



- 
- 
- 
- 
- 

The  African Union  Food and Agriculture Organization of the United Nations 

# FOOD SAFETY

## Conference for Africa

 International Association for Food Protection.

# PROGRAMME & ABSTRACT BOOK

*Virtual Event*

10th & 11th November 2021





# Contents

Welcome	3 - 4
Scientific Programme	5 - 10
Poster Programme	11 - 14
Food Safety Governance in Africa (Oral Abstracts)	15 - 18
Impact of COVID-19 on Food Systems in Africa (Oral Abstracts)	19 - 22
Food Safety from Field-to-Bowl (Oral Abstracts)	23 - 28
Continental Food Safety Initiatives	29
Food Safety Control Systems in Africa: The Role of Traditional and Emerging Technologies (Oral Abstracts)	30 - 36
Academic and Development Partnerships in Food Safety: National, Regional, Continental and International Initiatives (Oral Presentations)	37 - 44
Food Safety Governance in Africa (Poster Abstracts)	45 - 49
Impact of COVID-19 on Food Systems in Africa (Poster Abstracts)	50 - 51
Food Safety from Field-to-Bowl (Poster Abstracts)	52 - 68
Food Safety Control Systems in Africa: The Role of Traditional and Emerging Technologies (Poster Abstracts)	69 - 74
Academic and Development Partnerships in Food Safety: National, Regional, Continental and International Initiatives (Poster Presentations)	75 - 76



# Welcome Message

from the Scientific Committee Chair,  
ACAFP 2021 Food Safety Conference

I hope everyone is doing well and staying safe amidst the COVID-19 pandemic. You will agree with me that the pandemic has highlighted the need for putting in place resilient health and food systems globally. 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, development partners and students to share and discuss pertinent food safety issues on the continent.

This is the first conference being organized by the African Continental Association for Food Protection (ACAFP), and 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 Food Safety in Africa: Past, Current and the Future. The conference presentations have been structured under five sub-themes namely, 1) Food Safety Governance in Africa; 2) Impact of COVID-19 on Food Systems in Africa; 3) Food Safety from Field-to-Bowl in Africa; 4) Food Safety Control Systems in Africa: The Role of Traditional and Emerging Technologies; and 5) Academic and Development Partnerships in Food Safety: National, Regional, Continental and International Initiatives

The conference will comprise two keynote presentations, 32 technical oral presentations and one roundtable discussion. The Call for Abstracts for poster presentation yielded an impressive response and 50 have been accepted for presentation. It is unfortunate that this conference is being hosted virtually due to the travel restrictions imposed by the COVID-19 pandemic. However, with the technical support from Turners Conferences, the event will be interactive for all participants including poster presenters and exhibitors.





## Welcome Message (continued)

The abstracts for the oral and poster presentations have been compiled into this book of abstracts, which can be downloaded from the conference website. Additionally, posters and PowerPoint presentations will be downloadable. I encourage the presenters who wish to publish to their papers in journals to do so taking into consideration comments and suggestions that may be provided at the conference.

I take this opportunity to thank all members of the Scientific Committee (Prof. Obadina Adewale, Dr. AyoJesutomi Abiodun-Solanje, Prof. Kebede Amenu, Prof. Charles Muyanja, Mr. Abdoulie Jallow and Dr. Blaise Ouattara) for their commitment and hard work in putting together the scientific programme. I also thank other conference planning sub-committees and Prof. Joseph Odumeru, ACAFP President and chair of the conference organizing committee for their coordinated efforts and leadership. I acknowledge the professionalism exhibited by the team from Turners Conferences throughout the planning of this conference. I also thank all the invited distinguished speakers and poster presenters for taking the time to share with us their views, experiences, and expertise.

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

Dr. Rose Omari  
Science and Technology Policy Research Institute,  
Council for Scientific and Industrial Research  
Accra, Ghana.

# Scientific Programme

## Day 1: 10 November 2021

*(This programme is provisional and subject to minor changes. The programme times are GMT.)*

08:30 – 09:20	<b>OPENING SESSION:</b> Moderator: Prof. Lucia Anelich	
08:30 – 08:35	Opening Remarks by ACAFP President	<b>Prof. Joseph Odumeru,</b> ACAFP President Director, Laboratory Service Branch – Ministry of the Environment, Conservation and Parks, Ontario, Canada
08:35 – 08:40	AU Statement	<b>Dr. Simplicie Nouala,</b> Head of Division Agriculture and Food Security, Department of Rural Economy and Agriculture
08:40 – 08:45	FAO Statement	<b>Mr. Suffyan Koroma,</b> Senior Policy Officer Food and Agriculture of the United Nations Subregional Officer for Eastern Africa
08:45 – 08:50	IAFP President Statement	<b>Dr. Ruth L. Petran,</b> President, IAFP. Senior Food Safety Advisor, The Acheson Group and Ruth Petran Consulting, Minnesota, USA
08:50 – 09:20	Keynote Speaker	<b>Dr. Godfrey Bahiigwa,</b> Director, Agriculture and Rural Development, African Union Commission
09:20 – 10:40	<b>FOOD SAFETY GOVERNANCE IN AFRICA</b> Moderator: Prof Obadina Adewale Olusegun	
09:20 – 09:45	Food Law and Regulations	<b>Prof. Bernd van der Meulen</b> European Institute for Food Law, Netherlands
09:45 – 09:55	Food Safety Regulation in Ghana: Innovations, Successes and Lessons	<b>Maria Aba Lovelace-Johnson</b> Food and Drugs Authority, Ghana

# Scientific Programme

09:55 – 10:05	Enhancing the effectiveness of public policy implementation: The case of the national policy for aflatoxin control in Ghana	<b>Rose Omari</b> CSIR – Science and Technology Policy Research Institute, Ghana
10:05 – 10:15	Imperatives of Food Regulatory Policy Development to Address Emerging Issues and Innovation in the Food Production Sector	<b>Prof. Samuel Goedefroy</b> Laval University, Canada
10:15 – 10:40	Questions & Answers	
10:40 – 10:55	Leg Stretch	
10:55 – 12:05	<b>IMPACT OF COVID-19 ON FOOD SYSTEMS IN AFRICA</b> <b>MODERATOR: PROF. SHEILA OKOTH</b>	
10:55 – 11:20	SARS-CoV-2 and Risk Related to Food & Food Packaging Safety	<b>Prof. Lucia Anelich</b> Anelich Consulting, South Africa
11:20 – 11:30	Presentation Title to be Confirmed	<b>Florence Mutua</b> International Livestock Research Institute (ILRI), Kenya
11:30 – 11:40	Assessment of Household Food Security Situation During the Covid-19 Lockdown in Kenya	<b>Dinga Lynette Aoko and Nelson K. Olang’o Jomo</b> Kenyatta University of Agriculture and Technology, Kenya
11:40 – 11:50	The Covid-19 Pandemic: Unprecedented Threats to Livestock Agri-food Systems in Africa	<b>Christian Keambou Tiambo</b> Centre for Tropical Livestock Genetics and Health (CTLGH), ILRI-Nairobi, Kenya
11:50 – 12:05	Questions and Answers	
12:05 – 13:05	Lunch Break & Exhibition Poster Sessions (Sub Themes 1, 2 and 3): <b>Moderator: Dr. Ajibola Oyedeji</b>	

# Scientific Programme

13:05 – 14:35	<p><b>ROUNDTABLE DISCUSSION: Moderator/Chair: Dr. Simplicie Nouala</b> Organised by the Africa Union Commission (AUC) <b>TOPIC: ACCESS TO SAFE AND NUTRITIOUS FOOD FOR ALL IN AFRICA</b></p> <ol style="list-style-type: none"> <li>1. Dr. Godfrey Bahigwa, Director, Agriculture and Rural Development, African Union Commission</li> <li>2. Hon. Neema Lugangira, Member of Parliament, United Republic of Tanzania</li> <li>3. Mr. Ade Freeman, Regional Program Leader, Food and Agriculture Organization (FAO)</li> <li>4. Dr. Ousmane Badiane, Executive Chairperson, Acting Managing Director, AKADEMIYA2063</li> <li>5. Dr. Hermogene Nsengimana, Secretary General, African Organization for Standardization (ARSO)</li> <li>6. Mr. Ernest Aubee, Head of Agriculture Division, ECOWAS Commission</li> <li>7. Mr. Hakim Mufumbiro, Coordinator, CCAFRICA</li> </ol>	
14:35 – 16:20	<p><b>FOOD SAFETY FROM FIELD-TO-BOWL IN AFRICA</b> <b>Moderator: Dr. Ayojesutomi Abiodun-Solanke</b></p>	
14:35 – 15:00	A Perspective on Mycotoxins in Food Crops in Sub-Saharan Africa	<b>Prof. David Miller</b> Carleton University, Canada
15:00 – 15:10	Food Safety in the Horticultural Sector in Ghana: Challenges/ Risks, Risk Factors and Possible Interventions	<b>Gloria Essilfie</b> University of Ghana, Ghana
15:10 – 15:20	Milk Production, Processing and Consumption in Pastoral Settings in Ethiopia: Food Safety within the Food Security	<b>Bekele Megersa and Kebede Amenu</b> Addis Ababa University, Ethiopia
15:20 – 15:30	An Approach for Improving Safety and Hygiene Control Practices in Emerging Dairy Chains	<b>James Ledo</b> CSIR – Food Research Institute, Ghana
15:30 – 15:55	Estimates of aflatoxin induced-liver cancer risk and associated health and economic impacts in Tanzania	<b>Prof. Martin Kimanya</b> Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH - East African Community (EAC), Tanzania

# Scientific Programme

15:55 – 16:05	Urban Food Markets in Africa – incentivizing food safety using a Pull-Push approach: Evidence to action towards improved microbiological safety and hygiene of tomato in Ethiopia	<b>Biruk Alemu Gemed</b> International Livestock Research Institute (ILRI), Ethiopia
16:05 – 16:20	Questions and Answers	
16:20	Closure of Day 1	
<b>Day 2: 11 November 2021</b>		
08:30 – 10:00	<b>CONTINENTAL FOOD SAFETY INITIATIVES</b> Moderator: Dr. Ajibola Oyediji	
08:30 – 09:00	Risk-based Inspection – Challenges and Perspectives for Africa	<b>Dr. Blaise Ouattara</b> Food Safety and Quality Officer, FAO Region office for Africa
09:00 – 09:20	NEPAD's Food Systems and Food Safety Programme	<b>Ms. Kefilwe Moalosi,</b> Nutrition and Food Systems Programme Officer, NEPAD, South Africa
09:20 – 09:40	Africa Food Safety Initiative	<b>Mr Mawuli Asigbee</b> University of Missouri Assistance Program (UMAP, Ghana
09:40 – 10:00	Questions and Answers	
10:00 – 10:10	Leg Stretch	
10:10 – 12:05	<b>FOOD SAFETY CONTROL SYSTEMS IN AFRICA: THE ROLE OF TRADITIONAL AND EMERGING TECHNOLOGIES</b> Moderator: Dr. Kebede Amenu	
10:10 – 10:35	Role of Fermentation as traditional practice in ensuring food safety in Africa	<b>Obadina Adewale Olusegun</b> Federal University of Agriculture, Nigeria
10:35 – 10:45	Safety Assessment of Traditional Fish Smoking Practices in Nigeria: A Scale Up Analysis	<b>Abiodun-Solanke Ayojesutomi</b> Federal College of Fisheries and Marine Technology, Lagos, Nigeria



# Scientific Programme

10:45 – 10:55	Improving Traditional Technologies to Enhance Food Safety: The Case of Brukina and Poultry Processing in Ghana	<b>Angela Parry-Hanson</b> University of Ghana, Ghana
10:55 – 11:05	Reducing Post-harvest Losses in Grains at the Smallholder Farmer Level: A Holistic Approach	<b>Isaac Sesi</b> CEO & Head of Product Development, Sesi Technologies Ltd., Ghana
11:05 – 11:15	Inactivation Effects on <i>Aspergillus flavus</i> and <i>Aspergillus parasiticus</i> on Peanut Seeds by Multi-hollow Surface Dielectric Barrier Discharge Plasma	<b>Gebremedhin Gebremariam</b> Ambo University and Addis Ababa Institute of Technology, Ethiopia
11:15 – 11:25	The Roles of African Traditional Fermentation Technologies in Food Safety: Challenges and Opportunities	<b>Dr. Tesfemariam Berhe</b> Ethiopian Biotechnology Institute, Ethiopia
11:25 – 11:35	Mycotoxin Regulations in Food and Feed: Local and Export Trade Perspective	<b>Dr Olaitan Olajuyigbe</b> Nigerian Institute of Oceanography and Marine Research, Nigeria
11:35 – 12:05	Questions and Answers	
12:05 – 13:05	Lunch Break & Exhibition Poster Sessions (Sub Themes 3, 4 and 5): Moderator: Dr. Ajibola Oyedepi	
13:05 – 14:40	<b>ACADEMIC AND DEVELOPMENT OF PARTNERSHIPS IN FOOD SAFETY: NATIONAL, REGIONAL, CONTINENTAL AND INTERNATIONAL INITIATIVES</b> Moderator: Dr. Rose Omari	
13:05 – 13:30	MYTOX-SOUTH® International Partnership to Improve Food Security & Food Safety	<b>Prof. Sarah De Saegar</b> Ghent University, Belgium
13:30 – 13:40	Academic, Industry and Governmental Partnerships: A Panacea for Ensuring Food Safety in Africa	<b>Dr Oluwafemi Adebo</b> University of Johannesburg, South Africa

# Scientific Programme

13:40 – 13:50	Experiences from Collaborative and Innovate SPS Projects in Africa	<b>Catalina Pulido</b> Standards and Trade Development Facility (STDF/WTO), Switzerland
13:50 – 14:00	Risk-based Food Safety Systems in Africa: Experiences from Two Collaborative Projects	<b>Barbara B. Kowalczyk</b> Ohio State University, USA
14:00 – 14:10	Building Food Safety Research Capacity in Africa Through Intercontinental Collaboration	<b>Dr Olumide Odeyemi</b> Highs International Foundation, Australia
14:10 – 14:40	Questions and Answers	
14:40 – 14:50	Leg Stretch	
14:50 – 16:10	<b>IAFP / ACAFP SESSION</b> Moderator: Dr. Moustapha Oke	
14:50 – 15:20	Changing Risk Profiles of Foods and How to Manage Them	<b>Ruth L. Petran</b> IAFP President
15:20 – 15:50	Food Fraud in Africa	<b>Prof. Charles Muyanja</b> Makerere University, Uganda
15:50 – 16:00	IAFP Association Information Presentation	<b>David W. Tharp</b> IAFP Executive Director
16:00 – 16:10	ACAFP Association Information Presentation	<b>Mr. Peter Kennedy,</b> Vice President ACAFP
16:10 – 17:00	<b>CLOSING CEREMONY</b> Moderator: Prof. Charles Muyanja	
16:10 – 16:40	The Future of Food Safety in Africa: Research Perspective	<b>Prof. Delia Grace Randolph</b> International Livestock Research Institute (ILRI), Kenya
16:40 – 17:00	Closing Remarks from IAFP, AU, FAO, ACAFP	



# Poster Programme

## POSTER SESSION 1

Wednesday, 10 November 2021, 12h05 – 13h05

*(This programme is provisional and subject to minor changes. The programme times are GMT.)*

### FOOD SAFETY GOVERNANCE IN AFRICA

Fruits and Vegetables Safety Regulations in International Trade and Africa's Exports: Evidence from the European Union Market	Olayinka Idowu Kareem
Compliance Assessment with Fish Quality and Safety Regulations by Industrial Fisheries in Lagos, Nigeria	Elizabeth Mangai
Food Sovereignty, Good Governance and Peace in DR Congo	Arsène Ntamusige
Assessment of Food Safety Legislation and Efforts in Nigeria	Augustine Okoruwa, John Tehinse, Nwando Onuigbo-Chatta and Seun Elere
The Need for Forensics Support in the War Against Food Fraud: A Focus on Ghana	Yahaya Sumara Sulley, Aaron Amankwa

### IMPACT OF COVID-19 ON FOOD SYSTEMS IN AFRICA

Does Covid-19 Pandemic Affect Purchasing Habit?	Sarra Jribi, Hanen Ben Ismail, Darine Doggui, Hajer Debbabi
Audit Frequencies in Time of COVID-19 Restrictions and Recovery: A South African Sample	Mutsa Rwasoka, Lulanie Swanepoel

### FOOD SAFETY FROM FIELD-TO-BOWL

Camel Meat Safety and the Status of Hygienic Practice in Abattoir and Butcherries of Nagelle Town, Southern Oromia, Ethiopia	Kedir Abdi, Sisay Girma, Balako Gumi and Zelalem Ayana, Oudessa Kerro
Food Safety of Fresh Produce in Africa: Past, Current and Future	Esther Areo, Amarachukwu Anyogub and Obadina Adewale
Bacteriological Safety Assessment and Coliform bacterial contamination of Milk and Other Dairy Products in Northwest Ethiopia	Achene Melaku Beyene, Zenebe Jemere, Baye Gelaw, Mucheye Getahun, Barbara Kowalczyk, Desalegn Mengesha, Seleshi Nigatu. Ahmed Yousef, Wondwossen Gebreyes



# Poster Programme

Exposure to Food Safety Concerns by Women, Men, and Youth in the Poultry Value Chain in Kenya; A Review	Ariel V. Garsow, Kathleen E. Colverson, Barbara B. Kowalczyk
Impact of Selected Marinades and Processing Methods on the Microbial Loads of Japanese Quail Meat ( <i>Coturnix coturnix japonica</i> )	Idowu-Mogaji, Grace Oluwatoyin, Adepeju, Adefisola Bola and Oyedele, Damilola Sayo
Effects of <i>Aframomum danielli</i> on Microbial Loads of Watermelon Juice ( <i>Citrullus lanatus</i> ) During Storage	Jokodola, Temilola Tolulope, Adegoke, Gabriel Olaniran, Idowu-Mogaji, Grace Oluwatoyin
Analytical Method Development and validation based on Paper Analytical Device (PAD) for Teff Injera (Ethiopian flatbread) Adulteration Detection	Yeniewa Kerie, Ariaya Hymete, Marya Lieberman, Ayenew Ashenef
The Technical and Political Perspectives of Food Safety in Africa: The Last Three Decades	Erica Kim, Sanja Ilic
Effect of Steeping, Handling and Packaging on the Microbial Quality of a Blended Traditional Food Thickener, "achi" Seeds ( <i>Barchystegia eurycoma</i> )	Kupoluyi, Abiodun
The Status and Trends of Food Safety in Nyankpala, Ghana	Mohammed Lawal, Shamsiyatu Murtala, Yahaya Damba
Salmonella as an Emerging Africa's Food Safety and Export Challenge: A Need for Urgent Interventions	Firew Tafesse Mamo, Birhan Addisie Abate, Kassahun Tesfaye, Tigist Getachew
E. Coli and Salmonella Load of Tomato Sold in Nairobi Metropolis	J.H. Nguetti, M.W. Okoth, J. Wang'ombe, W.F. Mbacham, S.E. Mitema

# Poster Programme

## POSTER SESSION 2

Thursday, 11 November 2021, 12h05 – 13h05

*(This programme is provisional and subject to minor changes. The programme times are GMT.)*

### FOOD SAFETY FROM FIELD-TO-BOWL CONTINUED

Antimicrobial Resistance Profiling of Pathogens Isolated from Commercially Sold and Home Garden Selected Fruits and Vegetables	Olanbiwoninu Afolake, Awotundun Theresa, Olayiwola John, Fashogbon Rachael
Prevalence, Phenotypic and Genotypic Characterization of Campylobacter spp and Salmonella spp Isolated from Poultry Value Chains Managed by Peri-urban women and Youth Farmers in Kiambu County, Kenya	Robert S. Onsare, John Njenga, Noel Kambi, Susan Kiranga, Peter Osako, Nasandra Wright, Barbara B. Kowalczyk
A Survey of Fumonins and Deoxynivalenol in Market Wheat Flour and Wheat Products in Kenya	Phanice Kheseli Otieno, Susan S. Imbahale, Vitalis Wafula Wekesa, Sheila Okoth
Characterization of Lactic Acid Bacteria Isolated from Sardines ( <i>Sardina pilchardus</i> ) with Antifungal and Probiotic Effects	Mounir El Boujamaai, Youssef Taoufiki and Abdellah Zinedine*
Effect of Climatic Variations on the Occurrence of Toxigenic Fungi in Wheat Collected in Two Moroccan Areas	Aicha El Jai, Catherine Brabet, Noel Durand, Didier Montet, Mohamed Rahouti, Abdellah Zinedine

### FOOD SAFETY CONTROL SYSTEMS IN AFRICA: THE ROLE OF TRADITIONAL AND EMERGING TECHNOLOGIES

Sources And Levels of Biochar on Tomatoes Seedlings Growth	Egas José Armando; José Mendes Massango and Simeão Gabriel Balane
Efficacy of Cold Plasma Treatment in The Postharvest Management of Stone Fruit: A Case Study of Nectarine	Zinash A. Belay, Neliswa A. Matrose, Oluwafemi J. Caleb
Diagnostic Analysis of Post-production Losses of Tomato ( <i>Solanum lycopersicum</i> ) in the Menoua Division, West region of Cameroon	Henri Grisseur Djoukeng*, Whitney Rakelle Anguezomo Assoumou, Nestor Lindou Peyoumeya
Assessment of Safety Performance in Banana Alcoholic Beverage Processing Factories in Rwanda	Grace Irakiza, Viateur Ugirinshuti, Olivier Kamana, Martin P. Ongol

# Poster Programme

Application of the Box–Behnken Design for the Optimization of Processing Variables in White Kenkey Production	Charlotte Oduro-Yeboah, Esther Sakyi-Dawson, Firibu Kwesi Saalia Christian Mestres, Genevieve Fliedel, and Wisdom Amoa-Awua
Disparity Between Farming Practices and Mycotoxins Contamination of Household Grains Among Farmers in Northern Uganda	Godfrey Wokorach, Sofie Landschoot, Kris Audenaert, Richard Echodu, Geert Haesaert
<b>ACADEMIC AND DEVELOPMENT PARTNERSHIPS IN FOOD SAFETY: NATIONAL, REGIONAL, CONTINENTAL AND INTERNATIONAL INITIATIVES</b>	
Partnership for Traceability and Authenticity of Mediterranean Food (Med food TTHubs): Case Study of Egypt & Tunisia	Elkady G., Arfaoui A. Barkouti A., Trabelsi F., Dessouky Y., Banias G
Sanitary and Phytosanitary-Related Capacity Development in Africa: The Impact of the European Union Interventions on Market Access	Olayinka Idowu Kareem, Christine Wieck



## FOOD SAFETY GOVERNANCE IN AFRICA

### Food Law and Regulations

Prof. dr. Bernd van der Meulen<sup>1,2</sup>

<sup>1</sup>European Institute for Food Law, Amsterdam the Netherlands ([www.food-law.nl](http://www.food-law.nl))

<sup>2</sup>University of Copenhagen

#### ABSTRACT

The essence of food safety is shielding consumers from food borne harm. Legislation and regulations ('law') have their role to play in providing rational rules of the game. These rules guide authorities and businesses and may empower consumers. The rules of the game of food ('food law') are never finished. Rulemaking is a process of continuous improvement to keep abreast of emerging safety issues and scientific developments. In food, more than in many other societal fields, rule makers can rely on support from international institutions.

The Codex Alimentarius provides a wealth of models and examples. It provides lists of food additives that have scientifically been assessed to be safe; of maximum residue limits in food for pesticides and for veterinary medicinal products; and of maximum limits of chemical contaminants (<https://www.fao.org/fao-who-codexalimentarius>). These can be used as starting points in improving national legislation. The UN Food and Agriculture Organization and the World Health Organization have devised tools national authorities can use to self-assess their food control systems (<http://www.fao.org/documents/card/en/c/ca5336en>).

Food regulatory scholars as well have role to play by making experience, lessons learned and best practices available across borders. In particular the emerging field of comparative food law provides tools for analysis and inspiration. The safety of a food item can be seen as the sum-total of the inherent properties of its ingredients and the item's condition in terms of contamination and deterioration.

This directs regulators' attention to the inherent properties of ingredients – which substances can be used in food and which should be avoided? – as well as to contamination – where is the limit of what is acceptable and which strategies can be followed to mitigate. Both great similarities and great differences can be observed in the way different countries regulate on food safety. This legal 'biodiversity' provides rich sources for evolution.

There remains a lot to be learned about approaches followed in Africa. ACAFP can contribute in this regard.

---

Keywords: food law; comparative food law

B.M.J. (Bernd) van der Meulen ([www.berndvandermeulen.eu](http://www.berndvandermeulen.eu)) ([Bernd.vanderMeulen@food-law.nl](mailto:Bernd.vanderMeulen@food-law.nl))

## Food Regulation in Ghana: Innovations, Successes and Lessons

Maria Aba Lovelace-Johnson<sup>1</sup>

<sup>1</sup>Food and Drugs Authority, P.O Box CT 2783, Cantonments, Accra

### ABSTRACT

This paper dwells on the challenges, innovations, successes, and lessons learnt which have ultimately, contributed to enhancing food safety and shaping and strengthening food regulation in Ghana. From April 1999 to date, Ghana has worked assiduously to improve food safety and reduce the incidence of foodborne diseases. The Food and Drugs Law (PNDC 305B) was enacted in 1992 for effective food regulation in Ghana whilst the Ghanaian legislature passed an act in 1996 to amend the Food and Drugs Law to provide for the fortification of salt to alleviate nutritional deficiencies. It was not until 1997 that the Food and Drugs Board (FDB) was established and mandated to ensure food safety and quality. In 2000, pursuant to the Food and Drugs Law, the Breastfeeding Promotion Regulation, LI 1667 was promulgated to control the sale and advertisement of breastmilk substitutes. In 2009, FDB realizing the multifaceted nature of food regulation, spearheaded the drafting of the country's food safety policy. The policy spells out the roles and responsibilities of government agencies involved in food regulation from farm to fork to eliminate grey areas and prevent duplication of functions. In view of the challenges met and lessons learnt by the FDB, the Public Health Act 2012, Act 851, Part 7 was promulgated in 2012 to revise and consolidate laws relating to public health to prevent disease, promote, safeguard, maintain and protect the health of humans and animals. A body corporate known as the Food and Drugs Authority was therefore established.

---

Keywords: Food Regulation, Food Safety, Public Health, Ghana

Maria Aba Lovelace-Johnson (maria.lovelace-johnson@fda.gov.gh)

# Enhancing the Effectiveness of Public Policy Implementation: The Case of The National Policy for Aflatoxin Control in Ghana

Rose Omari<sup>1</sup>

<sup>1</sup>Science and Technology Policy Research Institute, Council for Scientific and Industrial Research, P.O. Box CT 519, Cantonments, Accra, Ghana.

## ABSTRACT

Public policies are government actions or proposed actions directed at achieving certain desired goals or objectives. Policy-making process generally has stages such as agenda setting, formulation, adoption, implementation, and evaluation. The degree to which policy goals and objectives are achieved depends on the effectiveness of its implementation. However, in practice, some policies fail to deliver their expected results leading to waste of resources and reduction of public confidence in government. As part of the process of formulating the national policy for aflatoxin control in Ghana, literature review was conducted to identify barriers to effective policy implementation. The barriers included setting ambiguous goals, priorities and responsibilities; lack of space for learning and effecting corrections; lack of support and ownership by political actors; use of discretion by implementers in determining actions; and lack of resources, a clear implementation plan, communication, side or supportive policies and champions. Additional issues relevant for the policy were identified through a situational analysis of the prevalence, health and economic effects, strategies, policies and legislations for controlling aflatoxins, teaching and research capacities, and knowledge, attitude and practices of value chain actors on aflatoxins and their management. Inputs were also obtained through stakeholders' consultations. Measures for eliminating barriers to effective policy implementation, findings from situational analysis and stakeholder consultations were integrated into the aflatoxin policy development process. This approach has facilitated the development and enactment of a technical regulation for aflatoxin control and endorsement of the aflatoxin control policy by four ministers who have jointly submitted it to cabinet for approval. To conclude, the roots of a policy's success or failure often lie in decisions made early on at the agenda-setting and formulation stages. Hence, it is important to continuously monitor and evaluate public policies, draw lessons and integrate lessons learnt in new policies to improve their implementation.

---

Keywords: Policy implementation, Barriers, Public Policy, Food Safety, Aflatoxin

Rose Omari (rose.omari@yahoo.com)



# Imperatives of Food Regulatory Policy Development to Address Emerging Issues and Innovation in the Food Production Sector

**Samuel Benrejeb Godefroy\***

\*Food Risk Analysis and Regulatory Excellence Platform (PARERA), Institute of Nutrition and Functional Foods (INAF) – Department of Food Sciences, Faculty of Agriculture and Food Sciences, Université Laval, Québec, QC, Canada. Global Food Regulatory Science Society (GFoRSS), PARERA, Laval University, Quebec, QC. Canada

## ABSTRACT

This presentation will offer a short overview of the requirements of food regulatory policy development requirements to support a stronger food regulatory oversight enabling a higher level of compliance and a better adaptation to emerging needs such as the capacity to address emerging food safety issues and to enable innovation in the food production sector.

A stronger emphasis on enhanced collaboration, through compliance promotion and co-regulation are part of the ingredients to respond to this effort.

---

### Keywords

Best Food regulatory practice, Collaboration, Compliance promotion

Corresponding Author: [parera@fsaa.ulaval.ca](mailto:parera@fsaa.ulaval.ca)

## IMPACT OF COVID-19 ON FOOD SYSTEMS IN AFRICA

### SARS-CoV-2 and Risk Related to Food and Food Packaging Safety

Lucia Anelich<sup>1,2</sup>

<sup>1</sup>Anelich Consulting, P O Box 36536, Menlo Park, Pretoria, 0102, South Africa

<sup>2</sup>Central University of Technology, Centre for Applied Food Sustainability and –Biotechnology, Private Bag X20539, Bloemfontein, South Africa

#### ABSTRACT

The SARS-CoV-2 (COVID-19) pandemic has undoubtedly had a profound effect, globally, in almost all spheres of life and the food and beverage supply chain is no exception. Whilst we now understand far more than 18 months ago on the modes of transmission of the virus, questions arose early in the pandemic on the possibility of transmission of the virus through food and food packaging. This presentation will explore this possibility, relying on credible, scientific evidence to show that transmission via food and food packaging is highly unlikely and that ultimately, this virus poses an occupational health risk as opposed to a food safety risk.

---

Keywords: SARS-CoV-2; COVID-19; food safety; food packaging safety, coronavirus

Lucia Anelich (la@anelichconsulting.co.za)

## COVID-19 Mitigation and its Effects on Food Safety in East Africa

Florence Mutua<sup>1\*</sup>, Erastus Kangethe<sup>1</sup>, Delia Grace<sup>1, 2</sup>

<sup>1</sup>International Livestock Research Institute, P.O.Box 30709- 00100, Nairobi, Kenya

<sup>2</sup>Natural Resources Institute, University of Greenwich, Central Avenue, Chatham Maritime, Kent ME4 4TB. UK

### ABSTRACT

COVID-19 is not transmitted through food, however, measures put in place to contain its spread disrupted food systems in many ways. We interviewed experts working on food safety in countries within East Africa, to understand the effects the pandemic had on safety of foods consumed in the region. Several issues were observed, and these were related to: the bulk purchasing of food products, their handling, and storage; the rush to make purchases and supply of expired products or those nearing their expiry periods; the delay of food and feed trucks especially at border points; and the working in shifts, which, given the limited staff, reduced the capacity of food businesses to undertake the usual inspection. Future interventions should consider the negative impacts arising from enforcement of mitigation measures. A One Health approach would promote this.

---

Keywords: COVID-19, food safety, East Africa

Florence Mutua (f.mutua@cgiar.org)

Erastus Kangethe (mburiajudith@gmail.com)

Delia Grace (d.randolph@cgiar.org)



# Assessment of Household Food Security Situation during the Covid-19 Lockdown in Kenya

Dinga Lynette Aoko<sup>1</sup>, Ojijo Nelson K. Olang'o<sup>2\*</sup>

<sup>1</sup>Department of Human Nutrition Sciences, School of Food and Nutrition Sciences, College of Agriculture and Natural Sciences, Jomo Kenyatta University of Agriculture and Technology, P. O. Box 62000, 00200, Nairobi, Kenya

<sup>2</sup>Department of Food Science and Technology, School of Food and Nutrition Sciences, College of Agriculture and Natural Sciences, Jomo Kenyatta University of Agriculture and Technology, P. O. Box 62000, 00200, Nairobi, Kenya

## ABSTRACT

Food security remains a key challenge in Kenya and the situation has been exacerbated by the raging effects of COVID-19 pandemic, which pushed the Government of Kenya to impose a lockdown on April, 2020, in the counties of Nairobi and Mombasa. A survey was conducted to assess the effects of the COVID-19 lockdown on household food security situation in Kenya, from June to July 2020. A structured questionnaire which was administered through online social networks was used. A total of 444 responses were received, but only 80 were completely filled. Quantitative data were collected on the socio-demographic characteristics, dietary practices and coping strategies based on a set of questions to assess behavioral responses to manage incipient household food shortage. Data were analyzed using Statistical Package for Social Sciences (SPSS) version 23.0. Descriptive statistics such as mean, percentages and frequencies were carried out; relationships between the variables were assessed using chi-square test, Pearson correlation and multiple linear regression. Significance levels were determined at 95 percent confidence interval where a p-value of less than 0.05 was considered significant. The prevalence of low, medium and high dietary diversity scores were 7.5 percent, 17.5 and 75 percent, respectively, implying that the majority of the respondent households were food secure with pockets of food insecure households within the Nairobi Metropolitan region. There was a significant relationship between household dietary diversity and household income source ( $\chi^2=7.71$ ,  $p=0.02$ ), household perceived economic pressure during the COVID-19 lockdown ( $\chi^2=20.37$ ,  $p<0.01$ ), and household perceived ability to meet their food needs  $\chi^2=18.01$ ,  $p<0.01$ ). Consumption of less preferred and less expensive foods was the most (30 percent) often used coping strategy against food insecurity. The study recommends putting up mitigation strategies to support pockets of food insecure households during lockdowns imposed by government in the wake of the COVID-19 pandemic.

---

Keywords: food security, COVID-19 lockdown, dietary diversity, household income, household economic pressure, household food needs

Ojijo Nelson K. Olang'o (ojijonko@jkuat.ac.ke), Corresponding author  
Dinga Lynette Aoko (lynette.dinga@jkuat.ac.ke)

# The COVID-19 Pandemic: Unprecedented Threats to Livestock Agri-food Systems in Africa

Christian Keambou Tiambo<sup>1,2\*</sup>, Lyna Mukwa Fama Tongo<sup>3,4</sup>, Blaise Arnaud Hako Touko<sup>2,5</sup>, Mariette Anoumaa<sup>2,6</sup>, Barberine Silatsa Assongo<sup>2,7</sup>, Eric Bertrand Kouam<sup>2,8</sup>, Abdulai Jalloh<sup>9</sup>, Jean Jacques Mbonigaba Muhinda<sup>10</sup>, Simplicie Nouala<sup>2,11</sup>, Appolinaire Djikeng<sup>2,12</sup>

<sup>1</sup> Centre for Tropical Livestock Genetics and Health (CTLGH), ILRI-Nairobi, Kenya.

<sup>2</sup> Centre for Agricultural Studies, Education, Technologies and Innovations (CASETI), Dschang, Cameroon

<sup>3</sup> Plant Clinic International, Kinshasa, Democratic Republic of Congo

<sup>4</sup> Food and Agricultural Organisation (FAO) – Kinshasa, Democratic Republic of Congo

<sup>5</sup> Department of Zootechny, Faculty of Agronomy and Agricultural Science, University of Dschang, Dschang, Cameroon

<sup>6</sup> Department of Plant Biology, Faculty of Science, University of Dschang, Cameroon,

<sup>7</sup> Department of Biochemistry, Faculty of Science, University of Dschang -Cameroon

<sup>8</sup> Department of Crop Sciences, Faculty of Agronomy and Agricultural Sciences, University of Dschang, Cameroon

<sup>9</sup> West and Central African Council for Agricultural Research and Development (CORAF), Dakar, Senegal

<sup>10</sup> Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA), Entebbe, Uganda

<sup>11</sup> African Union Commission - Department of Agriculture, Rural Development, Blue Economy, and Sustainable Environment, (AUC-DRBESE). Addis Ababa, Ethiopia

<sup>12</sup> Centre for Tropical Livestock Genetics and Health (CTLGH), The Roslin Institute, University of Edinburgh, Edinburgh, UK

## ABSTRACT

Agriculture is a fundamental sector for livelihoods in Africa. The livestock subsector contributes 40% of the global value of agricultural output in Africa. It has become a prominent feature in the global agri-food systems due to increasing dietary shift towards livestock products by an increasing and wealthy urbanising population. Sustaining the balanced demand-supply scenarios particularly in African countries is rife with a number of challenges in all the segments of the livestock value chain. The situation is aggravated by the COVID-19 pandemic in the global landscape where more than 800 million people are struggling to escape from chronic hunger. Setbacks of COVID-19 are unprecedented, despite the incredible potential and opportunities for Africa to become the "global food basket". The social distancing measures have limited access of poor farmers to resources, input and services thus, aggravating their precarious conditions. However, a consistent paradigm shift for transboundary green economic markets, cost-sharing partnership model, joined efforts of regional trade blocs, self-determination in empowering the human capital and effective resource management are proposed as the way forward to Africa to arrest the negative impact of the pandemic mid-course, and ensure sustainable livelihoods and the food sovereignty of its nations. Harnessing the African animal diversity both in terms of genetics and production systems constitute itself the first pillar to livestock industry development and sustainability. Developing, improving, and promoting rustic local breeds is part of the measures against pandemic risks and livelihood degradation for livestock keepers. These intervention measures will be supported by a decentralised and shortened supply chains.

---

Keywords: Covid-19, Livestock, food systems, Africa, Threat, intervention strategy.

Christian Keambou Tiambo (c.tiambo@cgjar.org), Corresponding author

Lyna Mukwa Fama Tongo (lynamukwa@yahoo.fr)

Blaise Arnaud Hako Touko (hakoarnaud@gmail.com)

Mariette Anoumaa (mariettanou@gmail.com)

Barberine Silatsa Assongo (sabarberine@yahoo.fr)

Eric Bertrand Kouam (ericbkouam@yahoo.com)

Abdulai Jalloh (abdulai.jalloh@coraf.org)

Jean Jacques Mbonigaba Muhinda (Mbonigaba-muhinda@asareca.org)

Simplicie Nouala (Noualas@africa-union.org)

Appolinaire Djikeng (appolinaire.djikeng@ctlgh.org)

## FOOD SAFETY FROM FIELD-TO-BOWL IN AFRICA

### A Perspective on Mycotoxins in Food Crops in Sub-Saharan Africa

J. David Miller<sup>1</sup>

<sup>1</sup>Department of Chemistry, Carleton University, Ottawa, Ontario K1S 5B6, Canada

#### ABSTRACT

The first reference I can find to actions needed to reduce aflatoxin in crops in Africa was in 1963. A report from the UK government emphasized the “well understood” need to improve drying and storage to reduce the risk of aflatoxin in groundnuts in Africa. Much has been written about the agriculturally important mycotoxins in Africa since then. However, despite some successes, exposures to the agriculturally important mycotoxins have probably increased in much of Africa since 1963, primarily because of the relative increase in maize production. The IARC report “Mycotoxin control in low and middle income countries” (December 2015) found that a package of improving storage was a proven method to reduce aflatoxin exposure. Regardless of mycotoxins, APHIS data suggest that between 5 and 20% dry matter loss in maize occurs during storage. A report from APHIS released in September 2021 found that “technical solutions to reduce food loss and contamination have been developed by scientists. However, this has occurred without adequate investment and sufficient context-specific understanding of the social-cultural and economic barriers and facilitators to their adoption.” Of the many things that have been recommended to ameliorate mycotoxins exposure in Africa, improving crop storage in rural areas would be a low-cost intervention that would make a big difference in reducing aflatoxin exposure. Improving the value chain is also indispensable for improving the quality of food for the 50% of Africans who live in urban areas. I will frame this perspective against our recent data on biomarkers in children who were taken to hospital for severe stunting in Nigeria and from ~130 pregnant women in Rwanda who came to hospital together with a careful analysis of the diets of the women who helped us with this work.

---

Keywords: mycotoxins, public health, storage

J. David Miller (david.miller@carleton.ca)



# Food Safety in the Horticultural Sector in Ghana: Challenges/Risks, Risk Factors and Possible Interventions

Gloria Essilfie<sup>1\*</sup>, Rosalyn Quarcoo<sup>1</sup>, Samuel Lamptey<sup>1</sup>, Walter Hevi<sup>2</sup>, Godwin Amenorpe<sup>3</sup>, Margaret Owusu<sup>4</sup>, Faustina Atupra<sup>5</sup>

<sup>1</sup>University of Ghana, Department of Crop Science, School of Agriculture, P. O. LG 25, Legon, Ghana.

<sup>2</sup>CABI Ghana, PO Box CT 8630, Cantonments, Ghana

<sup>3</sup>BNARI, Ghana Atomic Energy Commission, Accra, Ghana

<sup>4</sup>CSIR-Food Research Institute, Accra, Ghana

<sup>5</sup>Food and Drugs Authority, Accra, Ghana

## ABSTRACT

The fruit and vegetable industry remains one of Ghana's most promising agricultural sector mainly because of heightened awareness of the health benefits associated with their consumption. There is a steady increase in consumption and patronage of ready-to-eat fruits and vegetables in Ghana due to ease of accessibility and a consciousness of the immense health and nutritional benefits. However, food safety is of ultimate concern due to the association of biological, chemical and physical hazards to fresh produce resulting in an escalation of foodborne illness. This report is a review of key microbiological, physical and chemical hazards in Ghana's horticultural value chain complemented with findings from key informant interviews. The study identified the risk factors and hazards that contaminate fruits and vegetables in addition to existing methods for mitigating health risks and reducing pathogen levels in the produce. The study revealed that enteric pathogens such as *Escherichia coli* (*E. coli*) and *Salmonella* spp. mainly contaminate the produce through fresh manure and contaminated irrigation water used during the production of vegetables. Chemical hazards identified include pesticides (organochlorine pesticides) and heavy metals such as Cadmium, Arsenic, Chromium and Lead. Physical hazards identified included twigs, roots, sand and stones. Washing fruits and vegetables thoroughly with potable water and sanitizing with vinegar and Chlorine solutions were among common practices stakeholders adopt to reduce microbial levels. Soil remediation has also been reported as a more common approach for reducing chemical contaminants on agricultural fields. The study therefore recommends the establishment of a traceability systems as well as appropriate measures and standards for hygienic practices for fresh fruits and vegetables produced and sold on the local market in Ghana. Value chain actors should be sensitized regularly on measures and interventions that can be employed to significantly reduce the levels of foodborne hazards and associated risks.

---

Keywords (Foodborne hazards, Fruits and Vegetables, Health risks, Ghana, Horticultural Value Chain)

Gloria Essilfie (gessilfie@ug.edu.gh) Corresponding author

Rosalyn Quarcoo (naanorkor27@gmail.com)

Samuel Lamptey (sammydatey@yahoo.com)

Walter Hevi (w.hevi@cabi.org)

# Milk Production, Processing and Consumption in Pastoral Settings in Ethiopia: Food Safety within the Food Security

Bekele Megersa<sup>1\*</sup>, Kebede Amenu<sup>1</sup>

<sup>1</sup>Addis Ababa University, College of Veterinary Medicine and Agriculture, P.O.Box 34, Bishoftu, Ethiopia

## ABSTRACT

Dairy products are the major staple food for pastoralists that contributed to a high proportion of required energy, protein, vitamins and minerals. Pastoralists rely on local animals for milk production with 25% to 35% estimated off-take of the total milk yield. The average daily milk off-takes have been estimated to be 2.5 to 6.5 liters for camels (1422 kg lactation off-take) and about 1.0 to 1.5 litres for cows (300 – 680 kg per lactation) under traditional management. Goats and sheep (seldom), which can produce about 40–60 kg of milk per lactation, are also used to supplement the milk deficit during the dry period, particularly for children and for family tea. Unhygienic milk handling and poor sanitation practices, and inadequate storage facilities are among commonly reported challenges responsible for high microbial contamination low quality of dairy products. As results, milk samples were found to be contaminated with *Staphylococcus* spp. (89.8 %), *Streptococcus* spp. (53.7 %), *E. coli* (31.5 to 52.7%) including *E. coli* O157:H7, *Salmonella* spp. (17.6 %), *Klebsiella* spp. (5.6 %) and *Enterobacter* spp. (5.6 %). Detection of pathogenic organisms such as *Salmonella* spp and *E. coli* O157:H7 in ready-to-consume milk has potential public health threats for consumers in an area where raw milk consumption is common. Prevailing risky practices such as unhygienic milk handling, reluctance to boiling and preference for raw dairy product consumption together with observed high bacterial contamination make pastoral communities at risk of food-borne infections. In particular, children are more vulnerable to milk borne infections, which have consequent impacts on their linear growth and health. Food borne illnesses have been reported to be associated the nutritional status of children in pastoral and agrarian communities in Ethiopia.

---

Keywords: Milk handling, Consumption, Microbial quality, Food safety, Food security

Bekele Megersa: (bekelelati@gmail.com), Corresponding author

Kebede Amenu: (kamenu@gmail.com)

# An Approach for Improving Safety and Hygiene Control Practices in Emerging Dairy Chains

James Ledo<sup>1\*</sup>, Kasper Hettinga<sup>2</sup>, Jos Bijman<sup>3</sup>, Jamal Kussaga<sup>4</sup>, Pieter Luning<sup>2</sup>

<sup>1</sup>CSIR- Food Research Institute, P. O. Box M20, Accra, Ghana

<sup>2</sup>Food Quality and Design Group, Wageningen University, P.O. Box 17, 6700 AA Wageningen, Netherlands

<sup>3</sup>Business, Management and Organization Group, Wageningen University and Research, P.O. Box 8130, 6700EW, Wageningen, the Netherlands

<sup>4</sup>Department of Food Technology, Nutrition and Consumer Science Sokoine University of Agriculture, Tanzania

## ABSTRACT

Emerging dairy chains are characterized by prominent informal production and distribution systems, with recurring concerns for microbial and chemical hazards (e.g., aflatoxin) of fresh milk. Despite multiple interventions in these chains, safety and hygiene control practices are still rudimentary which seem to hinder their capacity to meet the growing demands. Therefore, this study aimed to demonstrate an approach to unravel underdeveloped state of safety and hygiene control practices in emerging dairy chains, and test a behavior-based training intervention to improve practices. Using Tanzania as an example, we applied multiple data collection tools such as in-depth interviews, focus group discussions, and systematic on-site observations to assess practices along the chain, and performed microbial and aflatoxin M1 (AFM1) analysis of the milk to pilot a developed customized assessment tool. The tool incorporated a four-level differentiation grid (i.e., poor, basic, intermediate, and standard) which assessed and differentiated performance levels of eleven safety and hygiene practices crucial for control of microbial and AFM1 safety of fresh milk along the chain. Three distinct clusters were identified based on practice performance. However, for all the three clusters basic level performance was observed for both large and small scale farmers on crucial practices such as milk safety monitoring method, udder and teat care, and personal hygiene. High microbial load exceeding the maximum limit was noted to an extent that no further growth was observed along the chain irrespective of the level of practice performance. High levels of AFM1 were observed among farmers which stored feed longer with limited measures to control mold growth. We tested a tailored training intervention based on a behavior change theory which led to improvement in knowledge and underlying behavior drivers. Altogether, to improve safety and hygiene control practices in emerging dairy chains, tools that precisely position practice performance levels are pivotal to inform tailored programs to achieve more sustainable outcomes.

---

Keywords: Fresh milk, On-farm practices, Microbial, Aflatoxin M1, Theory of planned behaviour

James Ledo (jamesledo88@gmail.com), Corresponding author

Kasper Hettinga (kasper.hettinga@wur.nl)

Jos Bijman (jos.bijman@wur.nl)

Jamal Kussaga (kussaga@sua.ac.tz)

Pieter Luning (pieter.luning@wur.nl)

# Estimates of Aflatoxin Induced-liver Cancer Risk and Associated Health and Economic Impacts in Tanzania

Martin E. Kimanya<sup>1</sup>, Michael N. Routledge<sup>2,3</sup>, Emmanuel Mpolya<sup>1</sup>, Chibundu N. Ezekiel<sup>4</sup>, Candida P. Shirima<sup>5</sup> and Yun Yun Gong<sup>6</sup>

<sup>1</sup>School of Life Sciences and Bioengineering, Nelson Mandela African Institution of Science and Technology, Arusha, Tanzania.

<sup>2</sup>School of Medicine, University of Leeds, UK.

<sup>3</sup>School of Food and Biological Engineering, Jiangsu University, Zhenjiang, Jiangsu Province, China

<sup>4</sup>Department of Microbiology, Babcock University, Ilishan Remo, Ogun State, Nigeria.

<sup>5</sup>Tanzania Bureau of Standards, Dar es Salaam, Tanzania.

<sup>6</sup>School of Food Science and Nutrition, University of Leeds, UK.

## ABSTRACT

Evidence about the risk and impacts of the aflatoxin menace can help policy makers appreciate the importance of the problem and strengthen aflatoxin mitigation measures. We estimated aflatoxin-induced liver cancer risk in 2016 and used the information to estimate the aflatoxin health and economic impacts for Tanzania. The risk of aflatoxin-induced liver cancer was assessed based on available aflatoxin biomarker data from a previous epidemiology study, hepatitis B virus infection prevalence and population size of Tanzania in 2016. The health burden due to aflatoxin-induced liver cancer was estimated using disability adjusted life years (DALYs). The economic impact was based on the minimum cost of treating one liver cancer case in Tanzania. The aflatoxin exposures ranged from 15.0–10,926.0 ng/kg bw/day (median, 105.5 ng/kg bw/day). We estimated that in 2016 there were about 1,480 (2.95 per 100,000 persons) new cases of aflatoxin-induced liver cancer in Tanzania and assumed all of them would die within a year. This mortality rate led to a total loss of about 56,247.63 life years. We estimated that, the minimum cost of treating the 1,480 cases of aflatoxin-induced HCC is about US\$ 10,119,990. These results show, quantitatively, the new liver cancer cases that could be avoided; and the monetary loss and the life years that could be saved, annually, by strengthening measures to control aflatoxin contamination in Tanzania.

---

Keywords: Aflatoxin, DALYs, aflatoxin-induced liver cancer, impact, Tanzania

Martin E. Kimanya (martin.kimanya@giz.de), Corresponding author

Michael N. Routledge (M.N.Routledge@leeds.ac.uk)

Emmanuel Mpolya (Emmanuel.Mpolya@nm-aist.ac.tz)

Chibundu N. Ezekiel (chaugez@gmail.com)

Candida P. Shirima (candidap@yahoo.co.uk)

Yun Yun Gong (Y.Gong@leeds.ac.uk)



# Urban Food Markets in Africa – Incentivizing Food Safety using a Pull-Push Approach: Evidence to Action Towards Improved Microbiological Safety and Hygiene of Tomato in Ethiopia

Biruk Alemu Gemed<sup>1</sup>, Kebede Amenu<sup>2</sup>, Sisay Girma<sup>3</sup>, Delia Grace<sup>4,5</sup> and Theodore Knight-Jones<sup>1</sup>

<sup>1</sup> International Livestock Research Institute (ILRI), P.O. Box 5689, Addis Ababa, Ethiopia

<sup>2</sup> College of Veterinary Medicine and Agriculture, Addis Ababa University, P.O. Box 34, Bishoftu, Ethiopia

<sup>3</sup> College of Veterinary Medicine, Haramaya University, P.O.Box 138, Dire Dawa, Ethiopia

<sup>4</sup> Natural Resources Institute, University of Greenwich, Central Avenue, Chatham Maritime, Kent ME4 4TB. UK

<sup>5</sup> International Livestock Research Institute, Box 30709, Nairobi, Kenya

## ABSTRACT

**Background:** Efforts to improve food safety in Low- and Middle-Income Countries (LMICs) have largely focused on regulating Value Chain (VC) actors (“a push approach”), with little success. However, in developed countries consumer demand for safer food (“a pull approach”) plays a key role in driving high standards of safety along food VCs, but the same effect has not been generated in LMICs. A food safety research project focusing on chicken and vegetable in urban settings in Ethiopia and Burkina Faso was initiated to see if this consumer “pull” could be created and harnessed to drive safety food in informal food markets in Africa, working in combination with the “push” of better regulation, and supporting VC actors to deliver higher standards. To do this we needed baseline data on food safety within these VCs.

**Methods:** A mixed methods approach (a qualitative value chain assessment followed by quantitative KAP survey) was carried out in two cities in Ethiopia (Harar and Dire Dawa) to understand the overview of tomato production, processing, retailing and consumption practices with particular emphasis on food safety.

**Results:** The study generated evidence regarding tomato VCs which are going to inform the various work packages of the project, such as quantitative microbial risk modeling, a consumer communication and awareness campaign and points for food safety interventions. The identified VCs were sometimes long and complex, with producers, middlemen (brokers), transporters, retailers, and consumers. There was a knowledge gap among the VCs actors on how to supply quality and safe food and among retailers about proper transportation, handling, and storage of tomatoes. Consumers were concerned about the perceived high usage of chemicals in vegetable production, such as pesticides, however, producers were not. The study identified knowledge variations, barriers, and poor practices during handling and marketing limited tomato safety and hygiene practices among the retail outlets in the two locations. The majority did not implement basic tomato safety and hygiene practices such as sorting, washing, protecting from direct sun light. High levels of tomato damage and wastage was also detected (7%).

**Conclusion:** Based on this information interventions are being developed to help build VC actors capacity, looking to reducing tomato damage, loss of quality and increase microbial contamination (push approach) and create consumer awareness (pull approach) to provide a demand that will fund and sustain improvements in tomato safety.

---

Keywords: Tomato; microbiological safety; Hygiene; Value chain; Retailers

Biruk Alemu (b.a.gemed@cgiar.org), Corresponding author

Kebede Amenu (kebede.amenu@aau.edu.et)

Sisay Girma (sisaygirma80@gmail.com)

Delia Grace (D.Randolph@cgiar.org )

Theodore Knight-Jones (T.Knight-Jones@cgiar.org)

## CONTINENTAL FOOD SAFETY INITIATIVES

### Risk-based Inspection – Challenges and Perspectives for Africa

Dr. Blaise Ouattara<sup>1</sup>

<sup>1</sup>Food and Agriculture Organization of the United Nations (FAO), Regional Office for Africa (RAF)

#### ABSTRACT

Agricultural transformation is assumed to have significant impact on poverty reduction. The vision in the transformation strategy is to achieve a hunger-free through an agricultural sector that drives income growth, accelerates achievement of food and nutritional security, generates employment and transforms Africa into a leading player in global food markets to grow wealth for millions of farmers. In traditional food inspection, inspectors make judgments about disease conditions and abnormalities on the basis of what they can see, feel and smell, a process known as organoleptic inspection. These practices are not suitable for detecting and controlling many frequently occurring meat-borne hazards such as *Campylobacter*, *Salmonella*, and shiga toxin-producing *Escherichia coli* (STEC), and they are not cost-effective. There is a need to adapt and modernize inspection practices to adopt to a more risk-based approach, where decisions, standards and control activities are based on specific knowledge of the risks. This presentation discusses the importance of modernization of meat inspection globally and in the context of Low and Medium Income Countries (LMICs). Building on a mapping and profiling study of slaughter establishments undertaken by FAO in Ghana, the author presents the challenges (weaknesses of regulatory frameworks, laboratory systems, coordination of the management of food safety activities, etc.) and opportunities for the development of modern meat inspection systems in Africa, including partnership with private sector. The presentation also introduces technical guidance and tools (e.g. Principles of Risk-Based Meat Inspection and their Applications, Food Control Systems Assessment Tool) and FAO's views on the development of strong food control systems and insurance of fair trade in the context of Agriculture Transformation strategy and the Africa Continental Free Trade Area (AfCFTA). The future of food control systems depends on the capability and the willingness to move to a risk-based approach.

# FOOD SAFETY CONTROL SYSTEMS IN AFRICA: THE ROLE OF TRADITIONAL AND EMERGING TECHNOLOGIES

## Role of Fermentation as Traditional Practice in Ensuring Food Safety in Africa

Obadina, Adewale Olusegun<sup>1</sup>

<sup>1</sup>Department of Food Science and Technology, Federal University of Agriculture, P.M.B. 2240, Abeokuta, Nigeria

### ABSTRACT

Indigenous fermented foods (IFFs) have a long history in Africa and are embedded in cultural norms and practices. Typically, these foods are produced at small or household scale using indigenous processing technologies. In addition, limited knowledge of good manufacturing and handling practices can lead to production under unhygienic conditions. This results in variations in the safety attributes of IFFs, as pathogenic bacteria can be introduced at any stage of the value chain. These foods have an important role in the African diet and can contribute to food security by increasing the availability of cheap, nutritious food and supporting livelihoods. However, the presence of foodborne pathogens and antibiotic-resistant bacteria in IFFs may constitute a health risk to consumers. African indigenous fermented foods offer a vast genetic potential of undiscovered strains that possess valuable technical characteristics. However, IFFs may also serve as vehicles of pathogenic and antibiotic-resistant bacteria and genetic determinants. To ensure adequate processing conditions and safety of fermented foods in Africa, the development of non-toxigenic starters with ability to antagonize pathogenic microorganisms and to degrade toxic substances needs continued attention. To achieve this, there is need for collaboration from all stakeholders, including researchers within the continent.

---

Keywords: Fermentation, Traditional Practice, Food Safety, Africa, Starter Culture

Obadina, Adewale Olusegun (obadinaw@gmail.com)

# Safety Assessment of Traditional Fish Smoking Practices in Nigeria: A Scale up Analysis

Abiodun-Solanke A.O<sup>1</sup>, Fakoya K.A<sup>2</sup>, Ajelara K.O<sup>2</sup> and Mangai O.E<sup>1</sup>

<sup>1</sup>Fisheries Technology Department, Federal College of Fisheries and Marine Technology

<sup>2</sup>Department of Fisheries Science, Lagos State University, Ojoo.

## ABSTRACT

Food safety is an important phenomenon that is being extended to many regions. This is because consumers are now more concerned about the risks from food hazards and also the need to take necessary steps to reduce these issues to the barest minimum, to ensure good health. In many developing countries however, food insecurity is still prevalent because many producers of foods being largely smallholders and in the rural areas, still engage in traditional practices with poor sanitary conditions which lead to marketing of products through informal routes. This leaves many beyond any official control for compliance to national regulatory standards. The slow progress in upgrading traditional food processing and preservation practices contributes largely to food and nutrition insecurity. The importance of fish and fish products in achieving food and nutrition security is in the public purview hence, the focus of this review on fish smoking in Nigeria. Many of the practices though traditional, are vital to reducing post-harvest food losses and increasing food availability because they are the cheaper options available in the coastal and riverine areas which are the major production areas for fisheries and other raw materials.

This review provides the safety evaluation of the handling, pre-processing, smoking, packaging, storage and marketing practices among others for the most popular traditional smoking of fish.

Regrettably, prevalence of inefficient, unhygienic, inappropriate practices, potential microbiological and chemical risks, lack of standardization due to inadequate data, traceability and poor management among others, are the food safety challenges observed. While a lot still needs to be done, it is believed that some improvements and recommendations with adopted technologies if adhered to, will go a long way to achieve fish safety.

This review also draws the attention of stakeholders including decision makers and regulators, to enact better policies, while the producers and consumers are abreast on measures to reduce risks for safer fish in Nigeria.

---

Keywords: Fish smoking, food safety, food insecurity, evaluation

Abiodun-Solanke A.O (tomi.solanke@fcfmt.edu.ng)

# Improving Traditional Technologies to Enhance Food Safety: The Case of Brukina and Poultry Processing in Ghana

Angela Parry-Hanson Kunadu<sup>1\*</sup>, Rebecca Agyiri-Mireku, Naa Atswei Nyakpo<sup>1</sup>, William Baidoo<sup>1</sup>, Nicole Sharon Afriffah<sup>2</sup>

<sup>1</sup>University of Ghana, Department of Nutrition and Food Science, P O Box LG134, Legon, Ghana

<sup>2</sup>University of Ghana, Department of Food Process Engineering, Legon, Ghana

## ABSTRACT

**Background:** To achieve food and nutrition security, it is important that all consumers can access safe and nutritious food. In Africa, most consumers access their food from informal channels where food safety challenges persist. This research presents opportunities for sustainable low technology innovation to improve safety of traditional processed foods in the informal sector.

**Methodology:** The food safety opportunities were identified using cross sectional surveys using self-administered questionnaires and face-to-face interviews among 366 consumers and 90 food vendors. The technology solutions tested used focus groups among target stakeholders to choose potential interventions. The interventions were used to develop hygienic Standard Operating Procedures (SOP) for brukina processors and simplified Hazard Analysis, and Critical Control Points (HACCP) based on quantitative risk assessment for poultry processors. ANOVA, chi-square tests and sensitivity analysis (using @Risk software) were conducted to establish significant differences and improvements in interventions.

**Results:** Our results indicate that 82% of consumers patronize meals outside home at least once a week and 24% had experienced foodborne illness in the last 3 months leading to the interview. Most food vendors (78%) were non-compliant to basic food hygiene regulation and 90% had no food hygiene training. Vendors were more inclined to practice food hygiene when other vendors were doing same (44%), when there is frequent inspection (52%) and when clients demand it (82%). The hygienic SOP for brukina processing caused 3.63 LogCFU/mL in coliform count and 2.83 LogCFU/mL in Staphylococcus aureus count. Brine at 3% and 5% caused 0.82 and 0.83 LogCFU/g reduction of Salmonella on chicken respectively. This reduction in Salmonella concentration on chicken meat can reduce risk of Salmonellosis through poultry handling and consumption in Ghana by 88%.

**Conclusion:** Simple improvements in traditional processing using inclusive, practical, and accessible methods can significantly and sustainably improve food safety in the informal sector.

---

Keywords (food safety, food hygiene, traditional technologies, innovation)

Angela Parry-Hanson Kunadu (aparry-hanson@ug.edu.gh), Corresponding author

Rebecca Agyiri-Mireku (rebekiamba@gmail.com )

Naa Atswei Nyakpo (naanyakpo@st.ug.edu.gh)

William Baidoo (william.baidoo@agroparistech.fr)

Nicole Sharon Afriffah (nsaffrifah@ug.edu.gh)



# Reducing Post-harvest Losses in Grains at the Smallholder Farmer Level: A Holistic Approach

Isaac Sesi<sup>1</sup>

<sup>1</sup>Sesi Technologies Ltd, AK-569-7001, Ayeduase New Site, Kumasi

## ABSTRACT

More than 30% of grains produced in Africa is lost because of post-harvest losses. Several factors account for these losses, including the lack of access to essential post-harvest tools, high moisture content, poor storage and poor post-harvest management. These factors also expose the grains to mould infection and subsequent aflatoxin contamination in some instances.

Given the varied causes of these losses, a single solution is insufficient to address post-harvest losses at the farmer level in a holistic manner. Instead, a set of complementary interventions that address the major causes of these losses has to be adopted to create a more holistic solution.

In presenting these interventions to smallholder farmers, one crucial factor that must be considered is their cost to farmers. Since smallholder farmers generally have low income levels, it is necessary to make any interventions available through a business model that is feasible for them.

With this background in mind, Sesi Technologies, an agritech company based in Ghana piloted “FarmerPack”, to provide smallholder grain farmers in the Ashanti region of Ghana with a holistic post-harvest management solution that addressed many of the causes of post-harvest losses.

We did this by combining simple tools like locally produced grain moisture meters and hermetic storage bags with essential post-harvest services, including drying, threshing and storage, along with market access to help farmers reduce losses and maximize their income.

Farmers had the option to pay with grain produce instead of cash, thereby making these interventions more accessible and eliminating the barriers to the adoption of similar interventions.

In this presentation, I share the approach, successes, challenges and insights from our “FarmerPack” pilot and how this model could potentially be feasible in the reduction of post-harvest losses and improvement of the safety and quality of grains at the smallholder farmer level.

---

Keywords: Post-harvest losses, hermetic storage, moisture testing, market access

Isaac Sesi (isaac@sesitechnologies.com)

# Inactivation Effects on *Aspergillus flavus* and *Aspergillus parasiticus* on Peanut Seeds by Multi-hollow Surface Dielectric Barrier Discharge Plasma

Gebremedhin Gebremariam<sup>1,2\*</sup>, Shimelis Admassu<sup>2</sup>, Tarekegn Berhanu<sup>3</sup>, Zlata Tučeková<sup>4</sup>, Richard Krumpolec<sup>4</sup>, Mirko Černák<sup>4</sup>

<sup>1</sup>Department of Food Process Engineering and Postharvest Technology, Ambo University, Ethiopia

<sup>2</sup>School of Chemical and Bioengineering, Addis Ababa Institute of Technology, Ethiopia

<sup>3</sup>Addis Ababa Science and Technology University, Ethiopia

<sup>4</sup>R&D Center for Low-Cost Plasma and Nanotechnology Surface Modifications (CEPLANT), Department of Physical Electronics, Faculty of Science, Masaryk University, Czech Republic

## ABSTRACT

In this research, multi-hollow surface dielectric barrier discharge plasma (MHSDBD) was developed and its inactivation effect on *Aspergillus flavus* and *Aspergillus parasiticus* on the superficial of peanut seeds was explored. Peanuts were artificially infected with *A. flavus* and *A. parasiticus*. They then were exposed with ambient humid air atmospheric cold plasma at 27W in the MHSDBD plasma system at the different time and air flow rate. Complete reductions of in *A. flavus* and *A. parasiticus* were attained after 8 min treatments at 0.5L/min using atmospheric ambient air as the cold plasma making gas. The inactivation influence of MHSDBD plasma on *A. flavus* and *A. parasiticus* microorganisms injected on peanut was decreased with the air flow rate increased. No variation or slight discounts were detected in *A. flavus* and *A. parasiticus* population at a higher air flow rate (20L/min). Effect of temperature (75°C) without activated plasma was also investigated during this study and did not bring a fatal influence on *A. flavus* and *A. parasiticus* microorganisms when compared with activated plasma.

---

Keywords: *Aspergillus flavus*; *Aspergillus parasiticus*; multi-hollow dielectric barrier discharge plasma; Inactivation

Gebremedhin Gebremariam (gebremedhin.gbremariam@aait.edu.et), Corresponding author

Shimelis Admassu (shimelis.admassu@aait.edu.et)

Tarekegn Berhanu (tarekegnbr@yahoo.com)

Zlata Tučeková (454060@mail.muni.cz)

Richard Krumpolec (235947@mail.muni.cz)

Mirko Černák (cernak@gimmel.ip.fmph.uniba.sk)

# The Roles of African Traditional Fermentation Technologies in Food Safety: Challenges and Opportunities

Tesfemariam Berhe (PhD)<sup>1</sup>

<sup>1</sup>Ethiopian Biotechnology Institute, Agricultural Biotechnology Directorate, Addis Ababa, P.O.Box: 5954, Ethiopia

## ABSTRACT

Fermented foods constitute a significant dietary culture of African diets playing vital role in the nutritional, functional and cultural relevance of the African communities. Food fermentation in African civilizations is the oldest ancient technology mainly used as preservation techniques. Moreover, fermentation is utilized for different purposes such as enhance nutritive value, flavour and texture enhancement, enrichment of products with essential nutrients and bioactive compounds, degrade anti nutritional factors, impart antioxidant/antimicrobial properties and improves digestibility/bioavailability. Recent reports also indicate that fermented food products are able to reduce or prevent obesity and disease related with metabolic disorders. The African continent is widely accepted as the place of origin of humans, traditional wisdoms, biodiversity, ethnic diversities and rich culture. The African continent located in the tropics is characterized by its favourable conditions for the growth of beneficial (fermenting) as well as non-beneficial microorganisms. The application of spontaneous fermentation technologies is considered as a main approach to utilize the potential of the diverse application of the fermenting microorganisms and disfavours the negative effect of the non-beneficial microorganisms. The untapped diversified genetic resources, favourable environmental conditions and rich cultural wisdoms of the African communities are huge potentials to be granted as good opportunities for sustaining fermentation technology in the continent and beyond. Africa has an age old history of production of diversified traditional fermented foods and is the continent with the richest variety of fermented foods. The challenges of African fermented foods are related with product characterization such as little is known about the microbial community, metabolite profile and fermentation/processing parameters. Therefore, our approach should be focused on the characterization, optimization, safety evaluation and protection of origin of designation of the traditional fermented foods so as to explore our natural resources and traditional wisdoms.

---

Keywords: traditional fermentation, African foods, food preservation, food safety, traditional wisdoms

Tesfemariam Berhe (Lucyselam@gmail.com)

# Mycotoxin Regulations in Food and Feed; Local and Export Trade Perspective

Olaitan Olajuyigbe<sup>1</sup>

<sup>1</sup>Nigerian Institute for Oceanography and Marine Research, Department of Fish Technology and Product Development, P.M.B. 12729, Victoria Island, Lagos, Nigeria.

## ABSTRACT

Mycotoxins are toxic secondary metabolites produced by mycotoxigenic moulds (mainly by the genera *Aspergillus*, *Fusarium* and *Penicillium*). Mycotoxins are mostly produced in cereals and feed ingredients of plant origin. They can therefore be introduced into food and feed by the use of contaminated feed ingredients. Animal by-products are sources of mycotoxin contamination in feed. Mycotoxins can contaminate food products before or after harvest, during processing and storage. Mycotoxins affect both local and international trade, and health.

The global concern about mycotoxins began in the early 1960s when it was discovered that the Turkey "X" disease was caused by aflatoxins. International trade in agricultural commodities amounts to hundreds of millions of tonnes yearly. Most commodities are susceptible to mycotoxin contamination as a result of the length of time between production in the exporting country and arrival at the importing country. Storage conditions on the farm and during transportation can also encourage the proliferation of mycotoxigenic fungi which can lead to rejection of the commodity at the point of entry of the importing country thereby leading to economic losses.

Mycotoxins control measures have been put in place for commodities being traded internationally by setting the acceptable limits for different mycotoxins in food and feeds (e.g. Aflatoxin 4µg/kg in EU and 20µg/kg in USA). However, little or nothing is being done on locally consumed commodities (especially in developing countries). There is a need for adequate awareness, monitoring, regulations and control measures in food and feeds in both local and international markets in order to ensure the safety of food being consumed globally. There is need for all stakeholders (researchers, farmers, processors, wholesalers, retailers, consumers, policy makers) to play their role in ensuring that our food and feed is free of mycotoxins.

---

Keywords: Mycotoxins, trade, regulations, food safety

Olaitan Olajuyigbe (olaitan\_afolabi@yahoo.com), Corresponding author

## ACADEMIC AND DEVELOPMENT OF PARTNERSHIPS IN FOOD SAFETY: NATIONAL, REGIONAL, CONTINENTAL AND INTERNATIONAL INITIATIVES

### MYTOX-SOUTH® International Partnership to Improve Food Security & Food Safety

Sarah De Saeger<sup>1,2</sup>, Celine Meerpoel<sup>1</sup> and Marthe De Boevre<sup>1</sup>

<sup>1</sup>Centre of Excellence in Mycotoxicology and Public Health, Department of Bioanalysis, Faculty of Pharmaceutical Sciences, Ghent University, Belgium

<sup>2</sup>Department of Biotechnology and Food Technology, Faculty of Science, University of Johannesburg, Doornfontein Campus, Gauteng, South Africa

#### ABSTRACT

Food safety is key to address global food security and improve human health. Mycotoxins, toxic fungal secondary metabolites, are a significant food safety threat in low- and middle-income countries. The mycotoxin problem has become more challenging partly due to knowledge on co-occurrence of multiple mycotoxins and climate change. Addressing mycotoxins effectively requires multi-disciplinary approaches that focus on prevention and remediation measures, and assessment for monitoring and control purposes. Building capacity in low- and middle-income countries to assess local risk timely and develop interventions and policies is key. To mitigate mycotoxins in the food system requires concerted action leveraging efforts from researchers from different fields of mycotoxicology, as well as stakeholders from farms, food industry, civil societies and governments.

MYTOX-SOUTH® (<http://mytoxsouth.org>) is an intercontinental, multi-disciplinary partnership that strives to improve food security and food safety through mitigation of mycotoxins at global level. It has the following goals: 1. Educating & training young students & scientists from middle- & low-income countries - Building capacity through co-creation; 2. Awareness creation - Networking/partnerships; 3. Conducting research and developing innovative technologies in terms of suitable mitigation strategies.

---

Keywords: MYTOX-SOUTH®, mycotoxins, holistic, multi-disciplinary, capacity building

Sarah De Saeger ([sarah.desaeger@ugent.be](mailto:sarah.desaeger@ugent.be)), corresponding author

Celine Meerpoel ([celine.meerpoel@ugent.be](mailto:celine.meerpoel@ugent.be))

Marthe De Boevre ([marthe.deboevre@ugent.be](mailto:marthe.deboevre@ugent.be))



# Academic, Industry and Governmental Partnerships: A Panacea for Ensuring Food Safety in Africa

Oluwafemi Ayodeji Adebo<sup>1</sup>

<sup>1</sup>Department of Biotechnology and Food Technology, Faculty of Science, University of Johannesburg, Gauteng, South Africa.

## ABSTRACT

There are growing concerns about food safety in Africa, as an estimated 91 million Africans are directly affected by foodborne illnesses every year, leading to about 137, 000 deaths. The contamination of food and their raw materials, the growth of undesirable microorganisms, their toxins and harmful metabolites, pose significant threats to consumers in Africa. Food safety is vital in achieving food security, which is central to overall growth, modernization, opportunities and security in Africa countries. It is also integral for achieving many of the sustainable development goals (SDGs) including ending poverty and hunger, good health and wellbeing. Different governmental institutions domiciled in Africa have sought to provide solutions to the inherent food safety problems in the continent. Also, academia and researchers in food and food-related industries have equally given some sustainable approaches to improving food safety, through experimental, field extension and community outreach approaches. These efforts have been largely individualistic, thereby localizing their impacts within the regions of their deployment, with minimal effects on the larger African populace. Food safety should be seen as a shared responsibility among all partners including academia, industry and the government. Convergence of efforts through the harmonization of visions of the different stakeholders, and their collaboration in the formulation of policy, research and extension frameworks are critical to achieving far-reaching solutions to the incidences and effects of food-borne illnesses in Africa. This presentation aims to emphasize the urgent need for the establishment of partnerships and collaboration among the key stakeholders central to achieving sustainable food safety in Africa and to suggest ways to foster these partnerships across the continent.

---

Keywords: Food safety, legislation, sustainable development goals (SDGs), new technologies

Oluwafemi Ayodeji Adebo (oadebo@uj.ac.za)

## Experiences from Collaborative and Innovate SPS Projects in Africa

Catalina Pulido<sup>1</sup>

<sup>1</sup>Standards and Trade Development Facility (STDF / WTO), Switzerland

### ABSTRACT

COVID-19 offered a tragic but powerful reminder of the ease and speed with which pests and diseases can cross borders and the critical role of global supply chains. The pandemic illustrated not only the need to reduce trade costs, but also the interconnections among food, agriculture and the environment. Strengthening food safety, animal and plant health systems is a clear priority for the future. The Standards and Trade Development Facility (STDF) is a global partnership that helps developing countries improve their food safety, animal and plant health capacity to meet sanitary and phytosanitary (SPS) requirements, based on international standards. This contributes to sustainable economic growth, poverty reduction and food security. Through our knowledge work and exchange of experiences, we promote that government authorities and the private sector work together to address SPS challenges and improve outcomes. PPPs have been the focus of STDF knowledge work since 2010. The STDF also has a funding mechanism to develop, implement and learn from innovative pilot projects in the SPS area. Almost half of the total STDF's support to developing countries goes to Africa, both in terms of numbers of projects as well as funding resources. The pandemic has also shown us first-hand the power that international cooperation and effective partnerships have in aiding global recovery from devastating shocks. The crisis pointed to the continued interest in and value of STDF's global multi-stakeholder approach in convening experts from across agriculture, health, trade and development, drawing on their technical expertise to drive catalytic SPS improvements in developing and least developed countries.

---

Keywords: SPS, PPP, collaboration, aid for trade

Catalina Pulido (catalina.pulido@wto.org)

## Risk-based Food Safety Systems in Africa: Experiences from Two Collaborative Projects

Barbara Kowalczyk<sup>1</sup>

<sup>1</sup>Director, Center for Foodborne Illness Research and Prevention; Assistant Professor, Department of Food Science and Technology, Core Faculty, Translational Data Analytics Institute, The Ohio State University, Columbus, OH, USA

### ABSTRACT

Food safety is often considered a “wicked problem” because of the complexity of changing food systems, the interdependent and multi-causal nature of food safety, the social and behavioral changes needed to effectively mitigate risks, and the potential for solutions to lead to unintended consequences. Not surprisingly, improving food safety can be daunting and many struggle with where to focus their efforts. Risk-based, evidence-informed approaches to food safety provide a framework for allocating limited resources in the most efficient and effective manner while, at the same time, maximizing public health benefits.

Several initiatives have been undertaken to develop roadmaps for implementing risk-based approaches to food safety in low- and middle-income countries. Two such projects are TARTARE and Chakula Salama, which focus on improving food safety in Ethiopia and Kenya, respectively. TARTARE addresses important knowledge gaps in understanding the burden of foodborne disease in Ethiopia and will develop cost-effective, gender-sensitive and socio-culturally appropriate approaches for mitigating the risk of Salmonella, Campylobacter and shiga toxin-producing E. coli in raw beef and dairy products. Chakula Salama uses a systems-based approach to reduce the risk of human infection from Salmonella and Campylobacter in poultry produced by small-scale women and youth poultry farmers in peri-urban areas of Kenya, with an overarching goal of building an enabling environment that fosters the implementation of risk-based approaches to food safety in Kenya.

This presentation will provide an overview of the role of risk-based approaches in improving food safety and outline the activities being undertaken in TARTARE and Chakula Salama.

---

Keywords: Risk-based, Ethiopia, Kenya

Barbara Kowalczyk (kowalczyk.1@osu.edu)

# Building Food Safety Research Capacity in Africa Through Intercontinental Collaboration

Olumide A. Odeyemi<sup>1</sup>

<sup>1</sup>Office of Research Services, Research Division, University of Tasmania, Launceston, Tasmania, Australia

## ABSTRACT

Over 90,000 deaths and 127 million illnesses due to foodborne diseases are reported annually in Africa. Children under five are mostly impacted by the burden of these diseases. To reduce the prevalence, mitigate public health implications and incidences of foodborne diseases in Africa, there is a need to strengthen and build the capacity and capability of African researchers through intercontinental collaboration with their counterparts from other continents.

---

Keywords (food safety, foodborne diseases, food spoilage, capacity building)

Olumide A. Odeyemi (oluodeyemi@gmail.com; olumide.odeyemi@utas.edu.au)

## IAFP / ACAFP SESSION

# Global Trends and Their Food Safety Considerations

**Ruth L. Petran, PhD, CFS.**

IAFP President. Principal, Ruth L. Petran Consulting and Senior Advisor, Food Safety at The Acheson Group.

### ABSTRACT

This presentation will relate the various food trends that have emerged partly due to the pandemic, but also to consumer demands. Most of these will progress into the future and include:

- Comfort foods for a wider range of consumers - including Plant-based "meats", vegan foods, indulgent foods
- Dining to Doorstep - e.g., via delivery, shopping services, store pickup
- Technology and digitization - enabling consumers know more about their foods, help with traceability, allow for collection and gathering insights from data, and contactless payments
- Balance of e-commerce and supreme service to keep customers coming back

While these are exciting developments, they can lead to food safety issues if not controlled well. This presentation will touch on these trends, highlighting possible food safety challenges with each and how they can be overcome. These risks are manageable if those who are charged with (1) managing risks and (2) providing regulatory oversight are fully engaged and collaborating.



## Food Fraud in Africa

Charles Muyanja<sup>1</sup>

<sup>1</sup>Makerere University, College of Agricultural and Environmental Sciences, School of Food Technology, Nutrition and Bioengineering, Department of Food Technology and Nutrition, P.O Box 7062, Kampala, Uganda

### ABSTRACT

There has been an increase in global food production in many parts of the world during the past decades. Trade liberalization has led to globalization where food is traded among different countries. Such developments have culminated into food fraud which is now a growing concern. There has also been an observed rise in cases of product fraud over the past few years across the African Continent. Everyone needs to eat safe food but trusting the source of the food has become more of a big challenge than before. Food fraud is deception of consumers using food products, ingredients, and packaging for economic gain. Although food fraud is undertaken for economic gains, it can also translate into public health threats emanating from consumption of adulterated products, hence leading to a food safety concerns. This paper discusses the drivers of food product fraud, highlighting the different forms of food fraud and food products/materials/ingredients which are highly susceptible to fraud. Documented incidences of food fraud in selected countries in Africa have been pointed out. The impacts of COVID 19 pandemic on food fraud are also discussed. The paper also discusses the implications of food fraud on consumer health and nutrition. This paper further hints on the mitigation measures for combating food fraud in Africa.

---

Charles Muyanja ([ckmuyanja@gmail.com](mailto:ckmuyanja@gmail.com)/[charles.kmuyanja@mak.ac.ug](mailto:charles.kmuyanja@mak.ac.ug))

## The Future of Food Safety in Africa: Research Perspective (Keynote Presentation)

Delia Grace<sup>1,2\*</sup>, Silvia Alonso<sup>2</sup>, Kebede Amenu<sup>3</sup>, Elizabeth Cook<sup>2</sup>, Michel Dione<sup>2</sup>, Theo Knight Jones<sup>2</sup>, Johanna Lindahl<sup>2</sup>, Florence Mutua<sup>2</sup>, Hung Nguyen-Viet<sup>2</sup>, Kristina Roesel<sup>2</sup>, Lian Thomas<sup>2</sup>

<sup>1</sup>Natural Resources Institute, University of Greenwich, Central Avenue, Chatham Maritime, Kent, UK

<sup>2</sup>International Livestock Research Institute, Nairobi, Kenya

<sup>3</sup>Addis Ababa University, Addis Ababa, Ethiopia

### ABSTRACT

The last decades have seen immense progress in food safety in Africa: the coming decades offer more. We summarise recent and ongoing food safety research, carried out by the International Livestock Research Institute and its partners. This is organised in four areas.

First is generating evidence on food-borne disease burdens to support decision making. We are helping update the landmark WHO report and giving country specific estimates. We helped estimate the economic burden of foodborne disease at \$17 billion USD per year for Africa. We are also conducting systematic literature reviews to generate best evidence on the priority hazards in Africa and the most effective interventions. An important impact pathway is in providing technical support to the African Union in its ground-breaking first regional food safety index. We have also helped review the AU food safety strategy and led food safety the UNFSS.

Second is strengthening food safety education in Africa through benchmarking a curriculum on food safety, providing blended training on risk assessment for professionals and hands-on training for value chain actors and supporting graduate fellows.

Innovation is a key function of research, and we are currently integrating One Health into Community-Led Total Sanitation, developing and testing "behavioural nudges" in Uganda and Kenya and conducting experiments in using binders to reduce aflatoxins in dairy feed and hence in milk.

These contribute to the most important impact of research: safer food at scale. Interventions to improve food safety at scale in east and west Africa. Here we mention research on upgrading value chains and our flagship "three-legged stool approach" to improving food safety in informal markets by empowering consumers to demand safe food, vendors to provide it, and policymakers to support it.

---

Keywords: food safety, Africa, policy, capacity-building, innovation, impact

Delia Grace (d.grace@cgiar.org), Corresponding author

Silvia Alonso (s.alonso@cgiar.org)

Kebede Amenu (kamenu@gmail.com)

Elizabeth Cook (e.cook@cgiar.org)

Michel Dione (m.dione@cgiar.org)

Theo Knight-Jones (t.knight-jones@cgiar.org)

Johanna Lindahl (j.lindahl@cgiar.org)

Florence Mutua (f.mutua@cgiar.org)

Hung Nguyen (h.nguyen@cgiar.org)

Kristina Roesel (k.roesel@cgiar.org)

Lian Thomas (l.thomas@cgiar.org)

## FOOD SAFETY GOVERNANCE IN AFRICA

### Fruits and Vegetables Safety Regulations in International Trade and Africa's Exports: Evidence from the European Union Market

Olayinka Idowu Kareem<sup>1</sup>

<sup>1</sup>Chair of Agricultural and Food Policy, Hohenheim Universität, Stuttgart, Germany.

#### ABSTRACT

The contemporariness of the issues of food safety regulations in domestic and international trade as well as for food security cannot be overemphasized. Food safety regulations stand out among other non-tariff measures, especially as it concerns Africa's market access to the European Union's (EU) market. The impact of food safety regulations on some agri-foods at times can almost double the impact imposed by tariffs. Thus, the preponderance and stringency of food safety regulations in the EU have export effects for Africa. The safety regulations have their pros and cons for different economic agents. Africa's food exporters perceived these regulations as important market access conditions to the EU market. The increasing incidences of these regulations are causing additional compliance costs burden for Africa. Moreover, Africa's food standards regulatory institution, though, in principle are in existence but they are very weak in delivering their mandate owing to the obsolete regulations and in many cases have an inadequate quality infrastructure. Therefore, making Africa's agri-food exporters confront all the food safety requirements in the EU. It is on this basis that this study investigates Africa's fruits and vegetable exports effects of the EU food safety regulations in a gravity model that explore a framework that disentangles these effects at both the extensive and intensive margins of exports from 1995 to 2018 for 52 African countries. The findings suggest that the decision to access this market for fruits exports is more hindered by the food safety regulations. However, at the actual or intensive margin of exports, food safety regulations seem not to have adverse effects on both commodities. Thus, the food regulatory institutions are weak and inefficient in the enforcement of food safety. Besides, Africa's food safety regulatory institutions are incapacitated in the enforcement of quality fruits and vegetable exports.

---

Keywords: Food safety regulations, fruits, vegetables, Gravity model, Africa-EU trade

Olayinka Idowu Kareem (olayinkaidowuus@yahoo.com), Corresponding author.

# Compliance Assessment with Fish Quality and Safety Regulations by Industrial Fisheries in Lagos, Nigeria

Elizabeth Mangai<sup>1</sup>

<sup>1</sup>Fisheries Technology Department, Federal College of Fisheries & Marine Technology, Lagos

## ABSTRACT

Seafood is prone to physical, biochemical and microbiological hazards from the point of catch till consumption. Fish is highly globalised food implying that contaminations at any point of the value chain can be conveyed to consumers far from the production point. Consumers are getting more interested in food safety and there are requirements that industrial fisheries organisations have to comply with, to ensure safety, wholesomeness of fish and to be able to get certification for food and processes. For quality consistency, product safety and acceptability as well as to facilitate trade, legislations are made and compliance to stipulated laws is reassuring. The Nigerian industrial fisheries engage in both local sales and export of seafood products hence have to comply with both indigenous and international legal requirements. Usually, checklists are used for compliance evaluation and during audits where compliance is only judged by affirmative or negative responses. The level of affirmation also needs to be categorised and this categorisation is lacking. Methods of evaluating regulatory compliance by industrial fisheries to ensure fish safety is usually qualitative. This paper assesses the regulatory compliance by industrial fish processing exporters in Lagos using a 20-point compliance scoring guide (20PCS) that was developed from regulatory requirements like Hazard Analysis Critical Control Points (HACCP), provisions of Sea Fisheries regulations (1995), Food Code (2013) and Factories Act (1990) for the evaluation of factory operations and food safety. It quantifies compliance using scores from 1-9 and percentages, with the inspectors of the competent authority in Nigeria as the respondents. Mean scores obtained ranged from  $6.505 \pm 3.085$  to  $8.625 \pm 0.637$  and 65-86% for parameters assessed. This method of assessing compliance can be used during self- or third-party audits and by regulatory bodies.

---

Keywords: Seafood safety, regulations, compliance, industrial fisheries

Elizabeth Mangai (liz.mangai@fcfmt.edu.ng)

## Food Sovereignty, Good Governance and Peace in DR Congo

Arsène Ntamusige<sup>1,2\*</sup>

<sup>1</sup>Department of Research, Technology and Innovations (Congo Bio Tech, DRC)

<sup>2</sup>Central African Studies Association

### ABSTRACT

Given the paradox between agricultural potentials of the DRC and its deficit state in agricultural and food security, one wonders how resources are organized, exploited and to which rationalities meet their management modes. The DRC is endowed with abundance of arable land, climates diversity, hydrographic network, fisheries potential, farmers' dynamism, very promising business opportunities and a potential market of more than 800 million inhabitants. Approaching the issue with foresight, it appears that agricultural and food security fields in the DRC suffer from a lack of both organizational and creative genius as well as a real strategic intelligence. We are at the heart of the irregularities of the Order of Governance and Food Sovereignty. These irregularities, do not explain how the agricultural resources that should have participated in building peaceful and happy societies in DR Congo turned into a weapon of war over time and how they turned into the lack of a coherent policy and adequate strategic guidelines to drive dynamics in the agricultural sector? This reflection focuses on this questioning. It starts from a context analysis binding food sovereignty, peace and good local governance in DR Congo, and comes out by the sketch of a new organizing dynamic of Congolese and DR Congo resources for creation of happiness and peace.

---

Keywords: Food sovereignty, good governance, peace, DR Congo.

Arsène Ntamusige (ntamusigearsene@gmail.com), Corresponding author

## Assessment of Food Safety Legislation and Efforts in Nigeria

Augustine Okoruwa<sup>1\*</sup>, John Tehinse<sup>2</sup>, Nwando Onuigbo-Chatta<sup>1</sup> and Seun Elere<sup>1</sup>

<sup>1</sup>Global Alliance for Improved Nutrition, Abuja, Nigeria.

<sup>2</sup>Funta Services Nigeria Limited, Abuja, Nigeria

### ABSTRACT

According to the World Health Organization (WHO), about 1 in 10 people in the world fall sick after eating contaminated food. Despite poor data collection on foodborne disease outbreaks, evidence exists to show that these contribute to ill health and death in Nigeria as well as reduce productivity and economic growth. With funding from the United States Agency for International Development (USAID), an assessment of food safety legislation and efforts in Nigeria was undertaken by the Global Alliance for Improved Nutrition (GAIN) through its EatSafe: Evidence and Action Towards Safe, Nutritious Food project. In addition to a desk review of the laws, regulations and standards, consultation with selected food safety stakeholders was undertaken to obtain their opinions on the status of food safety legislation and efforts in Nigeria. This involved virtual and face-to-face meetings with officials in relevant government Ministries, Departments and Agencies (MDAs), Non-Governmental Organizations (NGOs) and Food Business Operators in the Federal Capital Territory (FCT), Kebbi and Nasarawa States. Findings revealed that Nigeria currently operates a multiple agency Food Safety Control System which is mostly sectorial in nature. Many of the definitions of terminologies used in the body of the legislation are often vague, confusing, and not fully aligned with Codex or other international standard bodies. 14 out of the 16 (87.5%) existing legislations relating to food safety were enacted 10 to 100 years ago and some are overdue for review or repeal. Nigeria's Food Safety and Quality Bill produced in 2016 is still awaiting final passage into law, five years after. In conclusion, Nigeria needs to maintain effective food safety legislation and the accompanying regulations and guidelines. Moreover, the legislation should adequately address the whole range of food safety concerns in the food supply chain; including the informal food sector that has been hitherto neglected.

---

Keywords: Food safety, EatSafe, Legislation, Nigeria

Augustine Okoruwa (aokoruwa@gainhealth.org) Corresponding author

John Tehinse (jtehinse2013@gmail.com),

Nwando Onuigbo-Chatta (nonuigbo-chatta@gainhealth.org)

Seun Elere (selere@gainhealth.org)



# The Need for Forensics Support in the War Against Food Fraud: A Focus on Ghana

Yahaya Sumara Sulley<sup>1\*</sup>, Aaron Amankwa<sup>2</sup>

<sup>1</sup>University for Development Studies, P.O. Box TL 1882, Tamale Ghana

<sup>2</sup>School of Law, Northumbria University, Newcastle Upon Tyne NE1 8ST, UK.

## ABSTRACT

The issue of food fraud is often undermined whenever food safety is the subject of discussion. Food fraud is a very rampant situation in Ghana hence there are numerous falsified and adulterated food products on the consumer market. As Ghana work towards the prioritization of the fight against crimes with the publicity of food safety looming, food crimes are probably being ignored as a serious food safety issue especially in the Global South. Food fraud is an economically motivated phenomenon in Ghana due to factors including globalization, consumer taste and preference, desire to gain undue profit and low probability and severity of punishment to perpetrators of food fraud. The situation is imminent as the Ghanaian market is full of desperate sellers who will do everything to get profit from an innocent consumer, but most importantly, the food needs to be safe. This paper reviewed relevant literature concerning the food fraud situation in Ghana with a desktop approach. Findings of the study revealed that food fraud is not new in Africa and for that matter, Ghana is not an exception with sugar, sawdust, water, foam, carbide and Sudan IV been identified as adulterants in the Ghanaian market. The study concluded that the several years of ignoring relevant intelligence and policies concerning a robust food fraud environment has made it difficult to fight food fraud in Ghana these days. Perpetrators of these crimes are seen to be ahead of the regulatory bodies in terms of orchestrating their activities. Forensic support to identifying food fraud will yield efficiency, save time and ensure general productivity in bringing culprits of such crimes to justice. It further informs that with forensic science, there is hope that the "what, where, how" will be well understood and the "who" of such crimes will be brought to justice.

---

Keywords: Efficiency, food, food fraud, forensics, Ghana, Rampant

Yahaya Sumara Sulley (ysulley@uds.edu.gh), Corresponding author

Aaron Amnkwa (aaron.amankwaa@northumbria.ac.uk)

## IMPACT OF COVID-19 ON FOOD SYSTEMS IN AFRICA

### Does Covid-19 Pandemic Affect Purchasing Habit?

Sarra Jribi<sup>1\*</sup>, Hanen Ben Ismail<sup>1,2</sup>, Darine Doggui<sup>3</sup>, Hajer Debbabi<sup>3</sup>

<sup>1</sup>Department of Agri-Food Industries, National Institute of Agronomy of Tunisia (INAT), UR17AGR01, University of Carthage, Tunis, Tunisia

<sup>2</sup>Faculty of Mathematical, Physical and Natural Sciences of Tunis, LR11ES09, University Tunis El Manar, Tunis, Tunisia

<sup>3</sup>National Institute for Consumption (INC), Tunis, Tunisia

#### ABSTRACT

Purchasing food is common practice in our daily life. This decision results from a complex interaction among internal and external factors. Covid-19 pandemic has marked the whole world at different scales: emotionally, socially, economically and environmentally. This research aimed to assess the impact of Covid-19 crisis on purchasing habits. An online survey was conducted online on March, 2020. Respondents were asked about their demographics, perception of current situation and consumption habit. Results showed that 81.7% of respondent were scared (vaccines were not available during study period). Despite, spread of fear sensation, 67.5% of respondents were sure that Tunisia will overcome this crisis situation. Regarding purchasing behavior, respondents paid attention to ingredients list. In fact, 73% of them declared reading ingredients list (always or often). They also accorded attention to food label as 61% reported reading them. Attention was also accorded to claims and nutrition claims as 65% of respondents paid attention to them. These findings demonstrate that Covid-19 crisis situation enhanced good shopping behaviour: consumers accorded a high interest to characteristics of bought product which could be related to emotional impact of Covid-19 pandemic. In perspective, further efforts are needed to enhance this tendency outside crisis situation context.

---

Keywords: Consumer, Covid-19 pandemic, behaviour, purchase.

Sarra Jribi (sarra.jribi@inat.ucar.tn), Corresponding author

Hanen Ben Ismail (benismailhanen@yahoo.fr)

Darine Doggui (deryn\_dogui@yahoo.fr)

Hajer Debbabi (hajer.debbabi@inat.ucar.tn)

## Audit Frequencies in Time of COVID-19 Restrictions and Recovery: A South African Sample

Mutsa Rwasoka<sup>1\*</sup>, Lulanie Swanepoel<sup>2</sup>

<sup>1</sup>Mérieux NutriSciences, Stellenryk Building, Constantia Square Office Park, 16th Street, Midrand, 1685, South Africa

<sup>2</sup>Mérieux NutriSciences, 7 Warrington Road, Claremont, 7708, WC, South Africa

### ABSTRACT

To manage the COVID-19 pandemic, the World Health Organization (WHO) advised governments to implement measures such as social distancing, physical distancing, wearing of masks and encouraging employees to work from home. This is more of a challenge in food manufacturing facilities. However, the availability and provision of safe food is always required. Audits are a method used by food manufacturers to assess and ensure their food safety management systems are independently verified. Internal audits and hygiene audits may be conducted by independent parties. Conducting audits in these conditions was restricted due to lockdown measures.

**Method:** Data was collected on the number of food safety audits conducted in the year before the first COVID-19 restrictions were effected in South Africa; March 2019- Feb 2020. This was compared to the number of audits conducted from March 2020- Feb 2021 as this was the period with different levels of restrictions. Finally, the number of audits conducted from March 2021 to present has been evaluated.

**Results:** The comparison shows that there was a reduction in the number of audits conducted during the year since COVID- 19 restrictions were implemented.

**Conclusion:** Emergency situations such as the COVID-19 pandemic reduce the ability of manufacturers, to robustly verify their food safety management systems.

**Recommendation:** The use of technology in verifying food safety management systems can be accelerated.

---

Keywords (provide 3-5 keywords) Hygiene, Audits, COVID-19, South Africa

Mutsa Rwasoka (mutsa.rwasoka@mxns.com), Corresponding author

Lulanie Swanepoel (Lulanie.swanepoel@mxns.com)

## FOOD SAFETY FROM FIELD-TO-BOWL

### Camel Meat Safety and the Status of Hygienic Practice in Abattoir and Butcherries of Nagelle Town, Southern Oromia, Ethiopia

Kedir Abdi<sup>1</sup>, Sisay Girma<sup>1</sup>, Balako Gumi<sup>2</sup>, and Zelalem Ayana<sup>3</sup>, Oudessa Kerro<sup>4</sup>

<sup>1</sup>College of Veterinary Medicine, Haramaya University, Haramaya, Ethiopia.

<sup>2</sup>Akililu Lema Institute of Pathobiology, Addis Ababa University, Addis Ababa Ethiopia.

<sup>3</sup>College of Agricultural Science, Bule Hora University, Bule Hora, Ethiopia.

<sup>4</sup>Department of animal science, the University of Tennessee, Knoxville, Tennessee.

#### ABSTRACT

During December 2018 to August 2019 cross sectional study was conducted to assess the hygienic practice during handling of raw camel meat and identification of the major source of bacterial contamination at abattoirs and butcherries of Nagelle town. To achieve the objectives of this study, the data were collected from 68 camel meat sample and 60 from swab samples both from abattoir and butcher's workers and semi structured interview questionnaire, and site observation checklist were used. Descriptive statistics were used for data analysis. The study isolated and identified that all the tested positive camel meat samples were subjected to *E. coli* count, *Staphylococcus aureus* count and aerobic plate count (APC). The *S. aureus*, *E. coli* and *Salmonella* spp. were detected from total of collected raw camel meat sample 12(35.3), 16(45.7) and 8(22.8) at abattoirs and 19(54.3), 22(64.5) and 10(29.4) from at butcherries respectively. Mean *S. aureus* counts for camel meat were 2.76 and 3.07 log<sub>10</sub> CFU/g while mean *E. coli* counts were 2.81 and 3.94 log<sub>10</sub> CFU/g, from abattoirs and butcherries respectively. There were no significant differences ( $p > 0.05$ ) between the *E. coli* and *S. aureus* count. Mean Aerobic Plate Counts of camel meat from abattoirs (4.67 log<sub>10</sub> CFU/g) were not significantly different as compared to APC values of butcherries (5.49 log<sub>10</sub> CFU/g). The isolated and identified bacteria were in decreasing order *E. coli*, *S. aureus* and *Salmonella* spp. were detected from swab sample such as person hand, environment, cutting board and knife at abattoirs and butcherries respectively. Thus, the present study reveals the fact that raw camel meat is heavily contaminated with the high incidence of bacterial pathogen and the major source of bacterial contamination were in decreasing order person hand, environment, cutting board and knife respectively. It is concluded that major source of bacterial contamination of raw camel meat at butcherries house than abattoirs in Nagelle town Therefore there is an urgent necessity to minimize the contamination of camel meat handling at abattoirs and sold at butcherries house by implying proper general hygienic and equipment sanitation practices.

---

Keywords: Camel Meat, *Escherichia coli*, *Staphylococcus Aureus*, *Salmonella* spp.

Kedir Abdi (kedirabdi4@gmail.com)

## Food Safety of Fresh Produce in Africa: Past, Current and Future

Esther Areo<sup>1\*</sup>, Amarachukwu Anyogub<sup>2</sup> and Obadina Adewale<sup>2</sup>

<sup>1</sup>Department of Food Science and Technology, Federal University of Agriculture, Abeokuta, Ogun State, Nigeria. P.M.B. 2240

<sup>2</sup>Food, Nutrition & Public Health, School of Life Sciences, University of Westminster, 115 New Cavendish Street, London W1W 6UW, United Kingdom. University of West London, St Mary's Road Ealing, London W5 5RF, United Kingdom

### ABSTRACT

Food-borne illnesses are critical challenges in Africa that have created disaster on Africa's economy. About 91 million of people are infected, 137 thousand die annually because of the incurable diarrheal diseases caused by resistant bacteria isolated from food. The emergence of Antimicrobial Resistance (AMR) is the acquired ability that makes microorganisms to withstand killing activity of antimicrobial which prolong infection period, cause death and drain the economy. In Nigeria, despite the estimated cost of illnesses of about US\$ 3.6 billion spent per annum, more than 200,000 deaths are reported as a result of AMR. Globally, 700 thousand deaths have been occurring, but it has been predicted to increase to 10 million people by 2050, of which 2.4 million will be from high income countries, if AMR is not well tackled. Fruits and vegetables which have been encouraged to be taken daily in order to promote and satisfy humans medically and nutritionally are versatile route to spread AMR. This work discussed the devastating threat AMR in fruits and vegetables has, has been having and will have against various Sustainable Development Goals. It buttressed its emerging thwarting of food safety experts' visions including worsening climate change that limit food security of fruits and vegetables. Recommendations in this review will create steps that can eradicate AMR while protecting the antimicrobials and good quality fruits and vegetables even for the next generations to come.

---

Keywords: Food safety, Food-borne illnesses, Antimicrobial Resistance, Fruits and vegetables

Esther Areo (estherareo1910@gmail.com), \*Corresponding author  
Amarachukwu Anyogub (amara.anyogub@pm.me)  
Obadina Adewale (obadinaw@gmail.com)

# Bacteriological Safety Assessment and Coliform bacterial contamination of Milk and Other Dairy Products in Northwest Ethiopia

Achenef Melaku Beyene<sup>1\*</sup>, Zenebe Jemere<sup>2</sup>, Baye Gelaw<sup>1</sup>, Mucheye Getahun<sup>1</sup>, Barbara Kowalczyk<sup>3</sup>, Desalegn Mengesha<sup>3</sup>, Seleshi Nigatu<sup>2</sup>, Ahmed Yousef<sup>3</sup>, Wondwossen Gebreyes<sup>3</sup>

<sup>1</sup>University of Gondar, College of Medicine and Health Sciences, Department of Medical Microbiology, P. O. Box 196, Gondar, Ethiopia

<sup>2</sup>University of Gondar, College of veterinary Medicine and Animal Sciences, P. O. box 196, Gondar, Ethiopia

<sup>3</sup>Ohio State University, Columbus, USA

\*Corresponding author: - Tel.: +251918065724; E-mail: tbeyene11@gmail.com

## ABSTRACT

Milk can be easily contaminated by potentially pathogenic micro-organisms due to unhygienic production and processing. Determining the current status of the bacteriological quality of milk products will help to design strategies to minimize the risks. This study was conducted to assess the bacteriological quality of milk and milk products, isolate and assess the antimicrobial susceptibility patterns of *E. coli* isolated from these products from selected districts in Northwest Ethiopia. Bacteriological qualities of 57 samples were assessed by total mesophilic aerobic and total coliform counts. Coliform bacteria were isolated from 112 samples using standard bacteriological techniques and confirmed by biochemical tests. The mean total mesophilic aerobic bacterial (TMAC) and total coliform counts (TCC) of all samples were 6.18 and 5.59 log<sub>10</sub>cfu/ml, respectively. Both counts indicated that the majority of samples had poor grades. Based on TCC, 93.8% of milk samples from different sources had poor grades. Out of examined samples, 70.5, 20.4, 6.3 and 2.7 % were positive for *Citrobacter* species, *E. coli*, *Enterobacter* and *Klebsiella* species. In conclusion, most of the samples had poor bacteriological quality and were contaminated by different coliform bacteria. Therefore, hygienic production and handling of milk and other dairy products must be implemented to improve the bacteriological quality, reduce the contamination of coliform bacteria. Further studies are required to characterize the isolated bacteria by using conventional and molecular techniques.

---

Keywords: Bacteriological Quality; Coliform bacteria; Milk; Northwest Ethiopia

Achenef Melaku (Beyene tbeyene11@gmail.com)

Zenebe Jemere (zenebejemere6@gmail.com)

Baye Gelaw (tedybayegelaw@gmail.com)

Mucheye Getahun (muchegiza@gmail.com)

Barbara Kowalczyk (kowalczyk.1@osu.edu)

Desalegn Mengesh (degefaw.1@osu.edu)

Seleshi Nigatu (seleshe2@gmail.com)

Ahmed Yousef (yousef.1@osu.edu)

Wondwossen Gebreyes (wondwossen.gebreyes@cvm.osu.edu)



## Exposure to Food Safety Concerns by Women, Men, and Youth in the Poultry Value Chain in Kenya; A Review

Ariel V. Garsow<sup>1</sup>, Kathleen E. Colverson<sup>2</sup>, Barbara B. Kowalczyk<sup>1,3</sup>

<sup>1</sup>Department of Food Science and Technology, The Ohio State University, 2015 Fyffe Rd, Columbus, OH 43210, USA.

<sup>2</sup>Animal Sciences Department and USAID Livestock Systems Innovation Lab, University of Florida, USA.

<sup>3</sup>Translational Data Analytics Institute, The Ohio State University, Columbus, OH 43210, USA.

### ABSTRACT

Small holder poultry production is the source of food and income for many rural households in Kenya and East Africa, but poultry products can be contaminated with Salmonella and Campylobacter spp. Family members have different roles in poultry production, with women and youth more actively involved in the earlier steps of the value chain including poultry production and processing at the household level. This literature review summarizes current knowledge on the relationships between gender roles and youth in ensuring food safety in the poultry value chain in Kenya and East Africa. Of the twelve articles identified, a majority referenced gender roles while a limited number referenced youth or food safety. Due to their roles in the care and keeping of poultry, women have a critical role in ensuring the safety of poultry products. Additionally, women and youth may have a greater risk of exposure to foodborne pathogens on farm. Future research in food safety that includes gender and youth is needed to reduce foodborne disease in Kenya and East Africa.

---

Keywords: Gender, youth, food safety, poultry, East Africa

Ariel Garsow (garsow.1@osu.edu), Corresponding author

Barb Kowalczyk (Kowalczyk.1@osu.edu)

Kathy Colverson (kcolverson@ufl.edu)

# Impact of Selected Marinades and Processing Methods on the Microbial Loads of Japanese Quail Meat (*Coturnix coturnix japonica*)

Idowu-Mogaji, Grace Oluwatoyin<sup>1</sup>, Adepeju, Adefisola Bola<sup>2</sup> and Oyedele, Damilola Sayo<sup>2</sup>

<sup>1</sup>Department of Wildlife and Ecotourism Management, University of Ibadan, Ibadan, Nigeria

<sup>2</sup>Department of Food Science and Technology, Joseph Ayo Babalola University, Ikeji-Arakeji, Nigeria

## ABSTRACT

Health-conscious consumers currently demand for foods with high nutritional value that are free from chemical preservatives. The utilization of quail meat and egg emerged some few years back as a low cost of animal protein source. Ginger is a rhizome extensively used as spice with antimicrobial properties widely used in meat-based foods. The study investigated the safety and microbial quality of raw and processed (fried and baked) quail meat (*Coturnix coturnix japonica*) and the effect of selected marinades [brine 4 % (w/v), ginger juice 2% (v/v), mixture of brine 4 % (w/v) and ginger juice 2% (v/v)] on its microbial loads. Completely randomized (CRD) experimental design was used for the quail meat processing. Total bacteria and total fungi count of the raw, marinated, processed (baked and fried) quail meat were determined using standard laboratory procedures. The results for the microbiological analyses (total bacteria counts) for raw, marinated, baked and fried quail meats ranged as follows; 9.0-20.5 cfu/g10<sup>-3</sup>, 20.5cfu/g10<sup>-3</sup> (raw), 7.5-9.5 cfu/g10<sup>-3</sup> and 0.0-1.5 cfu/g-3, 1.0-2.5 cfu/g10<sup>-3</sup> while the total fungi counts varied from 11.0-22.0 cfu/g10<sup>-3</sup>, 22.0 cfu/g10<sup>-3</sup> (raw), 11.0-13.5 cfu/g10<sup>-3</sup> (marinated), 0.5-2.0 cfu/g10<sup>-3</sup> (baked) and 2.5-3.0 cfu/g 10<sup>-3</sup> (fried), respectively. Significant (p<0.05) differences exist for both the total bacteria and fungi counts of the raw and processed quail meats. In conclusion, it can be deduced from the study that processing methods significantly reduced the microbial counts of the quail meat.

---

Keywords: quail-meat, marinades, microbial-load, processing methods

Idowu-Mogaji, G.O., (c\_toyinmogaji@yahoo.com) Corresponding author

Adepeju, Adefisola Bola (adepejuadefisola@gmail.com)

Oyedele, Damilola Sayo (mercyoye2001@yahoo.com)

# Effects of Aframomum Danielli on Microbial Loads of Watermelon Juice (*Citrullus lanatus*) During Storage

Jokodola, Temilola Tolulope<sup>1</sup>, Adegoke, Gabriel Olaniran<sup>1</sup>, Idowu-Mogaji, Grace Oluwatoyin<sup>2</sup>

<sup>1</sup>Department of Food Technology, University of Ibadan, Nigeria.

<sup>2</sup>Department of Wildlife and Ecotourism Management, University of Ibadan, Nigeria.

## ABSTRACT

The dietary pattern of human life gives great value to non-alcoholic beverages all over the world. Consumption of fruits and vegetables in regular diet provides several health benefits. The nutraceutical potential of watermelon has been proved by several researchers, which makes it a better choice for health-conscious consumer. The rapid deterioration of watermelon product due to high moisture content is a big challenge in organic beverage industry. Hence the need for natural preservatives to enhance its stability. *Aframomum danielli* is a spice with established phytochemical contents such-as alkaloids, flavonoids/polyphenols and carotenoids as its active chemical compounds. The study evaluates the safety and microbial quality of *Aframomum danielli* treated watermelon juice during storage. Various concentrations of *Aframomum danielli* aqueous extract (1%, 2%, 3%, 5%, 10% and 15%) were used as the juice preservative at ambient temperature for 3 days and refrigeration condition for 15 days. Completely randomized (CRD) experimental design was applied in the production of watermelon juice. Total viable count of the watermelon juice at ambient temperature ranged from 0-1.8 cfu/g 10<sup>-5</sup> (day 0), 0-2.4 cfu/g 10<sup>-5</sup> (day 1), 0-2.5 cfu/g 10<sup>-5</sup> (day 2), 2.0-8.4 cfu/g 10<sup>-5</sup> (day 3). The total viable count at refrigeration condition varied from 0-3.2 cfu/g -3 (day 0), 0-6.7 cfu/g -10<sup>-3</sup> (day 5), 2.2-9.5 cfu/g 10<sup>-3</sup> (day 10) and 3.0-9.8 cfu/g 10<sup>-3</sup> (day 15). There was significant difference ( $p < 0.05$ ) amongst all the watermelon juice samples at ambient and refrigeration condition except for 2% *Aframomum danielli* concentration of ambient with no significant difference ( $p > 0.05$ ) along the storage days. This shows that *Aframomum danielli* aqueous extract can be used as preservatives for storage stability of watermelon juice at both the ambient and refrigeration conditions.

---

Keywords: watermelon juice, *Aframomum danielli*, storage.

Jokodola Temilola Tolulope (temijoko1@gmail.com), Corresponding author

Adegoke, Gabriel Olaniran (goadegoke@yahoo.com)

Idowu-Mogaji, Grace Oluwatoyin (c\_toyinmogaji@yahoo.com)

# Analytical Method Development and validation based on Paper Analytical Device (PAD) for Teff Injera (Ethiopian flatbread) Adulteration Detection

Yeniewa Kerie<sup>1,2</sup>, Ariaya Hymete<sup>1</sup>, Marya Lieberman<sup>3</sup>, Ayenew Ashenef<sup>1</sup>

<sup>1</sup>Department of Pharmaceutical Chemistry and Pharmacognosy, Addis Ababa University, College of Health sciences, School of Pharmacy, P.O. Box. 1176, Addis Ababa, Ethiopia

<sup>2</sup>Department of Pharmaceutical Chemistry, School of Pharmacy, College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia

<sup>3</sup>Department of Chemistry and Biochemistry, University of Notre Dame, Notre Dame, IN 46556, USA

## ABSTRACT

**Background:** Food adulteration is the act of intentionally or unintentionally addition, substitution, or replacement of high-quality products with an inferior and even harmful substance. In Ethiopia, different traders of staple foods had been arrested by police being suspected of mixing food with strange things. Teff [*Eragrostis teff* (Zucc.) Trotter] is a major food crop native to Ethiopia utilized for the production of traditional staple foods and beverages. Now days, there is a report that claims teff flour is adulterated with "Gesso" and baked as teff injera. Hence this study aims analytical method development on a paper analytical device (PAD) that is simple, user-friendly, and onsite testing system for teff injera adulteration detection.

**Methods:** The PAD test card was developed to detect the quality of teff injera. Small amounts of chemicals were deposited on 12 lanes in different lines of the PAD to create a color barcode in response to different elements found in teff or adulterants. As a preliminary and supportive procedure, chemical colour reactions formations were performed in test tubes. Microwave Plasma Atomic Emission Spectrometer (MP-AES) was also used as confirmatory test. PADs were printed with wax inks using a Xerox ColorQube 8570 printer. Analytical grade chemicals and reagents were employed.

**Results:** During tube tests, pure teff injera flour was dissolved in distilled water. Then drops of NaOH, Buffer, and Eriochrome black-T indicator were added. Blue colour was observed in pure teff injera after addition of EDTA. But persistent red colour was observed after the addition of EDTA in teff injera that contains "Gesso". In the PAD optimized method, potassium ferrocyanide and diluted HCl were incorporated in one lane at different lines that gave a Prussian-blue color for pure teff injera. This color was not present on adulterated ones with "gesso". Ammonium thiocyanate and diluted HNO<sub>3</sub> were incorporated in another lane at different lines that gave a bloody-red colour for pure teff injera. The color was pale red on adulterated sample. According to MP-AES results teff injera containing "Gesso" had a greater calcium level than pure teff injera while the reverse is true for iron levels.

**Conclusion:** The Method developed in this study for teff injera adulteration by "Gesso" detection based on PAD, tube tests and MP-AES can help the consumer and the regulator to circumvent this challenge.

---

Key Word: Food Adulteration, Teff injera, PAD, "Gesso", Ethiopia

Yeniewa Kerie (Yenewa.Kere@uog.edu.et), Corresponding author

Ariaya Hymete (ariaya.hymete@aau.edu.et)

Marya Liberman (mlieberm@nd.edu)

Ayenew Ashenef (ayenew.ashenef@aau.edu.et)

# The Technical and Political Perspectives of Food Safety in Africa: The Last Three Decades

Erica Kim<sup>1</sup>, Sanja Ilic<sup>2</sup>

<sup>1</sup> The Ohio State University, College of Education and Human Ecology, Columbus, Ohio, USA

<sup>2</sup> The Ohio State University, College of Education and Human Ecology, Columbus, Ohio USA

## ABSTRACT

In many developing countries, poultry production is one of the most important livelihood strategies for the many low-income households. Especially in the rural areas like Kiambu County in Kenya, poultry serves as a source of nutrition and consumption and it mainly generates income for household livelihood. Most of the traditional rural households raise chicken under extensive system with little inputs, and therefore introducing many food-safety concerns along the poultry processing stages from farm to fork. Poultry value chain is prone to contamination of microorganisms such as Salmonella and Campylobacter. Education of the food safety knowledge and its application to poultry production in developing countries plays a critical role in order to improve productivity and profitability in small-scale poultry producers. There still exist challenges to overcome when it comes to implementing and executing the food safety regulations and guidelines supported by Kenyan government and raising awareness of food safety process among the stakeholders. This research analyses current process of poultry production, and further identifies various stakeholders along the value chain for implanting viable, appropriate intervention considering existing challenges and limitations. Some of the limitations to overcome involves the lack of food safety awareness among stakeholders, weak stakeholder networks, insufficient scientific data and inadequate capacity in risk analysis. These are to be addressed and coordinated appropriately in the intervention methods so to mitigate the occurrence of foodborne diseases and increasing the food safety awareness through education intervention.

---

Keywords: Food safety, Education, Intervention, Poultry, Nutrition

Erica Kim (kim.6824@osu.edu)

Sanja Ilic (ilic.2@osu.edu)

# Effect of Steeping, Handling and Packaging on the Microbial Quality of a Blended Traditional Food Thickener, "achi" Seeds (*Barchystegia eurycoma*)

Kupoluyi, Abiodun<sup>1</sup>

<sup>1</sup>Department of Food Science and Technology Federal University of Agriculture, Abeokuta, Nigeria

## ABSTRACT

The quality and safety of food commodity is not only dependent on pH, temperature, relative humidity, moisture content, availability of air of both the food material and storage environment but much more on the practices utilized by processors and sellers. This study investigated the effect of steeping, handling, and packaging on the fungal contamination of "achi" seeds processed and distributed in some Nigeria markets.

**Methodology:** Moist "achi" seeds tied in polyethylene were obtained randomly from five different sellers in the Oyingbo market and blended. Dry un-steeped seeds were also randomly collected from five sellers in same market. Aseptically collected dry seeds and the milled seeds were transported in ice to the laboratory for microbial investigation. Serial dilution was carried out and the dilution 4 and 5 (4-1 and 5-1) were inoculated on Potato Dextrose Agar (PDA) using the pour plate method and incubated at room temperature for 7 days.

**Results:** Fungi colonies of *Aspergillus* and *Penicillium* species were isolated from the steeped samples that were packaged in small polyethylene and blended in the market while the un-steeped seeds that was dry milled in the laboratory using the stainless blended were found to be free from fungal contamination.

**Discussion and conclusion:** The fungal contamination discovered could be attributed to processing (steeping, packaging, storage and blending) methods adopted by the sellers. Milling the seeds with the hand milling machine used for other products like melon, 'ogbono' and dry pepper was found to be a source of cross contamination. Dry milling of the "achi" seeds and the use of frequently and thoroughly cleaned machine is a very effect means of hindering fungal contamination of the food thickener.

**Industrial Relevance:** Adherence to set processing standards must be encouraged and enforced to inhibit fungal contamination and eliminate inherent economic loss and health hazards.

---

Abiodun Kupoluyi (abikups@gmail.com)



## The Status and Trends of Food Safety in Nyankpala, Ghana

Mohammed Lawal<sup>1,2</sup>, Shamsiyatu Murtala<sup>3</sup>, Yahaya Damba<sup>3</sup>

<sup>1</sup>Federal University of Technology, Minna. 920211 Main Campus, Gidan Kwano, Minna, Niger State, Nigeria.

<sup>2</sup>Africa Centre of Excellence for Mycotoxin and Food Safety, Minna, Niger State, Nigeria.

<sup>3</sup>University for Development Studies, Nyankpala Campus, Department of Biotechnology. P.O. Box TL 1882, Tamale, Ghana

### ABSTRACT

Despite its seriousness, food fraud has not received the necessary attention in food safety discourses in Ghana. Food fraud is considered generally as the intentional misrepresentation of the contents or identity of food for economic gain. The study was aimed at assessing the food fraud awareness level of participants as well as investigate the foods most likely to be implicated in food fraud cases in Nyankpala.

Data was collected from 257 participants which constituted 75 food business operators (FBOs) and 182 consumers via a simple random sampling technique using a questionnaire. Participants were educated briefly on food fraud before proceeding to answer the questionnaire.

Results gathered indicated that most participants (55.9%) were not aware of food fraud and its activities before the study. Beverages and juices, spices, oils, meat and fish, baked foods, honey, milk and semi-processed local foods such as groundnut paste, "dawadawa" and "agushi" were all foods revealed to be implicated in food fraud by participants. Adulteration was the commonest food fraud action as tampering, substitution and mislabelling was also mentioned. Only 43.2% indicated they could distinguish genuine food from tampered food when they come across one.

Food fraud is further predicted to increase. This does not only compromise the kinds of food we consume but as well pose a threat to consumer health and wellbeing. Fight against food fraud by FDA Ghana should be re-strategised by making food defence a key aspect in food safety campaigns and systems.

---

Keywords: Foods, food fraud, and adulteration

Mohammed Lawal (mohammedjack3@gmail.com), Corresponding author

Shamsiyatu Murtala (mhizzshamsy@gmail.com)

Yahaya Damba (ydamba@uds.edu.gh)

# Salmonella as an Emerging Africa's Food Safety and Export Challenge: A Need for Urgent Interventions

Firew Tafesse Mamo\*<sup>1</sup>, Birhan Addisie Abate<sup>1</sup>, Kassahun Tesfaye<sup>1</sup>, Tigist Getachew<sup>1</sup>

<sup>1</sup>Ethiopian Biotechnology Institute, Addis Ababa, Ethiopia

## ABSTRACT

Sesame is economically and nutritionally important crop. The world sesame productions are mainly (>70%) supplied by developing countries (Asia and Africa). Of these countries, Sudan, Ethiopia, Nigeria, Tanzania and Uganda from African are among the top producers. These countries exported with average volume of 316,704.9, 280,851.4, 167,527.5, 103,327.6, 24,251.25 tons of sesame with average values (USD) of 437,055.1, 437,875.6, 232,401, 141,530.5, 29,245.75 respectively from 2012 to 2019. This indicates, as sesame has a vital economic advantage for African counties. EU countries are the main raw sesame seed importers (>68%) from Africa. Recently, salmonella contaminations of sesame seeds originated from Africa is becoming bottleneck for the export market. In contrary, the global sesame market demand is rising with increasing food safety awareness and stringent control. According to the EU Rapid Alert System for Food and Feed (RASFF) reports, a total of 344 notification were given for sesame seeds exported from the top three sesame exporting African countries like Sudan (n=202), Nigeria (n=104), and Ethiopia (n=37), from 2000– 2021. Among the notification 97 % (334) of them results complete rejections from the borders of different EU countries due to the presence of salmonella. Several salmonella serovars including the common serovars isolated from humans were reported. The sesame contamination could be occurred at any point of the value chain from the farm, storage, transportation up to cleaning and packaging steps. Therefore, salmonella tasting capacity has to be established from primary transaction sites up to the export point. Strong support and regulation should be in place from the farm preparation, harvesting and storage as farmers involving in sesame cultivation are smallholding and their farms are carried on marginal soils. Coordination should be there among different food safety regulators. Moreover, good farming practice, hygienic manufacturing practice should be promoted through trainings and awareness rising activities.

---

Keywords: Sesame; Food safety; Salmonella; RASFF.

Firew Tafesse Mamo (f.tafesse80@gmail.com), Corresponding author

Birhan Addisie Abate (birhanaddisie@gmail.com)

Kassahun Tesfaye (kassahun.tesfaye@aau.edu.et)

Tigist Getachew (tigistgetachew627@gmail.com)

## E. Coli and Salmonella Load of Tomato Sold in Nairobi Metropolis

J.H. Nguetti<sup>1</sup>, M.W. Okoth<sup>1</sup>, J. Wang'ombe<sup>3</sup>, W.F. Mbacham<sup>4</sup>, S.E. Mitema<sup>2</sup>

<sup>1</sup>Department of Food Science, Nutrition and Technology; Faculty of Agriculture; College of Agriculture and Veterinary Sciences; University of Nairobi- Kenya. P.O Box 29053-00625, Kangemi, Nairobi

<sup>2</sup>Department of Public Health, Pharmacology and Toxicology; Faculty of Veterinary Medicine; College of Agriculture and Veterinary Sciences; University of Nairobi- Kenya. P.O Box 29053-00625, Kangemi, Nairobi

<sup>3</sup>School of Public Health, College of Health Sciences, University of Nairobi- Kenya. P.O Box 19676-00200 Nairobi

<sup>4</sup>Department of Health Economics, Policy and Management; Catholic University of Cameroon, Bamenda- Cameroon. P.O Box 3851, Messa, Yaoundé

### ABSTRACT

Tomato is intensively grown and highly consumed in Kenya. However, the vegetable can harbor bacteria and becomes potentially risky to consumers' health. A cross-sectional study was done to establish E. coli and Salmonella loads in tomatoes marketed in Nairobi from January to June 2017. Tomatoes were sampled from three open-air markets (OAM1, OAM2 and OAM3) and two supermarkets (SM1 and SM2) twice a month with first collections between the 1st and 10th days of each month while second collections were between the 23rd and 28th days of month. Four samples were always picked per open air market and from four different nooks to cover the whole area. Also, 4 collections per each supermarket were randomly done in boxes used for display. At least 1kg sample was handpicked from each site making together 40 samples monthly from all sites. For analysis, 2 tomatoes were picked per sample and by pooling, 8 tomatoes were set aside as one sample per site. A total of 60 analyses per bacteria were done. Analysis method included washing, isolation, enumeration and characterization. Data were analysed using GenStat and SPSS and thereafter means, standard deviation and level of confidence were determined. Tomato samples had 76% E. coli above the recommended load and the same samples had 20% of non-typed Salmonella spp. The month of January ( $4.33 \log_{10} \text{cfu.ml}^{-1} > 2$ ), February ( $2.44 \log_{10} \text{cfu.ml}^{-1} > 2$ ) and May ( $2.8 \log_{10} \text{cfu.ml}^{-1} > 2$ )  $p \leq 0.05$  which were wet months had highest E. coli prevalences while March, April and June which were dry periods had low presences. E. coli levels were more in open air markets samples (OAM1  $2.79 \log_{10} \text{cfu.ml}^{-1}$ ; OAM3  $3.08 \log_{10} \text{cfu.ml}^{-1}$ ; OAM2  $2.31 \log_{10} \text{cfu.ml}^{-1}$ ) compared to those of supermarkets (SM1  $2.07 \log_{10} \text{cfu.ml}^{-1}$ ; SM2  $1.56 \log_{10} \text{cfu.ml}^{-1}$ ). Fresh tomato from some markets in Nairobi harbors E. coli above recommended load and also contains Salmonella; proper disinfection is recommended before consumption.

---

Keywords: Salmonella, E. coli, supermarkets, open-air market, consumers, Nairobi

J.H. Nguetti (jhnguetti@gmail.com), Corresponding author

S.E. Mitema (esmitema@uonbi.ac.ke)

M.W. Okoth (mwokoth@uonbi.ac.ke)

J. Wang'ombe (jwangombe@uonbi.ac.ke)

W.F. Mbacham (wfmbacham@yahoo.com)

# Antimicrobial Resistance Profiling of Pathogens Isolated from Commercially Sold and Home Garden Selected Fruits and Vegetables

Olanbiwoninu Afolake<sup>1\*</sup>, Awotundun Theresa<sup>1</sup>, Olayiwola John<sup>1</sup>, Fashogbon Rachael<sup>1</sup>

<sup>1</sup>Ajayi Crowther University, P.O. Box 1066, Oyo, Oyo State, Nigeria.

## ABSTRACT

Fruits and vegetables have been implicated in disease outbreaks and identified as vehicles for transmission of pathogenic Antimicrobial Resistant (AMR) microorganisms which is of food safety concern. This study aimed at profiling the AMR microorganisms in selected home-garden (HG) and commercially sold (CS) fruits and vegetables, within the South-West region of Nigeria. Watermelon, cucumber, tomato and garden-egg samples were collected and subjected to microbiological analysis. Isolates were screened for pathogenicity, spoilage potential and antimicrobial sensitivity using amoxicillin-clavulanic acid, ampicillin, ceftazidime, ceftriaxone, cefuroxime, ciprofloxacin, cloxacillin, erythromycin, gentamicin, nitrofurantoin, ofloxacin (antibiotics), fluconazole, griseofulvin and nystatin (antifungals). Detection of AMR genes were carried out molecularly. Of the 164 microorganisms isolated, 146 (89%) were bacteria and 18 (11%) were fungi. The genera: *Bacillus* (15.9%), *Corynebacterium* (11.0%), *Lactobacillus* (1.2%), *Listeria* (1.8%), *Staphylococcus* (12.8%), *Enterococcus* (1.2%), *Micrococcus* (1.2%), *Acinetobacter* (3.7%), *Aeromonas* (2.4%), *Alcaligenes* (0.6%), *Brucella* (0.6%), *Vibrio* (0.6%), *Aspergillus* (3.7%), *Cladosporium* (0.6%), *Fusarium* (0.6%), *Geotrichum* (1.2%), *Penicillium* (0.6%), family *Enterobacteriaceae* (36.0%) and *Yeasts* (4.3%) were identified. Isolates with haemolytic potentials were 51 (31%) while 49 (30%) had spoilage potentials. Only 65 (40%) of the bacterial isolates were pathogenic with higher occurrence in CS [41 (63%)] than HG [24 (37%)], and 48 (91%) of the bacterial isolates were multi-drug resistant strains. From the 12 pathogenic fungi, 5 *Aspergillus* spp. produced aflatoxins. AMR genes: *bla*TEM and *bla*CTX-M were detected in *Salmonella enterica* isolated from CS tomato, *bla*TEM, *bla*SHV, *bla*CTX-M and *ERM*(B) were detected in *Listeria monocytogenes* from CS watermelon, *bla*SHV and *bla*CTX-M were detected in *Bacillus cereus* from CS tomato, *bla*TEM, *bla*SHV, *bla*CTX-M and *ERM*(F) were detected in *Staphylococcus aureus* from HG garden-egg. The presence of pathogens with AMR genes in CS and HG fruits and vegetables is a pointer to public health risks and food safety threats. Hence, the need for improved hygienic practice.

---

Keywords: Fruits, vegetables, pathogens, antimicrobial resistance, food safety

Olanbiwoninu Afolake (aa.olanbiwoninu@acu.edu.ng), Corresponding author

Awotundun Theresa (abimbolaawotundun@gmail.com)

Olayiwola John (jo.olayiwola@acu.edu.ng)

Fashogbon Rachael (rachaelyms@yahoo.com)

# Prevalence, Phenotypic and Genotypic Characterization of *Campylobacter* spp and *Salmonella* spp Isolated from Poultry Value Chains Managed by Peri-urban women and Youth Farmers in Kiambu County, Kenya

Robert S. Onsare<sup>1\*</sup>, John Njenga<sup>1</sup>, Noel Kambi<sup>1</sup>, Susan Kiranga<sup>1</sup>, Peter Osako<sup>1</sup>, Nasandra Wright<sup>2</sup>, Barbara B. Kowalcyk<sup>2</sup>

<sup>1</sup>Kenya Medical Research Institute (KEMRI), Kenya

<sup>2</sup>Ohio State University (OSU), USA

<sup>3</sup>University of Nairobi (UoN), USA

## ABSTRACT

Foodborne disease (FBD) causes estimated 91M illnesses and \$16.7B in human capital losses annually in Africa. Global access to safe food is crucial for the attainment of Kenya Vision 2030 Agenda and United Nations Sustainable Development Goals. Food safety in Africa is a key public health concern as it affects all ages, genders and income levels. FBD in Kenya have been directly linked with economic losses, antimicrobial resistance, permanent disability and even deaths. In Kenya there is currently paucity of scientific data describing prevalence and characteristics of key Foodborne pathogens such as *Campylobacter* spp and *Salmonella* spp and risk factors as well as food safety practices that may be contributing to FBD. This puts the human population at risk of managing not only foodborne illnesses, but other bacterial diseases due to emerging challenges such as genetic transfer of resistant genes through such mechanisms as mobile genetic elements.

It is against this background that we recently received funding from USAID through the Feed the Future Food Safety Innovation Lab (FSIL) to implement a project title, 'Chakula salama: a risk-based approach to reducing foodborne disease and increasing production of safe foods in Kenya'. This is a collaborative research project between Ohio State University (OSU), Kenya Medical Research Institute (KEMRI), University of Florida (UF) and University of Nairobi (UoN). One of the main objectives of this project is to determine the prevalence, phenotypic and genotypic characteristics of *Campylobacter* spp and *Salmonella* spp isolated from poultry value chains managed by peri-urban women and youth farmers in Kiambu County, Kenya. The overall aim is to reduce risk of *Salmonella* and *Campylobacter* in poultry produced by small-scale women and youth poultry farmers in Kiambu County in Kenya. It is expected that data from this study will generate information for justifying increased attention to foodborne illness as well as determine scalable interventions for youth and gender to increase effectiveness of the food safety system. In addition, the project plans to roll-out expert training on sampling, microbial testing, burden, risk- based decision- making with representation from about 40 county regional (County) governments in Kenya. The project findings will also chart a roadmap and tools for other value chains in Kenya and other LMIC to implement risk- based food safety systems.

---

Keywords: Food safety, Food borne diseases, antimicrobial resistance

Robert Onsare (robert.s.onsare@gmail.com),

Corresponding author John Njenga (jengajohn86@gmail.com)

Noel Kambi (nornowel@gmail.com)

Susan Kiranga (susanmuthoni342@gmail.com)

Peter Osako (peterosako27@gmail.com)

Nasandra Wright (wright.1363@osu.edu)

Barbara B. Kowalcyk (kcolverson@ufl.edu)

# A Survey of Fumonisin and Deoxynivalenol in Market Wheat Flour and Wheat Products in Kenya

Phanice Kheseli Otieno<sup>\*a</sup>, Susan S. Imbahale<sup>a</sup>, Vitalis Wafula Wekesa<sup>b</sup>, Sheila Okoth<sup>c</sup>

<sup>a</sup>Department of Applied and Technical Biology, Technical University of Kenya, P.O Box 52428 – 00200, Nairobi

<sup>b</sup>Dudutech IPM Limited, P.O BOX 1927 - 20117, Naivasha, Kenya.

<sup>c</sup>School of Biological Sciences, University of Nairobi, P.O Box 30197 - 00100, Nairobi

## ABSTRACT

Fumonisin and deoxynivalenols are secondary metabolites produced by certain pathogenic *Fusarium* sp. in cereals like wheat. They have diverse acute chronic effects on both humans and livestock when consumed. In the recent past, incidences of infection of wheat by mycotoxin-producing fungi have increasingly been reported in Kenya. There has also been a dramatic shift in the consumption of wheat and its products by the Kenyan population and livestock. Consequently, an increase in the importation of the commodity has ensued since Kenya's wheat production capacity can only meet 20% of the national demand. Transportation and storage of grains in inappropriate conditions can increase the fungal and mycotoxigenic load. This survey investigated the occurrence and levels of fumonisin and deoxynivalenol in randomly selected market wheat flour and wheat flour-based products (Bread, Biscuits, Weetabix, spaghetti, and indomie) common in the Kenyan market. Mycotoxin analysis was done by ELISA method (Helica Biosystems Inc.). Over 75% of the analyzed samples had toxin levels within the recommended maximum limits as per the EU standards while the rest had non-detectable amounts. The highest amounts (5.6µg/kg) of deoxynivalenol were detected in wheat flour and, its occurrence frequency in all the analyzed samples was higher as compared to fumonisin. There were no significant differences ( $P>0.05$ ) in levels of fumonisin and deoxynivalenol among the various wheat flour products investigated. However, there were significant differences in the levels of fumonisin and deoxynivalenol between the wheat flour brands and wheat flour products, with higher toxin levels occurring in wheat flour. The overall research finding highlights the health safety of the analyzed samples for domestic consumption. However, with the occurrence of the toxins in 75% of the samples, more surveys should be done to establish consistency in the observed safety status of wheat-based products in the Kenyan market. Due to the effects of changing climatic conditions both in Kenya and other countries that import wheat, maintenance of efficient processes for the production of wheat flour and wheat-based products to meet the recommended mycotoxin levels should be observed strictly. This is to reduce the anticipated fumonisin and deoxynivalenol risks related to consumption of contaminated wheat-based food products.

---

Key Words: Fumonisin, Deoxynivalenol, Market, Wheat, Flour and Products

\*Corresponding Author: phanicekheseli@yahoo.com

# Characterization of Lactic Acid Bacteria Isolated from Sardines (*Sardina pilchardus*) with Antifungal and Probiotic Effects

Mounir El Boujamaai, Youssef Taoufiki and Abdellah Zinedine\*

Laboratory of Marine Biotechnologies and Environment (BIOMARE), Chouaib Doukkali University, Faculty of Sciences, PO Box 20, El Jadida 24000. Morocco.

## ABSTRACT

Lactic acid bacteria (LAB) are a group of ubiquitous microorganisms, which produce lactic acid as the main product during fermentation of sugars. Thus, these bacteria are widely used in the food industry, for their organoleptic properties, and the bio-preservation of food from spoilage and invasion by hazardous microorganisms. On the other hand, LAB are considered as probiotics, which can cure or prevent many diseases.

The aim of this study is the characterization of 25 strains of LAB isolated from samples of sardines (*Sardina pilchardus*) collected from the market in the city of El Jadida (Morocco). The lactic acid strains were isolated on MRS medium (De Man, Rogosa, Sharp) and then studied to evaluate their biological and biotechnological properties.

Microscopic observation showed that 40% of isolates have the coccishape and 60% of isolates have bacillus shape. All strains showed positive Gram stains and negative catalase. Generally, 64% of isolates were found able to produce diacetyl (flavoring substance) and only 12% of isolates were found able to produce gas (CO<sub>2</sub>). In addition, 72% of isolates showed a significant acidification capacity ranging from  $\Delta\text{pH} = 0.61 \pm 0.08$  to  $\Delta\text{pH} = 1.68 \pm 0.10$  for 6 hours, and from  $\Delta\text{pH} = 0.51 \pm 0.16$  to  $\Delta\text{pH} = 2.14 \pm 0.12$  for 24 hours. Enzyme production tests showed that out of the 25 isolates of LAB, no strain produced the lipase enzyme, while 28% of the strains showed significant proteolytic activity, with a diameter of the proteolytic zones varying between  $5.5 \pm 0.70$  mm and  $10.5 \pm 1.41$  on solid medium, which suggests their potential power of valorization in the biotechnological field.

The antagonist activity of 4 isolates of LAB against other microbial species was then evaluated. The results showed that 75% of the LAB strains are active against toxigenic mold species belonging to the genera of *Penicillium* and *Aspergillus* with diameters of inhibition on solid medium ranging from  $4.6 \pm 1.15$ mm to  $19.66 \pm 1.52$ mm. In contrast, no inhibition against bacterial strains such as *E. coli* and *S. aureus* was observed by the 4 isolates tested.

---

Keywords: Lactic acid bacteria, Antifungal activity, Proteolytic activity, Probiotics, Sardine.

Abdellah ZINEDINE (zinedineab@yahoo.fr) Corresponding author  
Mounir EL BOUJAMAAI (mounir.elboujamaai@gmail.com)  
Youssef TAOUFIKI (taoufikiyoussef0@gmail.com)



# Effect of Climatic Variations on the Occurrence of Toxigenic Fungi in Wheat Collected in Two Moroccan Areas

Aicha El Jai<sup>1\*</sup>, Catherine Brabet<sup>2,3</sup>, Noel Durand<sup>2,3</sup>, Didier Montet<sup>2,3</sup>, Mohamed Rahouti<sup>4</sup>, Abdellah Zinedine<sup>1\*\*</sup>

<sup>1</sup>Chouaib Doukkali University, BIOMARE Laboratory, El Jadida 24000, Morocco

<sup>2</sup>UMR 95 QualiSud, CIRAD, 34398 Montpellier Cedex 5, France

<sup>3</sup>Qualisud, Université de Montpellier, Avignon Université, CIRAD, Institut Agro, IRD, Université de La Réunion, France

<sup>4</sup>Faculty of Sciences, Botany, Mycology and Environment Laboratory, Rabat MA-10040, Morocco

## ABSTRACT

Morocco, a Mediterranean and North African country, has a climate with annual variations in recorded temperature and precipitations. Moroccan cereal production amounted to 2.56 million tons of wheat harvested in 2020. Wheat is an important cereal crop that significantly contributes to the livelihoods of farming communities and the Moroccan economy. Several fungal species were isolated from the wheat field, their occurrence cause spoilage and reduction in food quality and safety during different stages of the chain production such as pre-harvest, post-harvest processing and storage. Thus, their presence is considered a potential risk due to their ability to produce mycotoxins. This work provides data about the presence of toxigenic fungal species in wheat sampled collected in two different areas (continental and littoral) in the country.

Analytical results showed that out of 60 total wheat grain samples sampled during 2019 and 2020 seasons from two different areas in Morocco, 26 (43%) samples were positive, with the presence of 46 toxigenic fungal species, belonging mainly to *Penicillium* (26), *Aspergillus* (7), *Alternaria* (7), *Cladosporium* (3), *Epicoccum* (2) and *Trichoderma* (1). Data from this survey demonstrated that 15 positive samples were from the continental area, while 11 positive samples were from the littoral area. The multi-occurrence of toxigenic fungal species was also observed in seven positive samples.

This is the first study assessing the impact of climate variations on multi-occurrence of toxigenic fungal species in wheat samples harvested from two different climatic areas from Morocco. Therefore, determination of the fungi's potential to produce mycotoxin is currently in progress, as well as the critical factors responsible for mycotoxin production. Finally, biological strategies to reduce mycotoxin contamination in cereals and derivatives will be also investigated.

---

Keywords: Toxigenic fungi, Occurrence, Climatic variations, Wheat, Morocco.

Abdellah ZINEDINE (zinedineab@yahoo.fr) Corresponding author

Aicha EL JAI (aichaeljai01@gmail.com)

# FOOD SAFETY CONTROL SYSTEMS IN AFRICA: THE ROLE OF TRADITIONAL AND EMERGING TECHNOLOGIES

## Sources And Levels of Biochar on Tomatoes Seedlings Growth

Egas José Armando\*; José Mendes Massango and Simeão Gabriel Balane

<sup>1</sup> Lecturer at the School of Rural Development, Department of Rural Engineering, Bairro 5° Congresso, Vilankulo.

Student at the Agrarian Production Department, Degree in Agricultural Production, Bairro 5° Congresso, Vilankulo - Mozambique

Professor at the School of Rural Development, Department of Agrarian Production, Bairro 5° Congresso, Vilankulo - Mozambique

### ABSTRACT

The use of biochar in agriculture has shown to be potential for soil, water, environment and plants attributes. Biochar is obtained from pyrolysis of organic materials from different sources. The quality of biochar depends on pyrolysis process and raw materials. In the order hand, farmer have been using biochar from different sources under different levels, with no clear information of the adequate doses. Thus, this study aimed to evaluate the effect sources of biochar on seedling tomatoes seedlings development. The trial was conducted at Rural development school from Eduardo Mondlane University, in Vilankulo - Mozambique, under randomized blocks, in factorial scheme, consisting on two factors (biochar sources and levels of application). The factor sources of biochar comprised on: bananas husks, orange husks, wood sawdust, chicken bed; while the factor levels consisted of application of 7 ton/ha – standard; -20%; -10%; +10%; 20%. To evaluate the trial was collected data of index of seedlings emergency, seedlings steam diameter, height and number of leaves. The data was submitted to normality analysis of Shapiro Wilk, homogeneity of Hotelling, Analysis of variance and mean test of Tukey at 5% of significance. The results showed a significant effect for the combined effect for index of seedlings emergency, pointing out that the use of banana biochar at 8,4 ton/ha presented better results for index of seedling emergency, additionally, this treatment presented high number of leaves per seedling. For the steam diameter and seedlings height, the combined effect was significant, showing that the use of 8,4ton/ha presented better results with the use of biochar from wood sawdust. Thus, this use of biochar from banana and wood sawdust is better, both at 8,4ton/ha, moreover, it is recommended to use high levels above 8,4ton/ha, once the levels adjusted to linear model.

---

Keywords: Compost, environment, soil amendment, agriculture

Egas José Armando (egas.j.armando@uem.ac.mz), Corresponding author

José Mendes Massango (imortalmendez@gmail.com)

Simião balane (simiao.balane@uem.ac.mz)

# Efficacy of Cold Plasma Treatment in The Postharvest Management of Stone Fruit: A Case Study of Nectarine

Zinash A. Belay<sup>1</sup>, Neliswa A. Matrose<sup>2</sup>, Oluwafemi J. Caleb<sup>1,2</sup>

<sup>1</sup>Agri-Food Systems & Omics Laboratory, Post-Harvest and Agro-Processing Technologies (PHATs), Agricultural Research Council (ARC) Infruitec-Nietvoorbij, Private Bag X5026, Stellenbosch, 7599, South Africa

<sup>2</sup>Post-Harvest and Agro-Processing Technologies (PHATs), Agricultural Research Council (ARC) Infruitec-Nietvoorbij, Private Bag X5026, Stellenbosch, 7599, South Africa

## ABSTRACT

Stone fruit are highly perishable, easily wounded, and susceptible to pathogenic infection during postharvest handling and storage. The current strategy to control these postharvest diseases employs use of chemical especially, fungicides. Concerns over application of chemical treatments has been increased because of consumer demand for residue free fruit. Cold plasma (CP) by far, is one of the newest technologies in food industry for microbial inactivation and has been shown beneficial effect to keep the safety of the produces without compromising the quality. However, its surface decontamination efficacy in stone fruit has not been cover yet. Therefore, this study investigated the effects of different CP parameters on retarding the growth of *B. cinerea* on nectarine fruit. Fruit were inoculated with *B. cinerea* and dived in to four groups. Three groups of the fruit were subjected to plasma treatment for 2, 5 and 10 min using an output discharge voltage of 90 kV. The fourth group was un-treated fruit a control. All the four sample groups were stored for 10 days at 15 °C and sampling were done every two days interval. The results indicated that cold plasma treatment significantly ( $p < 0.05$ ) control the growth of *B. cinerea* compared to the control (untreated) samples. Comparing the results of CP treated fruit, higher efficacy towards controlling the growth of *B. cinerea* was observed at the longer the exposure time (10 min) than the lowest exposure time (2 min). The information obtained in this study would be useful for the nectarine fruit producers to ensure the microbial safety of the fruit and reduce postharvest loss.

---

Keywords: Nectarine, *B. cinerea*, microbial inactivation, storage

Oluwafemi J. Caleb (CalebO@arc.agric.za) Corresponding author

Neliswa A. Matrose (MatroseN@arc.agric.za)

Zinash A. Belay (Belayz@arc.agric.za)

## Diagnostic Analysis of Post-production Losses of Tomato (*Solanum lycopersicum*) in the Menoua Division, West Region of Cameroon

Henri Grisseur Djoukeng\*, Whitney Rakelle Anguezomo Assoumou, Nestor Lindou Peyoumeya

University of Dschang, Faculty of Agronomy and Agricultural Sciences, P.O.Box 222, Dschang, Cameroon

### ABSTRACT

The agricultural product supply chain from the field till the final consumer is subject of several losses. These losses, both qualitative and quantitative, known as postharvest losses are caused by several factors. In Cameroon, tomato (*Solanum lycopersicum*) is among the most important fruits with a consumption of about 35%. This study aims to reduce postharvest losses of tomato for contribute to increase income and standard of living of fruits and vegetables producers in the Menoua division. The study was conducted in two tomato production basins, namely Tsinfou and Litieu. The various postharvest technics adopted by producers, transporters and traders were identified through investigations and direct observations. The rate loss of tomato and its deterioration over a certain period of time were evaluated and interpreted. Also, the type, nature and causes of these postharvest losses were determined. The results from this study show that, show that inappropriate post-harvest technics are practiced in all links of the supply chain. The rate loss during harvest, transportation, trading and conservation are 11.75%, 7.45%, 21% and 35.5% respectively. They are caused by factors such as, mechanical action (impact of shocks and vibrations), biological and microbial action (predators, fungi, etc.), environmental and climatic factors (humidity, temperature, etc.) and socio-economic factors (impact of road infrastructure and non-government assistance). These losses reduce actor's incomes and the availability of tomatoes on the market, hence the inaccessibility for poor citizens. To reduce these losses emphasis should be placed on a technical framework enabling stakeholders to better define the outline of appropriate techniques. Establishment of affordable processing and conservation units, government assistance, qualified workforce and maintaining a good state of roads should be adopted.

---

Keywords: postharvest losses, supply chain, postharvest technics, handling

Henri Grisseur Djoukeng (hgdjoukeng@gmail.com), Corresponding author  
Whitney Rakelle Anguezomo Assoumou (whitneyrakelleanguezomoassoumo@gmail.com)  
Nestor Lindou Peyoumeya (nestorlindou2@gmail.com)

# Assessment of Safety Performance in Banana Alcoholic Beverage Processing Factories in Rwanda

Grace Irakiza<sup>1\*</sup>, Viateur Ugirinshuti<sup>2</sup>, Olivier Kamana<sup>2</sup>, Martin P. Ongol<sup>3</sup>

<sup>1</sup>Dabela Foods Ltd, P.O.Box 26222, Kampala, Uganda

<sup>2</sup>National Industrial Research and Development Agency, Department of Applied Research and Development and Foresight Incubation, P.O. BOX 273, Kigali, Rwanda

<sup>3</sup>Uganda National Council for Science and Technology, P.O. Box 6884, Kampala, Uganda

## ABSTRACT

Although the Rwandan competent authorities are putting effort to improve the safety of traditional banana alcoholic beverages, safety problems still exist. This study aimed to apply customized diagnostic tool to gain an insight into the performance of food safety in traditional banana alcoholic beverage factories as an evidence based to support the selection of suitable interventions for improvement to assure sustainability and meet growing market of traditional banana alcoholic beverages. Literature search was used to identify context factors, quality assurance and control activities that can influence safety of banana alcoholic beverage and validated by processors through interview and participant observation. The data were collected in eleven factories located in Kigali city and four provinces of Rwanda using an assessment tool. Data analysis was performed using Microsoft Office Excel. All factories have shown to operate in relatively high-risk context (score 2-3), most of control activities were at basic level (score 1) whereas assurance activities were at relatively average level (score 1-2) which resulted into poor food safety performance (score 1). The key factors contributing to the poor performance were found to be traditional processing methods, inadequate technical staff, lack of capital resources, people behaviour toward food safety, lack of safety commitment, inadequate supporting document system, inadequate sanitation program, poor hygienic design of equipment and building, lack of CCP analysis, verification, validation and inadequate recording keeping. This shows that, the modern food safety practices can't be applied in traditional food processing factories due to traditional methods and equipment, low level of science-based knowledge related to processing technology, food safety and hygiene. Therefore, there is a need to design modern equipment that are easy to clean and disinfect to replace traditional ones, to train technical staff on processing technology, safety and hygiene, and to change behaviours towards making decisions based on scientific knowledge.

---

Keywords: diagnostic tool, food safety performance, quality assurance, quality control, traditional banana alcoholic beverage.

Grace Irakiza (graceirakiza@gmail.com), Corresponding author Viateur Ugirinshuti (viateur.ugirinshuti@nirda.gov.rw)  
Olivier Kamana (olivier.kamana@nirda.gov.rw) Martin P. Ongol (m.ongol@uncst.go.ug)

# Application of the Box–Behnken Design for the Optimization of Processing Variables in White *Kenkey* Production

Charlotte Oduro-Yeboah<sup>1,3</sup>, Esther Sakyi-Dawson<sup>3</sup>, Firibu Kwesi Saalia<sup>3</sup> Christian Mestres<sup>2</sup>, Genevieve Fliedel<sup>2</sup>, and Wisdom Amoa-Awua<sup>1</sup>

<sup>1</sup>CSIR-Food Research Institute. P.o.Box M20, Accra-Ghana

<sup>2</sup>CIRAD, UMR QualiSud, TA B-95/16, 73 avenue JF Breton, 34 398 Montpellier Cedex 5

<sup>3</sup>Department of Food Science and Nutrition, University of Ghana, LG134, Legon, Ghana

## ABSTRACT

White *kenkey* is one of several variants of *kenkey*, a staple food in Ghana that is made from fermented maize dough. Its production is done by artisanal processors, using non-standardized procedures. These result in wide variations in quality characteristics from among producers, and within batches of *kenkey* from the same producer. The determination of optimum process conditions for critical process variables for the production of white *kenkey* is crucial in achieving a desired product quality in a consistent manner. The objective of this study was to optimize processing parameters of steeping time, fermentation time and steeping temperature on physicochemical properties of white *kenkey*. A Box–Behnken design was used to study the effects of processing variables of steeping time, steeping temperature, and fermentation time on white *kenkey* quality parameters of moisture content, pH, titratable acidity, glucose and lactic acid content. Sensory (hedonic) tests were done on the white *kenkey* using incomplete block designs ( $k=5$ ,  $b=21$ ,  $N=105$ ,  $\lambda=2$ ,  $r=7$ ). The data obtained from the sensory tests were fitted to response surface regression models to determine the effects of process variables on the sensory attributes of white *kenkey*. Contour plots of each of the sensory attributes were generated from the regression models. All the plots were then superimposed on the same axis to obtain the optimum region of the process variables.

Each of the process variables of steeping time, steeping temperature and fermentation time had significant effects on the physicochemical and sensory characteristics of white *kenkey*. The optimum region for process variables at which the most acceptable *kenkey* was obtained were steeping time of 30–45h at 30–35°C temperature and 12 h dough fermentation. These optimum process conditions were successfully validated and could be adopted by artisanal processors to assure consistent quality parameters for white *kenkey*.

---

Keywords: Box–Behnken, Response surface methodology, optimization, white *kenkey*, processing variables, contour plots

Charlotte Oduro-Yeboah (Adwoaadom3@gmail.com)

Esther Sakyi-Dawson (esakyid22@gmail.com)

Firibu Kwesi Saalia (fsaalia@yahoo.com)

Christian Mestres (Christian.mestres@cirad.fr)

Genevieve Fliedel (genevieve.fliedel@cirad.fr)

Wisdom Amoa-Awua (wis.amoa@gmail.com)

# Disparity Between Farming Practices and Mycotoxins Contamination of Household Grains Among Farmers in Northern Uganda

Godfrey Wokorach<sup>1,2,\*</sup>, Sofie Landschoot<sup>1</sup>, Kris Audenaert<sup>1</sup>, Richard Echodu<sup>2,3</sup>, Geert Haesaert<sup>1</sup>

<sup>1</sup>Department of Crops and Plants, Campus Schoonmeersen Building C, Faculty of Bioscience Engineering, Ghent University, Valentin Vaerwyckweg 1, B-9000 Ghent, Belgium

<sup>2</sup>Multifunctional Research Laboratory, Gulu University, P.O.BOX 166, Gulu, Uganda

<sup>3</sup>Department of Biology, Faculty of Science, Gulu University, P.O. BOX 166, Gulu, Uganda

## ABSTRACT

Farming practices are critical factors that increase food contamination with mycotoxins. Farmers' dedication to good agricultural practices and access to good inputs is key to mitigating crop failures and mycotoxins contamination. In this study, we interviewed farmers (n=478) from northern Uganda to understand their farming practices and related them to mycotoxins content of households grains. Among the farmers interviewed, only a marginal fraction has access to irrigation (n=7, 1.48%), fertilizer (n=26, 5.44%), and improved seeds (n=192, 40%). Cereal seeds were predominantly obtained through farmers' savings (n=390, 81.78%) and local sharing (n=225, 47.16%). Use of machines for harvesting (n=3, 0.63%) and shelling (n=37, 5.98%) was low. Whereas none of the farmers reported using machines to quantify moisture content of grains. Grain moisture was determined by traditional methods of biting (n=341, 75.78%) and palm feel (n=29, 6.44%). Grain storage was done predominantly with interwoven polythene bags (n=416, 88.75%), cribs (n=41, 8.8%), or on floor (n=17, 3.5%) with mean storage time of five months. None of the farmers cited use of improved hermetic storage technologies. Significant proportion of farmers used mouldy grains to feed animals (n=287, 60.29%), making local brew (n=123, 25.84%), human food (n=43, 9.03%), and for sale (n=37, 7.79%). Shelling of grains on bare ground resulted in a significant ( $p = 0.002$ ) increase in the proportion of maize grains with aflatoxins. Whereas separating old and new grains during storage resulted in a significant ( $\chi^2 = 7.63$ ,  $p = 0.0057$ ) reduction in the proportion of maize grains with aflatoxins. We observed frequent occurrence of aflatoxins in grains under most farming practices. In conclusion, limited access to improved agricultural inputs characterized grain production patterns in northern Uganda. Therefore, national investment must prioritize access to agricultural inputs to help mitigate drought, pests, and storage problems, which are determinants of mycotoxins contamination of grains.

---

Keywords: Aflatoxin, Mycotoxins, farmers, Agriculture

Godfrey Wokorach (godfrey.wokorach@ugent.be), Corresponding author

Sofie Landschoot (Sofie.Landschoot@UGent.be)

Kris Audenaert (Kris.Audenaert@UGent.be)

Richard Echodu (richardechodu2009@gmail.com)

Geert Haesaert (Geert.Haesaert@UGent.be)



## ACADEMIC AND DEVELOPMENT PARTNERSHIPS IN FOOD SAFETY: NATIONAL, REGIONAL, CONTINENTAL AND INTERNATIONAL INITIATIVES

### Partnership for Traceability and Authenticity of Mediterranean Food (Med food TTHubs): Case Study of Egypt & Tunisia

Elkady G.<sup>1\*</sup>, Arfaoui A.<sup>2</sup>, Barkouti A.<sup>2</sup>, Trabelsi F.<sup>2</sup>, Dessouky Y.<sup>1,3</sup> Banias G

<sup>1</sup>Arab Academy for Science, Technology & Maritime Transport (AASTMT), P.O.Box 1029, Alexandria, Egypt

<sup>2</sup>Higher School of Engineers of Mjez El Bab (ESIM), Km5, Route du Kef, 9070, Tunisia

<sup>3</sup>Institute for Bio-Economy and Agri-Technology, Centre for Research and Technology, Hellas, Themi, 57001 Thessaloniki, Greece ((MED Food TTHubs Project Coordinator)

#### ABSTRACT

Along with the improvement of living standards and the growing public health issues related to alimentation, concerns about both the safety and quality of food continue to escalate in the African continent. Thus, increasingly, more and more players in the food sector are demanding for traceability procedures to ascertain the origin of agri-food products, ingredients and their attributes, from the farm through food processing, retail to the consumer. Against this backdrop, two African Higher Education Institutions: The Higher School of Engineers of Mjez El Bab (University of Jendouba, Tunisia) and the Arab Academy for Science, Technology & Maritime Transport (University of Alexandria, Egypt) integrated a partnership gathering several other Mediterranean universities, research groups and private sector entities in the framework of a Partnership for Research and Innovation in the Mediterranean area (PRIMA) project which started in 2020. The project entitled "Trace & Trust Hubs for MED food" aims to establish and operate seven Trace & Trust Hubs, which will form a permanent transnational network playing the role of a one-stop-shop for traceability and authenticity for 'added value' Mediterranean food products in each of the countries involved (Tunisia, Egypt, Jordan, Greece, Italy, Portugal, Spain). To achieve this goal, the Med food TTHubs developed a set of common traceability and authentication protocols, called Voluntary Scheme of Traceability, that will be supported by a dedicated web-based platform. This e-platform, managed through a blockchain approach aims to facilitate the sharing of information across the supply chain and support traceability documentation.

This poster will present with more details the approach of the Med food TTHubs project with focus on two supply chain cases: processed vegetables in Egypt and pomegranate & fig in Tunisia.

---

Keywords: Food safety, Traceability, Partnership, Hubs, e-Platform

Ghada El Kady (ghada-elkady@outlook.com), Corresponding author

George Banias (g.banias@certh.gr)

Yasser Gaber Dessouky (ygdessouky@yahoo.com)

Achouak Arfaoui (arfaoui.achouak@gmail.com)

Fatma Trabelsi (trabelsi.fatma@gmail.com)

Amal Barkouti (amalbarkouti@gmail.com)

# Sanitary and Phytosanitary-Related Capacity Development in Africa: The Impact of the European Union Interventions on Market Access

<sup>1</sup>Olayinka Idowu Kareem, <sup>2</sup>Christine Wieck

<sup>1</sup>Chair of Agricultural and Food Policy, Hohenheim Universität, Stuttgart, Germany.

<sup>2</sup>Professor and Head, Chair of Agricultural and Food Policy, Hohenheim Universität, Stuttgart, Germany.

## ABSTRACT

The contemporariness of the issues of sanitary and phytosanitary (SPS) measures' compliance owing to the continuous trade partners' technical measures heterogeneity, capacity development (CD) towards compliance and their impact on market access cannot be overemphasized. However, the impact of SPS-related CD on export market access and its roles in SPS compliance, particularly for Africa, is yet to be explored and thus, remains largely subjected to empirical discourse and analytical discoveries. The non-existent of empirical analysis on the SPS-compliance and export effect of SPS-related CD would not enable us to distil the impact of the efforts that have been made and are still being made by development partners, donor countries and/or agencies such as the EU to improve export market access through CDs tailored to enhance compliance to the food safety regulations.

A cursory evaluation of the agri- food sector indicates that Africa has insufficient ability and capability to provide capacity development training to improve the EU SPS compliance and market access. This impacts heavily on the export quality and SPS enforcement, making this issue germane for Africa's market access to the EU market and the ability to reduce unemployment and poverty. Thus, the objective of this paper is to investigate the effects of SPS-related capacity development provided by the EU on Africa's agri-food export market access to the EU market. A gravity model is specified to investigate the impact of SPS capacity development on Africa's agri-food export to the EU using panel data from 2009-2017 for 47 African countries. The findings suggest a significant and direct impact of the EU SPS capacity development on Africa's market access to the EU. However, the magnitude of the impact of the CD is very minimal. This imply that the EU SPS-related CD for Africa has the prospect of enhancing market access.

---

Keywords: SPS, SPS-related capacity development, Market Accesss, Gravity model, Africa-EU trade

Olayinka Idowu Kareem (olayinkaidowuus@yahoo.com), Corresponding author.

Christine Wieck (Christine.wieck@uni-hohenheim.de)





- 
- 
- 
- 

The **ACA**FP African Continental Association for Food Protection   Food and Agriculture Organization of the United Nations

# FOOD SAFETY

## Conference for Africa

 International Association for Food Protection.  
• • • • •

