Allium cepa*) were washed, dried, sterilized and grounded aseptically. Ginger (50 g), turmeric (50 g), garlic (20 g), bitter kola (10 g), onion (30 g) and neem leaf (30 g) were weighed into a stainless bowl. Two liters of sterile water at temperature 35 ^{o}C was used to soak the mixed powder for 2 hours, mixed together with mechanical stirrer and screw press was used to squeeze out the juice. Two thousand gram of peeled pineapple was washed, juiced and added to the prepared juice as sweetener. The mixture was divided into two and poured into a separate airtight vessel labeled A and B, both vessels were pasteurized at 62 ^{o}C for 30 minutes. *Saccharomyces cerevisae* (2g) was introduced to vessel B and allowed to ferment for 5 days at 27±2 ^{o}C. The microbial qualities and phytochemical properties of both fermented and non fermented juice were investigated. The presence of photochemical in both fermented and unfermented juice indicates that the juice has antioxidant properties which offer protection that reduces the risk of many diseases, and therefore can be recommended to the malnourished or immunocompromised people.

Keywords: Microbial quality, Phytochemicals, Antioxidant, Immunocompromised

Efficiency of some Extract of Medicinal Plants against Toxigenic *Aspergillus flavus*

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Abstract 2

This study investigates the prevalence, ecology, pathogenicity, and control strategies of *Aspergillus flavus*, a major aflatoxin-producing fungus threatening food safety, public health, and the environment. Laboratory analyses involved ethanolic extraction of selected Nigerian medicinal plants, antifungal susceptibility testing against *A. flavus*, and determination of minimum inhibitory concentrations (MICs). Morphological and molecular techniques were used to confirm fungal identity, while agar well diffusion assays measured zones of inhibition. Results revealed that *Azadirachta indica*, *Moringa oleifera*, and *Vernonia amygdalina* exhibited significant antifungal activity, with inhibition zones up to 17 mm and MIC values as low as 12.5 µg/mL, while *Cola acuminata* and *Theobroma cacao* showed no activity. The study highlights the influence of environmental factors and climate change on fungal proliferation and aflatoxin production. Findings suggest that integrating plant-based antifungal agents, environmental monitoring, and strict food safety regulations could provide an effective strategy for mitigating *A. flavus*-related risks.

Keywords: Toxigenic *Aspergillus flavus*; Biocontrol, antimycotic

Effects of Moringa Leaf Ethanolic Extract on Fungi Responsible for Carrot (*Daucus carota*) Spoilage and Carrot Associated helminths

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Abstract 3

Carrot (*Daucus carota*) is a root vegetable eaten for its sweet taste and health benefits. Unfortunately, carrots spoilt fast due to fungal contamination, while poor hygiene during handling and storage can also lead to helminth transmission. This study evaluated the antifungal activity of *Moringa oleifera* leaf ethanolic extract against fungi isolated from spoilt carrots and assessed the presence of carrot-associated helminths. Five fungal species *Aspergillus niger*, *Aspergillus flavus*, *Aspergillus fumigatus*, *Mucor mucedo*, and *Rhizopus stolonifer* were subjected to *in - vitro* antifungal testing at varying concentrations of *M. oleifera* leaf extract (1 g/9 ml, 2 g/8 ml, and 3 g/7 ml), with sodium benzoate serving as a standard control. Radial growth measurements indicated that the extract inhibited fungal growth in a concentration-dependent manner. *A. niger* and *A. flavus* showed the highest susceptibility, with growth diameter of 19.50a±0.707mm and 20.50a±0.707mm at concentration of 3 g/7 ml respectively, values closely comparable to the positive control. *Rhizopus stolonifer* showed moderate inhibition, whereas *A. fumigatus* and *Mucor mucedo* were less sensitive, retaining relatively higher growth diameters. Helminth examination of carrot samples revealed presence of *Ascaris lumbricoides* eggs in carrot samples gotten at Sabo market and no detectable eggs or larvae in the other two markets sampled. The lowest concentration of *M. oleifera* leaf extract (1 g/9 ml) was able to remove the eggs of *A. lumbricoides*. These findings highlight the potential of *M. oleifera* leaf ethanolic extract as a natural antifungal

agent for the control of carrot spoilage fungi, and helminth contamination, thereby improving economic loss and food safety.

Keywords: *Moringa oleifera*, carrots, helminth, antifungal

Harnessing the Antifungal Potential of *Streptomyces flavogriseus* Secondary Metabolites from Diverse Sources for Smart Agricultural and Food Security Innovations

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Abstract 4
The growing demand for sustainable food security amidst rising threats from fungal pathogens underscores the urgent need for innovative antimicrobial solutions. Actinomycetes, particularly the Streptomyces genus, are renowned for their ability to produce diverse bioactive secondary metabolites with broad pharmaceutical and agricultural applications. This study assesses and compares the antifungal secondary metabolites produced by *Streptomyces flavogriseus* isolated from diverse environmental sources to explore their potential as eco-friendly antifungal agents. The isolates were obtained from selected terrestrial and non-terrestrial environments and cultured on standard actinomycete media. Secondary metabolites were extracted using solvent partitioning and analyzed for antifungal activity against known pathogenic fungi using agar diffusion and broth dilution methods. The active compounds were further characterized using chromatographic and spectroscopic techniques. Preliminary findings suggest that *S. flavogriseus* from varied ecological sources produces potent metabolites such as Actinomycin D and Holomycin, known for their antifungal and biocontrol properties. These compounds hold promise for integration into smart agricultural practices aimed at reducing fungal contamination, crop losses, and post harvest spoilage. This research contributes to the VOWDA 2025 theme by highlighting the role of women in STEM-led biotechnological innovation and promoting sustainable food security through microbial resource utilization. The outcomes are expected to inform future strategies for developing natural, safe, and broad-spectrum antifungal agents for agricultural and pharmaceutical applications.

Keywords: *Streptomyces flavogriseus*, secondary metabolite, smart agriculture, antifungal activity, food security

Assessment of Food Hygiene Knowledge and Practices among Food Handlers in Ondo West Local Government Area

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Abstract 5

Foodborne illnesses remain a significant public health concern, particularly in low and middle-income countries where food hygiene practices may be suboptimal. Food handlers play a critical role in preventing food contamination and ensuring food safety. Therefore, this study aims to assess the level of knowledge, hygiene practices, and availability of food hygiene training programs among food handlers in Ondo West Local Government Area. A cross-sectional descriptive study was conducted among 220 food handlers selected through a two-stage sampling technique across six randomly selected wards in Ondo West LGA. Respondents were stratified by type of food handlers as listed: street vendors, market stall workers, bakers, caterers, and butchers/fishmongers. Data were collected using a structured interviewer-administered questionnaire and analyzed with the aid of SPSS software (SPSS version 25). Chi-square tests assessed associations between socio-demographic variables and knowledge, while logistic regression evaluated the correlation between knowledge and hygiene practices. The study revealed that 53.6% of food handlers had high knowledge of food hygiene, and 79.1% demonstrated good hygiene practices. Education and workplace setting were significantly associated with knowledge levels ($p < 0.001$), ($p < 0.002$), while age, gender, and years of experience were not. Logistic regression showed that high knowledge significantly predicted good hygiene practices (OR = 6.45, $p < 0.001$). Over 70% supported hygiene training, regular inspections, and safe water use. Despite commendable food hygiene knowledge among handlers in Ondo West LGA, gaps between knowledge and practice persist. Addressing this requires continuous education, targeted behavioral reinforcement, and regular, hands-on training and monitoring to improve and sustain hygiene

standards. Strengthening policy enforcement and hygiene education will enhance food safety and reduce the risk of foodborne diseases in the community.

Keywords: Food Hygiene, Food Handlers, Knowledge and Practice, Public Health.

Effect of Processing Methods on the Level of Toxigenic Aspergillus flavus in Maize Seeds.

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Abstract 6
Processing methods significantly affect the occurrence and sporulation level of toxigenic *Aspergillus flavus* in maize seeds. This study investigated the influence of various drying and storage techniques on *A. flavus* contamination in inoculated maize grains. The drying methods employed included a constructed wooden solar dryer lined with aluminium foil, a wooden solar dryer lined with black polythene, calabash (*Crescentia cujete*), trays lined with plantain (*Musa paradisiaca*) leaves, and trays lined with *Thaumatococcus daniellii* leaves. Storage methods evaluated comprised freezer, glass bottle, earthen pot, tin container, resealable polyethylene bag, *T. daniellii* leaf, *M. paradisiaca* leaf, aluminium foil, and woven polypropylene bag. After three weeks of observation, maize grains dried using calabash recorded the lowest spore count of *A. flavus*, while those dried with *T. daniellii* leaves exhibited the highest level of sporulation. A continuous decline in spore count was also observed in maize grains dried with plantain leaves and calabash. Among the storage treatments, maize stored in the freezer showed the least sporulation, with progressive reduction in spore counts over successive weeks. Similarly, reduced spore levels were recorded in maize stored in resealable polyethylene bags, earthen pots, and aluminium foil, indicating their effectiveness in suppressing *A. flavus* growth. Conversely, an increase in sporulation occurred in maize samples stored in plantain leaves. The findings suggest that appropriate post-harvest drying and storage methods, particularly the use of calabash for drying and freezer or sealed containers for storage, can effectively minimize *A. flavus* contamination and enhance maize safety.

Keywords: Processing, Maize, mold storage drying

Microbial Population and Identification of Microorganisms Associated with Fermentation Site Aerosols across Akoko, Ondo State

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Abstract 7
This study examined the microbial population and identified microorganisms associated with aerosols from garri fermentation sites across Akoko, Ondo State. Air and surface samples were collected at varying time intervals using standard microbiological techniques. Bacterial isolates were characterized by colonial morphology, Gram staining, and biochemical tests, while fungal isolates were identified based on macroscopic and microscopic features. Antibiotic susceptibility of bacterial isolates was assessed using the disk diffusion method against selected antibiotics. Results showed that microbial counts varied with exposure time. Identified bacterial isolates included *Bacillus subtilis, Bacillus cereus, Staphylococcus aureus, Pseudomonas aeruginosa, Klebsiella pneumoniae, Proteus mirabilis, Escherichia coli, Enterobacter sp., Citrobacter freundii, and lactic acid bacteria such as Lactobacillus plantarum, Lactobacillus fermentum, Lactococcus lactis, Leuconostoc mesenteroides, and Pediococcus acidilactici. Fungal isolates included Byssochlamys fulva, B. zygos, B. nivea, Cladosporium sphaerospermum, Cryptococcus laurentii, and Geomyces pannorum.* Antibiotic susceptibility testing revealed high resistance among both Gram-positive and Gram-negative bacteria to several commonly used antibiotics, while fluoroquinolones and gentamicin exhibited greater effectiveness. The study concludes that garri fermentation sites in Akoko harbor diverse airborne bacteria and fungi, including multidrug-resistant species, posing potential public health risks and emphasizing the need for improved hygiene practices in local fermentation environment.

Keywords: Aerosols, Fermentation site, Microorganisms, Akoko, Antibiotics

Efficiency of some Extracts of Medicinal Plants against Toxigenic *Fusarium verticilloides*

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Abstract 8
This study investigated the antifungal efficacy of ethanolic extracts from seven medicinal plants against toxigenic *Fusarium verticilloides*. The study was conducted in the Mycology Laboratory of Adekunle Ajasin University, Akungba-Akoko, using a pure strain of *F. verticilloides* obtained from the International Institute of Tropical Agriculture (IITA), Ibadan. Extracts from the leaves of *Azadirachta indica, Ocimum gratissimum, Moringa oleifera, Vernonia amygdalina, Carica papaya, and Theobroma cacao,* as well as the kola nuts of *Cola acuminata*, were prepared using the cold maceration method with 95% ethanol. Their antifungal activity was evaluated using the agar well diffusion method and the broth micro-dilution method to determine the Minimum

Inhibitory Concentration (MIC). The results showed that *Ocimum gratissimum and Moringa oleifera* extracts exhibited the strongest antifungal activity, with both producing a zone of inhibition of 16.0 mm and a low MIC of 12.5 µg/mL. This activity was comparable to the positive control, Ketoconazole, which had a zone of inhibition of 18.0 mm and an MIC of 6.25 µg/mL. Moderate activity was observed in *Vernonia amygdalina* (13.0 mm; MIC 25.0 µg/mL) and *Cola acuminata* (11.0 mm; MIC 25.0 µg/mL). In contrast, extracts from *Azadirachta indica, Carica papaya, and Theobroma cacao* showed no antifungal activity, similar to the negative control (DMSO). The highest percentage yield of extract was obtained from *Carica papaya (62.0%), while Ocimum basilicum and Cola acuminata* had the lowest yields. These findings suggest that *Ocimum gratissimum and Moringa oleifera* possess potent antifungal properties against *Fusarium verticilloides* and could serve as viable bio-fungicides for controlling this pathogen and mitigating the risk of mycotoxin contamination in crops. Further research is warranted to isolate and identify the specific bioactive compounds responsible for this antifungal effect and to test their efficacy in field conditions.

Keywords: *Fusarium verticilloides*, bio-fungicides

Occurrence and Distribution of moulds in groundnut from Akungba community

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Abstract 9

Groundnut samples, a commonly consumed food products in Akungba-Akoko, Nigeria were purchased from Ibaka, Okusa, Glo Mast, Permanent site and Adefarati in Akungba-Akoko community, Nigeria. The present study aimed to assess the moulds contents groundnut in different locations in Akungba community, Ondo State, Nigeria. Dry groundnuts (*Arachis hypogaea*) were collected from different locations (Ibaka, Okusa, Glo Mast, Permanent site and Adefarati) in Akungba community, Ondo state in a sterilized tube and transported to Microbiology Laboratory of Adekunle Ajasin University, Akungba - Akoko. Fungi species were isolated using standard microbiological methods. The percentage occurrence of the groundnut samples were Aspergillus flavus which was the most dominant species, occurring in all five sampling locations and representing 26.32% of the total isolates. This was followed *by Aspergillus niger* (15.79%), while *Fusarium equiseti, Fusarium acuminatum, and Penicillium atramentum* each accounted for 10.53% of the total isolates. Other species with lower frequency (5.26% each) included *Aspergillus fumigatus, Aspergillus terreus, Fusarium graminearum, Fusarium poae,* and *Fusarium verticilloidies.* The *Aspergillus flavus* are usually responsible for aflatoxigenic mould contamination. Isolation of mould and aflatoxin producing strains of Aspergillus flavus in this study are of significance because they are sources of public health threat. Hence, improved storage conditions and monitoring of groundnuts before sale are recommended to avoid contamination during storage and to ensure a healthy and safe food supply along the trade chain and to the

consumers.

Keywords: toxigenic, Aspergillus, Groundnut

Knowledge and Perception of Food Safety Practices among Pregnant Women in Ondo Town

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Abstract 10
Food safety involves the proper handling, preparation, and storage of food to prevent foodborne diseases. These diseases pose serious public health challenges, particularly among pregnant women, where infections can cause miscarriage, stillbirth, preterm labor, and congenital anomalies. This study assessed the knowledge and perception of food safety practices among pregnant women in Ondo town, Nigeria. Ethical approval was obtained from the UNIMEDTH Research Ethics Committee, and informed consent was secured from all participants. A descriptive cross-sectional design was used, and data were collected from 350 pregnant women attending antenatal clinics in selected healthcare facilities through a semi-structured questionnaire. The questionnaire covered sociodemographic characteristics, knowledge of foodborne diseases, food safety practices, and perceptions. Data were analyzed using SPSS version 25, and the Chi-square test assessed associations, with significance set at $p < 0.05$. A large proportion (91.7%) of respondents had high knowledge of food safety. Most participants (68.9%) always cleaned their cooking environment, 22.6% often did, 7.1% rarely did, and 1.4% never did. Similarly, 88.3% reported separating raw and cooked foods, while 11.7% did not. However, 20% did not perceive foodborne diseases as a significant risk during pregnancy, indicating a gap in perception. No statistically significant associations were observed between knowledge levels and sociodemographic characteristics ($p > 0.05$). Although knowledge and awareness of food safety were high among pregnant women in Ondo town, risk perception remained suboptimal. Integrating targeted food safety education into antenatal care is recommended to strengthen preventive behaviors and reduce foodborne disease risks.

Keywords: Gender lens, Food Safety, Pregnant Women In Ondo Town

Determination of Antifungal Potential of Lactobacilli against Toxigenic *Fusarium verticillioides*

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Abstract 11
Contamination of maize with *Fusarium verticillioides* and its carcinogenic fumonisins is a critical food safety challenge in Nigeria. Sustainable alternatives to chemical fungicides are urgently needed. This study investigated the in vitro antifungal potential of autochthonous Lactobacillus isolates from fermented maize (ogi) against a toxigenic *F. verticillioides* strain. Three isolates were characterized as *L. plantarum, L. acidophilus, and L. rhamnosus*. Their cell-free supernatants (CFS) were evaluated using agar well diffusion and broth dilution assays. All CFS significantly inhibited fungal growth. *L. acidophilus* exhibited the strongest activity, with the largest inhibition zone (12.5 mm) and the lowest minimum inhibitory and fungicidal concentrations (MIC: 111 µg/mL; MFC: 212.5 µg/mL). Crucially, all lactobacilli substantially reduced fumonisin B_1 production. *L. acidophilus* was again the most effective, achieving a 79.75% reduction. These findings demonstrate that locally sourced Lactobacillus strains, particularly *L. acidophilus*, possess significant dual antifungal and anti-mycotoxigenic activity against F. verticillioides. This highlights their promise as safe, sustainable, and effective biocontrol agents for integrated management of Fusarium and fumonisin contamination in the Nigerian maize value chain, offering a viable strategy to enhance food safety and security.

Keywords: Biocontrol, Fumonisin, Fusarium verticillioides, Lactobacillus, Maize, Mycotoxin.

Detection and Prevalence of Multi-Drug Resistant *Escherichia coli* Isolated from Poultry Feed, Drinking Containers and Water in Commercial Poultry Farms in Akungba-Akoko Commumity.

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Abstract 12
Escherichia coli is a commensal bacterium in the intestinal tract of humans and animals, but pathogenic strains are significant causes of poultry disease. The rising antibiotic resistance in *E. coli* poses a serious global health challenge. This study assessed the prevalence and multidrug resistance patterns of *E. coli* from poultry farms in Akungba Akoko, Ondo State, Nigeria, and identified potential risk factors. Samples of chicken feed, drinking water, and water container surfaces were collected from different farms using sterile swabs and universal bottles. Isolation and identification were performed with CHROMagar, and antibiotic susceptibility testing was conducted using the Kirby–Bauer disc diffusion method. Of 21 samples, 85% were confirmed as

E. coli. Resistance was observed against Trimethoprim–Sulfamethoxazole (5 mm), Amoxicillin (0 mm), and Chloramphenicol (5 mm), while Ofloxacin (35 mm) and Ciprofloxacin (30 mm) showed strong activity. Intermediate resistance was recorded for Streptomycin (10 mm), Augmentin (7 mm), and Gentamicin (7 mm). The high prevalence of resistant *E. coli* indicates inappropriate antibiotic use and inadequate biosecurity practices in the poultry sector. These findings highlight the urgent need for rational antibiotic use, improved hygiene, and stronger biosecurity measures to curb the emergence and spread of multidrug-resistant E. coli in poultry production.

Keywords: *Escherichia coli*, multi-drug resistant, poultry farms

Microbiological Qaulity Evaluation of Local Beverages (Zobo and Kunu Drink) Sold in Ondo City

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Abstract 13

Local beverages are non-alcoholic drinks that are generally favored for their hydrating and nourishing qualities. Zobo and kunu are traditional beverages widely consumed in Nigeria. However, their safety and quality are often compromised by poor sanitation practices during production. This study aimed to compare the microbial quality of zobo and kunu beverages prepared under hygienic and non-hygienic conditions in Ondo City, Ondo State, Nigeria. Hygienic samples were prepared aseptically in controlled laboratory conditions, while non-hygienic samples were obtained from local street vendors in Ondo City. The samples were serially diluted to obtain dilution factors of up to 10^{-4} which were inoculated on nutrient agar, eosin methylene blue agar, mannitol salt agar and MacConkey agar, and potato dextrose agar for the isolation and enumeration of the total viable bacteria (TVB). Identification of the isolates was done on the basis of morphological, cultural and biochemical characteristics Hygienically prepared samples recorded low total viable bacterial counts (10^3 CFU/mL) with negligible coliform presence and no detectable pathogenic organisms, while non hygienically samples exhibited exceedingly high microbial loads of pathogenic bacteria including *Escherichia coli*, *Klebsiella* spp., *Staphylococcus aureus*, *Salmonella* spp., and *Shigella* spp. were isolated alongside fungi including *Aspergillus spp* and *Penicillium* spp. The absence of pathogens in hygienic samples confirms that proper sanitation practices can significantly reduce microbial contamination. This study shows the presence of potential pathogenic organism in the investigated zobo and kunu drinks, which poses

a threat to public health. There is need to educate the producers on good manufacturing practices (GMP) in order to safe guard against the risk of food borne illness.

Keywords: Local beverages **(**zobo and kunu drink), pathogenic bacteria and fungi.

Occurrence of Toxigenic Mould and Aflatoxins Production in Maize Sold in Akungba Community

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Abstract 14
This study investigates the occurrence of toxigenic moulds and aflatoxin-producing species in maize samples sold within Akungba community, Ondo state, Nigeria. The aim was to isolate,identify and determine the prevalence of fungal contaminants with emphasis on potential aflatoxin producers. Five dry maize samples were randomly collected from different locations in Akungba and subjected to microbiological analysis. Fungal isolation was carried out using surface-sterilized kernels plated on PDA and DRBC agar. Distinct colonies were purified and identified based on cultural and microscopic characteristics. Results showed that the total fungal load ranged from 1.0×10^3 to 3.2×10^6 sfu/g, with the highest contamination observed in sample OKUSA (3.2×10^6 sfu/g). A total of 68 fungal occurrences were recorded across the samples, representing multiple genera including Aspergillus, fusarium, penicillin, Rhizomes, and Alternaria. Among these, *Aspergillus niger* was the most prevalent, accounting for 22.6% of isolates, followed by *Fusarium verticillioides* (10.29%) and *Aspergillus tamarii* (8.82%). Toxigenic species such as *Aspergillus flavus and A. Parasiticus* well known producers of aflatoxins (B1,B2, G1, AND G2) were isolated from multiple samples. The study established that maize sold in Akungba community harbors a wide range of moulds, including aflatoxigenic species, and underscores the need for improved storage, handling and monitoring practices to reduce public health risks associated with mycotoxin contamination.

Keywords: Toxigenic mould, Aflatoxins, maize

CLIMATE-SMART AND SUSTAINABLE AGRICULTURAL PRACTICES

Interactive Effects of Weed and Fertilizer Management on FARO Rice Varieties in Lowland Ecosystems

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Abstract 15
Rice (*Oryza sativa L.)* remains a vital staple for over half of the world's population, particularly in sub-Saharan Africa, where lowland rice sustains food security and rural livelihoods. However, productivity in these systems is often constrained by weed competition and suboptimal nutrient management. This study investigated the interactive effects of weed management regimes and fertilizer types on three lowland rice varieties (FARO 44, FARO 57, and FARO 60) under field conditions in Abuja, Nigeria. A split-split plot design was used, comprising three fertilizer treatments (organic, inorganic, and none) and four weed management options (standard herbicide, reduced herbicide, manual weeding, and no weeding), resulting in 12 treatment combinations. Growth parameters including plant height, tiller number, leaf number, leaf area index (LAI), root traits, biomass, and relative growth rate (RGR) were evaluated over two seasons (2023–2024). FARO 60 consistently exhibited superior performance, with plant heights of 59.80 cm (2023) and 61.20 cm (2024), root numbers of 33.34 (2023) and 34.04 (2024), root length of 6.27 cm (2024), LAI values of 12.91 (2023) and 13.36 (2024), and biomass of 2.22 g (2023) and 2.39 g (2024) per plant. Conversely, FARO 44 produced the highest tiller (6.49; 6.48) and leaf numbers (9.78) across years. Among management practices, reduced herbicide without fertilizer (M2F3), standard herbicide with inorganic fertilizer (M1F2), and reduced herbicide with inorganic fertilizer (M2F2) consistently enhanced growth. Overall, the findings emphasize that varietal selection combined with integrated weed and nutrient management is crucial for optimizing lowland rice productivity.

Keywords: FARO varieties, nutrient management, reduced herbicide, sustainable farming, weed management

Optimizing Biogas Production from Cocoa Pod Husk through Alkaline Pre-treatment

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Abstract 16

Agricultural residues/waste (by-products), such as cocoa-pod-husk (CPH), offer an abundant and underutilised biomass resource with potential biogas production. It's established that biogas is a promising renewable fuel derived from organic materials. Biogas consists methane (primary source), carbon dioxide, and other gases (hydrogen sulfide, nitrogen, hydrogen, ammonia, water vapour). This study investigated the potential of CPH, as a feedstock for biogas production through anaerobic digestion, employing alkaline pre-treatment to enhance biodegradability and methane yield. Conversion of CPH biomass waste into trapped biogas through anaerobic digestion offers numerous advantages, including efficient waste disposal, generation of clean-energy, and potential energy diversification. After alkaline pre-treatment of biomass, the results showed there was a significant increase in biogas yield, with peak of 18.65 litres and a cumulative volume of 333.52 litres over 21 days; methane accounting for 56% of produced gas. This indicates efficient conversion of organic matter into valuable energy. The gas production began the first day of anaerobic digestion from the improvement in biodegradability of CPH, attributed to effective removal of lignin that hinders microbial activity, through alkaline pre-treatment process. Key process parameters such as pH, Volatile-Fatty-Acids (VFA), Total-Inorganic-Matter (TIC), and VFA/TIC ratio were analysed, highlighting the stability and efficiency of anaerobic digestion process. In conclusion, the use of anaerobic sludge as an inoculum greatly enhanced biogas production with confirmation of viability of using alkaline pre-treated CPH as a sustainable feedstock for biogas generation. This study demonstrates agricultural waste conversion into valuable renewable energy resource, contributing to sustainable waste management and energy generation.

Keywords: Cocoa pod husk, sustainable waste management, biogas, anaerobic digestion, alkaline pre-treatment, renewable energy.

BIOCHEMISTRY, BIOPHYSICS AND BIOTECHNOLOGY FOR AGRICULTURAL ADVANCEMENT

Functional Biscuits Fortified with *Ficus exasperata* and *Sphenostylis stenocarpa* Mitigate Hyperglycemia, Oxidative Stress, and Organ Dysfunction in Stz-Induced Diabetic Rats

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Abstract 17
Diabetes mellitus is a global health crisis characterized by persistent hyperglycemia and severe complications driven by oxidative stress. Conventional drugs often fail to prevent these complications, spurring interest in natural, plant-based therapies. *Ficus exasperata* (FE) and *Sphenostylis stenocarpa* (AYB) are African medicinal plants with documented hypoglycemic and antioxidant properties, but their combined efficacy in a functional food format remains unexplored. This study aimed to develop functional biscuits supplemented with FE and AYB and evaluate their protective effects on renal, hepatic, and oxidative stress markers in streptozotocin (STZ)-induced diabetic rats. Diabetic Wistar rats were divided into groups and treated for 14 days with either metformin or biscuits fortified with AYB flour and varying proportions of fermented and unfermented FE leaf flour. Key hepatic markers (AST, ALT, ALP), renal function markers (Urea, Uric Acid), and oxidative stress parameters (SOD, Catalase, TBARS) in pancreatic tissue were analyzed. The FE and AYB-fortified biscuits produced a significant ameliorative effect. Treatment groups showed a profound normalization of hepatic and renal markers compared to diabetic controls. Crucially, the biscuits significantly enhanced pancreatic antioxidant activity, elevating SOD and catalase levels while drastically reducing lipid peroxidation (TBARS). Biscuits with fermented FE exhibited superior efficacy. This study demonstrates that biscuits supplemented with *Ficus exasperata*-Sphenostylis stenocarpa are highly effective in mitigating hyperglycemia and protective against diabetes-induced oxidative organ damage. The findings position this functional food as a promising, affordable, and accessible dietary strategy for the holistic management of diabetes and its complications.

Keywords: Diabetes mellitus, oxidative stress, ficus exasperata, sphenostylis stenocarpa, functional food.

Alleviation of Oxidative Stress in Pancreatic Tissue by Biscuits Fortified with *Sphenostylis stenocarpa-Ficus exasperata* Flours in Stz-induced Diabetic Rats

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Abstract 18
Diabetes mellitus is a chronic metabolic disorder marked by persistent hyperglycemia and oxidative stress, often leading to pancreatic damage and reduced antioxidant defense. The present study investigated the antioxidant and pancreatic-protective effects of Sphenostylis stenocarpa-based biscuits fortified with fermented and unfermented Ficus exasperata leaves in streptozotocin (STZ)-induced diabetic rats. Biscuits were prepared in varying proportions of fermented (FFE)

and unfermented (UFFE) Ficus exasperata leaf powders. In vitro analysis was conducted to assess the total phenolic content (TPC), and total flavonoid content (TFC). The In vivo studies involved the induction of diabetes using STZ and administration of the biscuits to diabetic rats for 14 days. Group 1 serve as control, group 2 serve as induced, while group 3, group 4, group 5, group 6 and group 7 were induced and treated with metformin, (20g, 40g) FFE, and (20g, 40g) UFFE respectively. Biochemical assays were conducted to evaluate pancreatic tissue oxidative stress markers, including thiobarbituric acid reactive substances (TBARS), superoxide dismutase (SOD), and catalase (CAT). Results revealed that FFE-fortified biscuits had significantly ($p<0.05$) higher TPC and TFC. In diabetic rats, the biscuits significantly reduced TBARS levels, while FFE-fortified biscuits demonstrated greater restoration of SOD and CAT enzyme activities with enhanced efficacy compared to the standard drug (metformin). In conclusion, Sphenostylis stenocarpa biscuits fortified with fermented Ficus exasperata leaf exhibit the strongest antioxidant potential and confer protection against pancreatic oxidative damage in diabetic rats, highlighting its potential as functional dietary interventions for diabetes management.

Keywords: Oxidative stress; Ficus exasperata; Sphenostylis stenocarpa; Biscuits; Diabetes

Nephroprotective Effect of *Manihot esculenta* Leaf Extract on Kidney Albumin Levels in Streptozotocin Induced Diabetic Rats

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Abstract 19
Diabetic nephropathy (DN), a leading cause of morbidity in diabetes mellitus, is characterized by albuminuria, glomerular dysfunction, and progressive renal damage driven by hyperglycemia-induced oxidative stress and inflammation. This study evaluates the nephroprotective effects of *Manihot esculenta* (cassava) leaf extract on kidney albumin levels in streptozotocin (STZ)-induced diabetic wistar rats. Thirty male wistar rats (100–150 g) were randomized into six groups (n=5): basal control (water-treated), negative control (STZ only), positive control (STZ + 100 mg/kg metformin), and three STZ-treated groups receiving cassava leaf extract at 100, 200, and 400 mg/kg. Diabetes was induced via a single intraperitoneal injection of STZ (60 mg/kg in 0.1 M citrate buffer, pH 4.5). Treatments were administered orally for 21 days, and kidney albumin levels were quantified using commercial diagnostic kits. Data were analyzed by one-way ANOVA followed by Tukey's post-hoc test ($p<0.05$). The negative control group exhibited significant hypoalbuminemia (2.08 ± 0.05 g/dL) compared to the basal control (3.88 ± 0.04 g/dL). Cassava leaf extract dose-dependently restored albumin levels (2.47 ± 0.08 g/dL at 100 mg/kg, 2.79 ± 0.07

g/dL at 200 mg/kg, and 3.05 ± 0.05 g/dL at 400 mg/kg), which is comparable with the standard drug metformin (3.80 ± 0.07 g/dL). *Manihot esculenta* (cassava) leaf extract demonstrated significant nephroprotective effects by dose-dependently restoring kidney albumin levels. This suggests its potential to ameliorate diabetic nephropathy through antioxidative and anti-inflammatory mechanisms. Further studies are recommended to isolate its active compounds, elucidate underlying molecular pathways, and validate its therapeutic efficacy and safety in clinical settings.

Keywords: : Diabetic nephropathy, *Manihot esculenta* leaf extract, Streptozotocin, Kidney albumin, Nephroprotection, Oxidative stress, Inflammation.

Nephroprotective Effect of *Sphenostylis-Stenocarpa-Ficus Exasperata* Fortified Biscuits on Kidney Biomarkers in Stz-Induced Diabetic Rats

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Abstract 20

This study investigated the effect of *Stephnostylis stenocarpa* enriched biscuits fortified with fermented (FFE) or unfermented (UFFE) *Ficus exasperata* leaf on kidney biomarkers in streptozotocin (STZ)-induced diabetic rats. *Stephnostylis stenocarpa* fortified Biscuits were prepared in varying proportions of FFE and UFFE Ficus exasperata leaf flours. In vitro analysis was conducted to assess the Ferric Reducing Antioxidant Power (FRAP), Fe2+ Chelating Ability and ABTS Radical Scavenging Ability using standard protocols. The In vivo studies involved the induction of diabetes using STZ and administration of the biscuits to diabetic rats for two weeks. The analysis confirmed enhanced FRAP and Fe2+ Chelating Ability in the FFE fortified biscuit compared to the UFFE fortified biscuits. However, both biscuit samples showed a non-significant ($p>0.05$) ABTS Radical Scavenging Ability. Diabetic control group showed severe pathology, marked by significantly elevated levels of renal stress markers (Urea B, Uric Acid, and Creatinine). Results revealed that fortified biscuits caused substantial and statistically significant ($p<0.05$) reduction in these critical biomarkers with the effect more pronounced in the FFE fortified Biscuits. FFE biscuit formulation proved to be the most effective therapeutic intervention by demonstrating a superior FRAP, Fe2+ Chelating Ability, ABTS Radical Scavenging Ability and nephroprotective effect by normalizing Urea B, Uric Acid and Creatinine levels, indicating broad protection against major organ damage. The findings strongly conclude that *Stephnostylis stenocarpa*-Fermented *Ficus exasperata* fortified Biscuits provides the optimal formulation,

offering a practical, potent functional food strategy to mitigate oxidative stress and reverse diabetic-related renal pathology.

Keywords: Oxidative stress; *Ficus exasperata*; *Sphenostylis stenocarpa*; Biscuits; STZ-induced diabetes

Molecular Modulation of Pancreatic Incretin and Glucose Transport Pathways by *Sphenostylis Stenocarpa–Ficus exasperata* fortified biscuits in streptozotocin-induced diabetic rats.

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Abstract 21
Diabetes mellitus remains one of the most prevalent metabolic disorders globally. Conventional pharmacological agents are often associated with side effects necessitating the search for functional food alternatives. *Ficus exasperata* leaf are traditionally employed for managing metabolic disorders due to their phytochemical richness, while *Sphenostylis stenocarpa* is a nutrient-dense, underutilized legume with low glycemic index. This study explored the molecular modulation of key pancreatic biomarkers by biscuits formulated from *S. stenocarpa* fortified with fermented (FFE) and unfermented (UFFE) F. exasperata in streptozotocin (STZ)-induced diabetic rats. Biscuits were prepared by incorporating FFE and UFFE leaves into S. stenocarpa flour at 20 g and 40 g inclusion levels. Male Wistar rats were divided into experimental groups and diabetes was induced using STZ, after which treatments were administered for 14 days. Pancreatic tissues were analyzed for the expression of glucagon-like peptide 1 (GLP-1), dipeptidyl peptidase 4 (DPP-4), glucose transporter 4 (GLUT-4), and interleukin-6 (IL-6) using molecular assays. Diabetic controls showed impaired incretin signaling (↓GLP-1, ↑DPP-4), reduced GLUT-4, and elevated IL-6. Supplementation with fortified biscuits improved these markers with greater upregulation of GLP-1 and GLUT-4 genes expression and stronger downregulation of DPP-4 and IL-6 genes expression. These findings highlight complementary roles of FFE and UFFE in modulating pancreatic function. This study demonstrates that *S. stenocarpa* biscuits fortified with F. exasperata leaves exert significant antidiabetic effects through biomarker-specific pathways. The concordant effects of both formulations suggest their potential as functional food interventions in diabetes management. Further clinical evaluation is recommended to confirm their translational applicability in humans.
Keywords: Incretin pathway; Ficus exasperata; *Sphenostylis stenocarpa*; Functional food; STZ-induced diabetes

Women and Youth Empowerment in Agribusiness

Smart Agriculture for a Secure Future: The Critical Role of Women and Youths in STEM

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Abstract 22
Food security is one of the most important challenges facing many communities today. To achieve sustainable food systems, we need to include more women and young people in agriculture, especially through science, technology, and innovation. This paper focuses on how empowering women in STEM (Science, Technology, Engineering, and Mathematics) and promoting smart agriculture can improve food production, create jobs, and protect the environment. Women play a major role in producing and processing food, yet many of them do not have equal access to land, finance, or modern agricultural tools. By giving them better access to training, information, and digital technologies, they can become more productive and resilient to climate-change. Smart farming practices such as precision-farming, hydroponics, vertical-farming, and data-driven agriculture can help reduce waste, improve yields, and make farming more efficient. This paper reviews how stronger partnerships among governments, development agencies, private organizations, and local communities can promote agricultural-sector. These collaborations can create programs that train women and young people, provide start-up support, and promote innovation in agriculture. Empowering women and youths in smart agriculture is not only good for food security—it is essential for building a sustainable and inclusive future. When women and young people are given equal opportunities to lead and innovate in agriculture, communities grow stronger, economies become more stable, and the world moves closer to achieving zero-hunger. Finally, the team at Funafo Innovations Promotion Foundation for Women and Youths made recommendations on involving women and youths further, to engage in climate-action in the agricultural-sector.

Keywords: Sustainability, STEM, Smart Agriculture, Women, Youths.

A Decade of Impact: Advancing Gender Inclusion, Innovation, and Sustainability through the Voice of Women in the Development of Agriculture (VOWDA) in Nigeria (2013–2025)

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Abstract 23
Over the past decade, the *Voice of Women in the Development of Agriculture (VOWDA)* has emerged as a transformative platform advancing gender equity, innovation, and sustainability in Nigerian agriculture. Established in 2013 and officially registered with the Corporate Affairs Commission (CAC) in 2015, VOWDA has empowered women and youth through entrepreneurship, leadership, and research capacity development. Through integrated programmes, over 1,000 beneficiaries have been trained in smart and sustainable agricultural practices, value addition, and agribusiness management, resulting in a 68% increase in women-led enterprises and an average 45% rise in income. Educational empowerment through bursary awards has enabled 100 children of female farmers to complete secondary education, improving literacy and school retention rates in rural communities. Additionally, 200 early-career scientists have benefitted from mentorship, with 40% securing international fellowships, grants, or scholarships. Over 500 agricultural researchers have gained digital and proposal-writing skills, collectively attracting research funding. Community development initiatives have reached 600 rural women, promoting food safety, entrepreneurship, and climate-smart agricultural practices. VOWDA's decade-long activities reflect a measurable 78% empowerment effectiveness rate, underscoring its commitment to inclusive growth, innovation, and social transformation.

Keynote: Empowering women through science, innovation, and leadership is essential to achieving smart, sustainable agriculture and ensuring food security in Africa.

GOOD AGRICULTURAL PRACTICES (GAPS) AND FARMER CAPACITY BUILDING

Impact of Biochar and Probiotics in Reducing Odor and Enhancing Waste Management in Animal Housing

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Abstracts 24
Animal housing environments such as poultry pens, piggery units, and fish ponds face persistent challenges related to waste accumulation and offensive odors, which are often caused by the uncontrolled breakdown of organic matter and the release of gases like ammonia, methane, and hydrogen sulfide. These conditions not only affect animal health and welfare but also pose environmental risks and reduce overall productivity. Biochar, a carbon-rich product made from pyrolyzing organic waste, possesses aromatic ring structures that make it resistant to microbial decay. Its porous structure, large surface area, and negative surface charge allow it to adsorb odor-

causing gases, reduce moisture, and provide shelter for beneficial microbes. It also stabilizes organic matter, slowing decomposition and reducing gas release. Probiotics, such as Lactobacillus species, contribute by producing enzymes that break down organic waste more efficiently, and through their charged cell surfaces, they bind to suspended solids and harmful microbes, neutralizing pathogens and aiding in flocculation and biofilm formation. These actions reduce odor intensity and accelerate waste treatment. When used together, biochar enhances probiotic activity by offering a stable, protected microenvironment, while probiotics, in turn, promote the breakdown of waste materials accumulated in biochar's pores. This synergistic relationship improves the microbial balance, limits harmful emissions, and creates more stable conditions in animal housing systems. Recent studies support the effectiveness of this combined approach, showing improved fermentation parameters, reduced gas emissions, and better overall waste management. In conclusion, the biochar–probiotic synergy holds great promise for transforming waste and odor management in animal production, promoting animal health, environmental sustainability, and operational efficiency.

Keywords: Biochar, probiotics and biofilm formation

ONE HEALTH, FOOD SECURITY, AND ENVIRONMENTAL RESILIENCE

Influence of Human Capital on Food Security Status among Rural Households in Oriire Local Government Area, Oyo State Nigeria

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Abstract 25
Food insecurity in Nigeria at the moment is more pronounced with serious evidence of malnutrition and hunger especially in the rural countryside despite the abundant human assets. This study examined the influence of human capital indices on the food security status among rural households in Oriire Local Government Area. Primary data were collected with structured questionnaire and interview schedule. A multistage sampling technique was used to select 70 respondents for the study. The data were analyzed with descriptive statistics, food security index (Fi) and multiple regression analysis
The results showed that majority (67.14%) of the respondents were male, while their mean age

was 47years, most (84.29%) of them were married and had household size of 5 members on the average. It was found that 47.14% of the respondents had secondary education and their main occupations were trading and farming, while all (100%) had a health issue with headaches, body pain (92.86%), and malaria (87.14%). The food security status indicated that 58.57% of them were food insecure. Also, the analysis revealed that household size (-0.36864) had a significant negative effect while sex (0.36864) a male-headed, costs of illness treatment (0.00003) and health index (1.41762) had positive effects on food security.
In conclusion, the study identified the contributions of good health care (human capital), households with smaller size and male-headed on achieving food security. The study recommended that government and Non-Governmental Organizations should intervene to cushion the challenges of food insecurity with improved health facilities and family planning thereby developing local welfare.

Keywords: Human capital, Food security, Rural households, Health index, Male-headed households.

Evaluation of the Antibacterial Activity of *Cymbopogon citratus* Extracts on Multidrug Resistant *Escherichia coli* Isolated from Small-Scale Poultry Farms in Akungba-Akoko

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Abstract 26
The indiscriminate use of antibiotics for disease prevention and growth promotion in poultry production has contributed significantly to the emergence of multidrug-resistant (MDR) bacteria, posing serious risks to farmers, consumers, and the food chain. Avian Pathogenic *Escherichia coli* (APEC) represents a major threat in poultry farming, with infections commonly spread through contaminated feces. Given the rising challenge of antibiotic resistance, identifying effective alternative therapies has become essential. This study investigated the antibacterial potential of Cymbopogon citratus (lemon grass) extracts against multidrug-resistant *E. coli* isolates obtained from poultry samples. *E. coli* were isolated from 15 poultry droppings collected across four different locations using standard bacteriological techniques. The isolates were identified using CHROMagar and subjected to antibiotic susceptibility testing via the agar well diffusion method. Results showed that 90.9% of the isolates exhibited multidrug resistance to three or more antibiotic classes. The antibacterial assay revealed that *C. citratus*, particularly the methanol extract, demonstrated notable inhibitory activity against MDR *E. coli*. These findings suggest that lemon grass extracts may offer a promising natural alternative for managing antibiotic-resistant *E. coli* infections in poultry.

Keywords: *Escherichia coli*, antimicrobial resistance (AMR), lemon grass (Cymbopogon citratus), poultry farms.

Smart Agriculture and Digital Transformation

Application of Machine Learning for Visual Classification of Maize Quality: Implications for Food Safety and Aflatoxin Risk Reduction

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Abstract 27
Maize is a major staple in Nigeria, yet its safety is often threatened by fungal invasion and aflatoxin contamination, primarily from toxigenic Aspergillus flavus. Conventional detection methods, though reliable, are costly, time-consuming, and require specialized laboratory facilities, limiting their accessibility for routine field monitoring. This study explored the use of artificial intelligence (AI) as a rapid, non-invasive screening alternative. A machine learning classification model was developed using Google Teachable Machine and trained with image datasets of sound and defective maize kernels. When evaluated on a representative sample, the model predicted a 21% probability of being good maize and a 79% probability of being bad maize, suggesting a high likelihood of contamination or quality deterioration. The model effectively recognized visual biomarkers such as discoloration, shrivelling, and surface damage that often signify fungal colonization. Although not a substitute for microbiological or aflatoxin quantification assays, this prototype offers a valuable pre-screening step that can guide laboratory testing priorities. Integrating AI with traditional analytical methods enhances food safety surveillance, supports early contamination detection, and promotes sustainable aflatoxin risk management. Thus, this approach demonstrates strong potential as a real-time, non-destructive tool for maize quality assessment in food safety applications.

Keynote: Maize, Machine Learning, Teachable Machine, Food Safety, Aflatoxin *Aspergillus flavus*