

# AFRICA FOOD SAFETY WORKSHOP 2022

## POST EVENT REPORT



27 June - 1 July 2022  
Emperors Palace, Johannesburg  
[www.afsw2022.co.za](http://www.afsw2022.co.za)

AFRICA  
FOOD  
SAFETY  
WORKSHOP  
2022





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2022**



**Joint FAO/IAEA Centre**  
Nuclear Techniques in Food and Agriculture

**Emperors Palace | Johannesburg**





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MONDAY	DAY 1: Scientific capacity building, standards and public private partnerships
08:30 - 09:30	Registration - use of mobile app & housekeeping
09:30 - 10:45	National Anthem of South Africa; AFoSaN video Master of ceremonies: Ms Noncedo Vutula (Department of Agriculture, Land Reform and Rural Development-DALRRD) Opening Session: Minister of the South African Department of trade, industry and competition, NMISA CEO Welcome Opening remarks: Mr Shaukat Abdulrazak, Director, IAEA Division for Africa, Department of Technical Cooperation Mr Andrew Cannavan, o.b.o. Director Joint FAO/IAEA Centre of Nuclear Techniques in Food and Agriculture
10:45 - 11:15	Refreshment Break & Group Photo
11:20 - 13:00	<b>SESSION 1: Scientific capacity building and recognition of capabilities</b> Chair: Charles Nwachukwu (NAFDAC, Nigeria) Co-chair: Ms Lalia Jawara (FSQA, Gambia)
11:20 - 12:00	<b>Keynote presentation 1: Advancing food safety in Africa through the African Union Commission's SPS Policy Framework, the Food Safety Strategy and related technical capacity building with RECs and Member States.</b> Mr Godfrey Bahigwa, Director: Department of Agriculture, Rural Development, Blue Economy and Sustainable Development (DARBE), AU Commission o.b.o. AU Commissioner Sacko (ARBE)
12:00 - 12:15	The Africa Food Safety Network (AFoSaN) - Food Safety cross-cutting collaborations and capacity building –Mr El Hadji Niang (LACOMEV/EISMV, Senegal) and Mr James Sasanya (Joint FAO/IAEA)
12:20 - 12:35	NMISA Scientific capacity building; Dr M Fernandes-Whaley and Ms Kgaugelo Masekela
12:40 - 13:00	Q & A Discussion panel
13:00 - 14:00	LUNCH BREAK
14:15 - 16:00	<b>SESSION 2: Food safety education, the private sector and stakeholder awareness</b> Chair: Courage Saba (UDS, Ghana) / Daniel Apeh (CUST, Nigeria) Co-chair: Wim Reybroeck (ILVO, Belgium)
14:15 - 14:40	<b>Keynote presentation 2: Public Private Partnership success stories – Prof. P Gouws, Stellenbosch University Food Safety Centre, South Africa</b>
14:45 - 15:00	Building the food safety capacity of AGRI SMEs in Africa Dr. Chris Muyunda is Chairman of the Governing Council of the Comprehensive Africa Agricultural Development Programme (CAADP) Non-State Actors Coalition (CNC), SADC.
15:05 - 15:20	Q & A Discussion panel
15:20 - 15:40	Refreshment Break



<b>15:40 - 17:35</b>	<b>SESSION 3: Standards, Sanitary and Phytosanitary requirements within the AfCFTA</b> Chair: Chris Muyunda (CAADP, Zambia) Co-chair: Donald Masuku (SADC Met, NMISA, South Africa)
<b>15:40 - 16:15</b>	<b>Keynote presentation 3: Pan African Quality Infrastructure (PAQI), African Organisation for Standardisation (ARSO)- The critical role of Quality Infrastructure institutions – Ms Margaret Lungu, Zambia</b>
<b>16:20 – 16:35</b>	CODEX Committee Africa activities - Mr. Hakim Mufumbiro, Chairperson CCAfrica, Head of Food and Agriculture Standards, Uganda National Bureau of Standards (UNBS)
<b>16:40 – 16:55</b>	Veterinary pharmaceuticals and their influence on food safety standards setting process-Mr Assiongbon Teko-Agbo, School of Veterinary Medicine, Senegal/ Dr Sami Darkaoui (ONSSA, Morocco)
<b>17:00 – 17:30</b>	Quality infrastructure support for the promotion of fish exports – Dr Angelique Botha (NMISA) and Mr Shadrack Phophi (SANAS)
<b>17:35 - 17:50</b>	Q & A Discussion panel
<b>18:00 - 20:00</b>	<b>WELCOME COCKTAIL</b>

<b>TUESDAY</b>	<b>DAY 2: Advances in screening and confirmatory analysis for food safety testing, food monitoring and surveillance programs, setting MRLs</b>
<b>08:00 - 08:30</b>	Registration
<b>08:30 – 11:00</b>	<b>SESSION 4: Pesticide residues</b> Chair: Dr Laura Quinn (NMISA, South Africa) Co-chair: Ms Reda Ismael (Egyptian Organization for Standards and Quality, Egypt)
<b>08:30 – 09:05</b>	<b>Keynote presentation 4: The Importance of Mitigating Pesticide Residues in the African Food System- Luis Suguiyama, USDA/ Foreign Agricultural Service, USA</b>
<b>09:10 - 09:25</b>	The regulatory framework for the use of pesticides in crop production – The case of Mauritius – Mr S.D. Soborun, Ministry of Agro Industry and Food Security, Mauritius
<b>09:30 - 09:45</b>	African market survey study on pesticide residues – Luis Suguiyama, USDA
<b>09:50 -10:05</b>	WAPRC experience with harmonization of pesticide guidelines and requirements - Benoit Gnonlonfin (ECOWAS-FAO) and Sylvain Ouedraogo, West Africa and the Sahel Harmonized Pesticides Registration Committee (WAPRC)
<b>10:10 - 10:25</b>	<b>Refreshment Break &amp; Exhibition</b>
<b>10:25 - 10:40</b>	Monitoring and risk assessment of pesticides residues in selected herbal medicinal products in Ghana - Paul Osei-Fosu, Ghana Standards Authority, Ghana
<b>10:45 - 11:00</b>	Q & A Discussion panel
<b>11:05 – 11:25</b>	<b>MICROSEP/ WATERS™: ADVANCES IN LABORATORY INSTRUMENTATION SESSION 1</b>
<b>11:30 - 11:45</b>	Lightning round poster introductions
<b>11:50 - 12:30</b>	<b>POSTER SESSION 1 &amp; EXHIBITION</b>



	Engagement & adjudication (for poster prizes)
<b>12:30 - 13:30</b>	<b>LUNCH BREAK</b>
<b>13:30 - 16:30</b>	<b>SESSION 5: Veterinary drug residues</b> Chair: Dr Gerald Monga (CVRL, Zambia) Co-chair: Dr Sami Darkaoui (ONSSA, Morocco)
<b>13:30 - 14:05</b>	<b>Keynote presentation 5: Rapid screening for antimicrobial residues in food of animal origin - Dr Wim Reybroeck, ILVO Belgium</b>
<b>14:10 - 14:35</b>	Establishment of maximum veterinary drug residues (MRLs) and risk assessment – Prof Eric Mitema, Department of Public Health, Pharmacology and Toxicology, University of Nairobi, Kenya
<b>14:35 - 14:50</b>	Occurrence of veterinary drugs in food products of animal origin (Meat, Milk, Eggs, Honey) in Malawi: A survey of commercial products on the market and some selected farms – Mr S Kuyeli, MBS, Malawi
<b>15:00 - 15:15</b>	<b>Refreshment Break &amp; Exhibition</b>
<b>15:20 - 15:40</b>	Green-Sample Preparation -Liquid Chromatography-Mass spectrometry for Food Safety – Prof Mathew Nindi, UNISA, South Africa
<b>15:45 - 16:00</b>	Key Differences in the Procedures for Assigning Tolerances as Compared to MRLs – Dr Holly Erdely, US FDA
<b>16:05 - 16:30</b>	Q & A Discussion panel

<b>WEDNESDAY</b>	<b>DAY 3: One Health and antimicrobial resistance; Foodborne microbial and chemical hazards, zoonoses; Risk Analysis; Food Borne illnesses/outbreaks; Notification, responses, and epidemiology</b>
<b>08:00 - 08:30</b>	Registration
<b>08:30 - 10:00</b>	<b>SESSION 6: One Health and antimicrobial resistance; Foodborne microbial hazards, zoonoses</b> Chair: Prof Eric Mitema, University of Nairobi, Kenya Co-chair: Prof Claude Sabeta, University of Pretoria, South Africa
<b>08:30 - 09:05</b>	<b>Keynote presentation 6: Food safety is everyone's responsibility – but what does that mean? The One Health Approach...- Prof Francis Ejobi, Uganda</b>
<b>09:10 - 09:25</b>	Burden of Disease from Drug-resistant Infections: Monitoring and Evaluation of Fresh Produce in Nigeria-O.A. Olusegun, DFST, Federal University of Agriculture, Nigeria
<b>09:30 - 09:55</b>	Investigation of Antibiotic Resistance from Foodborne E. Coli Isolated from Poultry Meat in Mbare - Ms T. Chigiya, Department of Veterinary Technical Services -Veterinary Public Health Division, Zimbabwe
<b>10:00 - 10:25</b>	<b>Refreshment Break &amp; Exhibition</b>
<b>10:30 - 12:35</b>	<b>SESSION 7: Food borne hazards, Risk Analysis: Assessment, management and communication</b> Chair: Prof Hussaini Makun, (FUT Minna, Nigeria) Co-chair: Ms Bertha Jackson (CVL, Zimbabwe)

10:30 - 11:05	<b>Keynote presentation 7: Foodborne Microbial Hazards and Risk Analysis: Assessment, Management and Communication- Prof Lucia Anelich, South Africa</b>
11:10 - 11:25	Quantitative Microbial Risk Assessment for <i>Listeria monocytogenes</i> in Milk Sold at Informal Retail Points in Uganda – Ms Jean Rubakuba, Uganda Industrial Research Institute, Uganda
11:30 - 11:45	Food Safety Risk Analysis, a Cornerstone for Effective Food Safety System in East African Community: A Perspective towards a Regional Risk-based Food Safety System – Mr Theoneste Hagenimana, Department of Food Science and Technology, University of Rwanda, Rwanda
11:50 – 12:05	Risk Management for Mycotoxins Scoped in the First Total Diet Study in Nigeria – Dr Abimbola O. Adegboye, NAFDAC, Nigeria
12:10 - 12:25	An Overview of the USDA FSIS Annual Product Sampling Plan and Laboratory Support – Lorenza Rozier, USDA FSIS, U.S.A.
12:30 - 13:30	<b>LUNCH BREAK</b>
13:35 – 14:00	Q & A Discussion panel
14:05 - 14:25	Lightning round poster introductions
14:25 - 15:00	<b>POSTER SESSION 2 &amp; EXHIBITION</b>
	Engagement & adjudication (for poster prizes)
15:00 -15:15	<b>Refreshment Break &amp; Exhibition</b>
15:20-16:35	<b>SESSION 8: Food Borne illnesses/outbreaks; Notification, responses and epidemiology</b> Chair: Dr Justine Jolly Hoona (former MAAIF, Uganda) Co-chair: Mr El Hadji Mamadou Niang (LACOMEV ESMV, Senegal)
15:20 - 15:35	Prevalence of Diarrhoea among Children Under Five Years of Age in Association with the Status of Drinking Water Sources at Bububu, Zanzibar - Wahida M. Ali, Zanzibar Food and Drug Agency, Tanzania
15:40 – 15:55	Incidence of foodborne pathogenic bacteria causing food borne illness and their control to enhance food safety, Prof Ali Hammad, National Centre for Radiation Research and Technology, Egypt
16:00 – 16:15	The US Food and Drug Administration Food Safety Modernization Act - Fazila K. Shakir, MHS, U.S.A.
16:20 – 16:35	Q & A Discussion panel
18:00 - 22:00	<b>GALA DINNER</b>



THURSDAY	DAY 4: Advances in screening and confirmatory analysis for food safety testing, food monitoring and surveillance programs, setting MLs
08:00 - 08:30	Registration
08:30 -11:30	<b>SESSION 9: Mycotoxins, Marine Biotoxins, Heavy Metals</b> Chair: Dr Henry Njapau (NISR, Zambia) Co-chair: Ms Paloma Ellitson (NSI, Namibia)
08:30 - 09:05	<b>Keynote presentation 9: From Heavy Metal to Toxins: the Grand Challenges of Food Analytical Chemistry - Dr Zoltan Mester, NRC Canada (President IUPAC)</b>
09:10 - 09:25	Mycotoxin and food safety education: An imperative for improved health and economic prosperity in Africa - Prof Hussaini Makun, Africa Centre of Excellence for Mycotoxin and Food Safety, University of Minna, Nigeria
09:30 - 09:45	Quantitative analysis of mineral nutrients and heavy metals in a variety of rice consumed in Madagascar and Assessment of Dietary Intake - Mr N. N. Andriamahenina, Institut National des Sciences et Techniques Nucléaires, Madagascar
09:50 - 10:10	<b>Refreshment Break &amp; Exhibition</b>
10:15 - 10:30	Determination of Lipophilic Marine Biotoxins in Shellfish using Triple Quadrupole LC-MS/MS in Senegal. Mr El Hadji Mamadou Niang (LACOMEV ESMV, Senegal)
10:35 – 10:50	Status and risk assessment of food items sold in open markets in major cities of SADC countries for heavy metals: case studies of Zambia, DRC, Mozambique, and South Africa – Prof. L Chimuka, WITS University, South Africa
10:55 – 11:10	Aflatoxins determination by liquid chromatographic methods and occurrence of Aflatoxin B1 in animal feed from the north-western area of Morocco - Naoual Alahlah, Moroccan National Office of Food Safety-ONSSA, Agronomic and Veterinary Institute HASSAN II, Morocco.
11:15– 11:30	Q & A Discussion panel
11:30 - 11:50	Lightning round poster introductions
11:50 - 12:30	<b>POSTER SESSION 3 &amp; EXHIBITION</b>
	Engagement & adjudication (for poster prizes)
12:30 - 13:30	<b>LUNCH BREAK</b>
13:30 - 15:30	<b>SESSION 10: Persistent Organic Pollutants, Microplastics, Radionuclides</b> Chair: Prof Francis Ejebi (Soroti University, Uganda) Co-chair: Ms Bernadette Sourabie (LNSP, Burkina Faso)
13:35 - 14:10	<b>Keynote presentation 10: The Stockholm Convention List of POPs is Growing – Possible Consequences for African Food Laboratories- Prof Jacob de Boer, Vrije Universiteit, the Netherlands</b>
14:15 - 14:35	Determination and human exposure assessment of per- and polyfluoroalkyl substances in farmed marine shellfish in South Africa- Dr A Ovokeroye, University of Birmingham, UK & ARC-OVR, South Africa



14:40 - 14:55	Human exposure to extractables and leachables from single-use plastic food contact materials: a disposable sorptive sampler – Dr M Wooding, UHPLC-IMS-HRMSE and GC×GC-TOFMS – University of Pretoria, South Africa
15:00 - 15:15	<b>Refreshment Break &amp; Exhibition</b>
15:20 - 15:40	<b>MICROSEP/ WATERS™ ADVANCES IN LABORATORY INSTRUMENTATION</b>
15:45 - 16:00	NMISA Radioactivity Standards Laboratory capabilities for measurement of radionuclides in food and water – Ms Joline Lubbe, NMISA, South Africa
16:05 - 16:20	Q & A Discussion panel

FRIDAY	DAY 5: Food Fraud; Sustainable Skilling, Measurement standards, Proficiency Testing
08:00 - 08:30	Registration
08:30-10:40	<b>SESSION 11: Food Fraud</b> Chair: Ms Doreen Kenangwa (KEBS, Kenya) Co-chair: Mr Kephher Kateu (DGAL, Uganda)
08:30- 08:50	Chemical and Biochemical Methods for Detection of Food Fraud – Dr Zoltan Mester, NRC Canada
08:55 - 09:10	Efficient Process Techniques in Detecting Food Fraud and Efficacy in Methods of Food Authenticity- Mr Garjila Gansheya Danjuma, Africa Centre of Excellence for Mycotoxin and Food Safety, Federal University of Technology Minna, Nigeria
09:15 - 09:30	Q&A discussion panel
09:35 – 09:55	<b>HLUDIE™, KOETTERMANN™: ADVANCES IN LABORATORY INFRASTRUCTURE DESIGN – SAFETY, ADAPTABILITY, EFFICIENCY AND SUSTAINABILITY</b>
10:00 - 10:20	<b>Refreshment Break &amp; Exhibition</b>
10:20 -12:00	<b>SESSION 12: Sustainable Skilling, Measurement standards, Proficiency Testing</b> Chair: Mr Ephraim Moruke (DALRRD, South Africa) Co-chair: Mr Lawrence Cheetham Mingle (FDA, Ghana)
10:25 - 10:40	AOAC Sub-Saharan Africa Section – Dr Owen Fraser
10:45 - 11:15	The Value of Proficiency Testing – Examples from the QUASIMEME Program and the UNEP Interlaboratory Studies on POPs - Prof Jacob de Boer
11:20 - 11:35	Reference Materials and Proficiency Testing Schemes, making it relevant to Africa – Ms Désirée Prevoo-Franzsen
11:40 - 12:00	Q & A Discussion panel leading into <b>summary of workshop discussions</b>
12:05 - 12:20	<b>Summary of posters and poster prizes</b>
12:20 - 13:00	<b>WORKSHOP CLOSURE</b>
13:00 - 14:00	<b>LUNCH BREAK</b>
14:00 - 16:00	AFRIMETS TCQM (Chemical Metrology) Meeting



In 2022, the National Metrology Institute of South Africa hosted the second Africa Food Safety Workshop in collaboration with the FAO-IAEA Joint Technical Centre, the IAEA Technical Cooperation Department and the Africa Food Safety Network to promote standards, reliable methods of analysis and inter-institutional cooperation for better public health and trade.



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Representatives from national, regional and international institutions in the chemistry and microbiological field and prominent industry experts, academia, and regulators attended the workshop. Participation in the Africa Food Safety Workshop has allowed organisations to engage with influential scientists across the globe and key role players from Africa and the international community.





The purpose of the event was to enhance networking among food safety stakeholders in Africa; to facilitate the sharing of analytical knowledge and transfer of developed technologies related to a range of food hazards, and to encourage continent-wide discussions on how to best improve national/regional food safety control systems to safeguard consumers and facilitate trade. Through diverse discussion panels, the event explored how to best align laboratories to address challenges of setting food safety standards for both trade and public health; fitting food safety control systems into the African Continental Free Trade Agreement (AfCFTA) arrangements and reducing trade rejections.

The workshop took place in the form of lectures, posters and interactive panel discussions covering the following topics:

- Advances in screening and confirmatory analysis applied to food safety testing for: pesticides, mycotoxins, veterinary drug residues, heavy metals, marine biotoxins, phycotoxins, persistent organic pollutants, microplastics and radionuclides
- Foodborne microbial hazards: zoonoses, One Health and antimicrobial resistance
- Food fraud
- Scientific capacity building and recognition of capabilities: Measurement standards; proficiency testing and accreditation; sustainable skilling
- Risk Analysis: Assessment: management and communication
- Sanitary and Phytosanitary requirements within the AfCFTA
- Food monitoring and surveillance programmes; Maximum Residue Limits (MRLs) /Maximum levels (MLs)
- Food Borne illnesses/outbreaks: Notification, responses and epidemiology
- Food safety education, the private sector and stakeholder awareness





**250+**

Local, Regional and  
International  
**Attendees**

**35+**

**Countries**

- **Algeria** • Belgium •
- Burkina Faso • **Burundi**
- **Cameroon** • Canada •
- Egypt • **Eritrea** • **Eswatini**
- Ethiopia • Ghana •
- Ivory Coast** • **Kenya** •
- Lesotho • Madagascar
- **Malawi** • **Mauritania** •
- Mauritius • Morocco •
- Mozambique** • **Namibia**
- The Netherlands •
- Nigeria** • **Rwanda** •
- Senegal • South Africa
- **Sudan** • **Tanzania** •
- Tunisia • Uganda • **United Kingdom** • United States of America • **Zambia** •
- Zanzibar** • Zimbabwe

## Top reasons for visiting:

Networking

Personal Growth and Development

Content

Speakers

Other



## Attendance feedback:

Neutral



Satisfied



Extremely satisfied



## TESTIMONIALS

*The content, delivery and organisation of the workshop were impressive, and I surely recommend subsequent workshops to students, academia and value chain actors in the agriculture and food sector.*

- Prof Hussaini Mukun, Africa Centre of Excellence for Mycotoxin and food safety

*This was a very good workshop that brought together industry, researchers, academia as well as regulators and seasoned food safety experts with vast knowledge in the sector.*

- Dr Henry Rotich, Kenya Bureau of Standards

*I was impressed by the calibre of people that were invited and the knowledge that they brought. This ensures that one looks forward to the next engagement.*

- Ms Rose Modise, South African Bureau of Standards

*I was impressed at the categorisation of topics addressed, enabling networking amongst scientists, countries, and between delegates and exhibitors. I will definitely recommend the workshop to other scientists, exhibitors and institutions participating in the food safety space.*

- Mr Ephraim Moruke, Department of Agriculture, Land Reform and Rural Development (DALRRD)

*This regional workshop must be maintained and strengthened. It is a framework for exchanges between African countries but also with the world to popularize the achievements in terms of food safety in Africa. We have gained experience and have forged multilateral relations on food safety.*

*South Africa has set the bar very high.*

- Mr Elhadji Mamadou Mactar Niang, Veterinary Drugs Quality Control Laboratory (LACOMEV) of the Inter - States School of Veterinary Sciences and Medicine (EISMV) of Dakar (Senegal)

*The experience was awesome, Novel ideas and principles on how food safety issues in Africa could be addressed were acquired. It also gave me the opportunity for networking and collaboration with other experts in the field of food safety and how we could come up with safer food for better health in Africa.*

- Dr Alexander Ajai, Africa Centre of Excellence for Mycotoxin and Food Safety, Federal University of Technology Minna, Nigeria





## DAY 1: Scientific capacity building, standards and public private partnerships

- SESSION 1: Scientific capacity building and recognition of capabilities
- SESSION 2: Food safety education, the private sector and stakeholder awareness
- SESSION 3: Standards, Sanitary and Phytosanitary requirements within the AfCFTA

## DAY 2: Advances in screening and confirmatory analysis for food safety testing, food monitoring and surveillance programs, setting MRLs

- SESSION 4: Pesticide residues
- SESSION 5: Veterinary drug residues

## DAY 3: One Health and antimicrobial resistance; Foodborne microbial and chemical hazards, zoonoses; Risk Analysis; Food Borne illnesses/outbreaks; Notification, responses, and epidemiology

- SESSION 6: Food safety is everyone's responsibility – but what does that mean? The One Health Approach...- Prof Francis Ejobi, Uganda
- SESSION 7: Food borne hazards, Risk Analysis: Assessment, management and communication
- SESSION 8: Food Borne illnesses/outbreaks; Notification, responses and epidemiology

## DAY 4: Advances in screening and confirmatory analysis for food safety testing, food monitoring and surveillance programs, setting MLs

- SESSION 9: Mycotoxins, Marine Biotoxins, Heavy Metals
- SESSION 10: Persistent Organic Pollutants, Microplastics, Radionuclides

## DAY 5: Food Fraud; Sustainable Skilling, Measurement standards, Proficiency Testing

- SESSION 11: Food Fraud
- SESSION 12: Sustainable Skilling, Measurement standards, Proficiency Testing



# POSTER ABSTRACTS

## Accreditation ISO/IEC 17025: 2017 in the West African countries.

**M. Gbaguidi, A.P. Bridji**

For the harmonization of activities of accreditation, certification, standardization and metrology in West African Economic and Monetary Union (UEMOA-WAEMU), a community body named West African Accreditation System (SOAC-WAAS) was created in 2010 by the Regulation No3/2010/CM/UEMOA of the Council of Ministers.

The objective was, to provide in West African countries with an accreditation body able of assessing the competence of Conformity Assessment Bodies (CABs), namely certification bodies, inspection bodies and laboratories operating in the WAEMU countries. Ultimately, the SOAC accreditation system was designed as a community body contributing to the protection of West African consumers and delivering a passport to access for West African products and services to national, regional and international markets.

After evaluation of all applications, Ivory Coast was selected to host the SOAC headquarters and its activities officially started on 2018. To make accreditation accessible to as many CABs as possible, the Republic of Ivory Coast recognized, SOAC as a non-profit community organization with public utility in May 2019 and granted to SOAC a diplomatic mission status in November 2021.

This new status aimed to strengthen the signing of cooperation agreements with technical and financial partners. Therefore, the SOAC has been an associate member of the International Laboratory Accreditation Cooperation (ILAC) since 2019.

Thus, after 4 years of activities, the SOAC has accredited 33 laboratories and 1 certification body in which 15 organizations (44%) operate in the food safety sector. Furthermore, beyond West African countries, SOAC has begun a process of international recognition.

It was evaluated on April 2021 with a view to signing the Mutual Recognition Agreements (MRA) of the ILAC.

Finally, the work that led to its creation and its operationality enabled SOAC, thanks to its successful results, to become a community tool at the service of conformity assessment bodies in West African countries.

## Antimicrobial Resistant Pathogenic Bacteria in Food

**S. Abouelnour**

The emergence of antibiotic resistance among foodborne and zoonotic pathogenic bacteria is of great public health concern worldwide. Food and food products from animal origin can be a source of both multidrug resistant pathogenic bacteria and genes. The presence of such bacteria in food chains can provide a direct infection hazard following ingestion of contaminated food or by food handling. From the viewpoint of public health concern, the development of antimicrobial resistant pathogenic bacteria causes increased frequency of treatment failure and severity of infection which leads to prolonged duration of illness, increased hospitalization cases and death. Most of the known cases of antibiotic resistant bacteria are transmitted from animals to human either directly, or via the environment or food chain. The main antimicrobial resistant pathogenic bacteria involve Salmonella (non-typhoidal), Campylobacter spp., E. coli, Klebsiella pneumoniae, Methicillin-resistant Staphylococcus aureus (MRSA) and extended-spectrum B-lactamase (ESBL) producing Enterobacteriaceae. These pathogenic bacteria are often resistant to a wide range of different classes of antimicrobial agents and can significantly complicate the treatment of infections. In this poster we will focus on the major antimicrobial resistant pathogenic bacteria, implicated food, transmission of antimicrobial resistant from livestock to human and from human to animals, spreading antibacterial resistance (incidence, hospitalization, death), herbal medicine alternative to antibiotic, health-care costs and strategies to combat antimicrobial resistance



# POSTER ABSTRACTS

## Bacterial Profile of Nigerian Fufu and their Susceptibility to Antibiotics

**K.A. Enwuchola, A.O. Musa, D.O. Apeh**

Fufu samples were obtained from five locations in Anyigba, Kogi East, Nigeria. Isolation and identification of the bacteria species were carried out using standard microbiological procedures. Antibiotics susceptibility of the isolates was determined using a panel of 10 antibiotics by disc diffusion method following British Society for Antimicrobial Chemotherapy (BSAC) and KirbyBauer Guidelines for Antibiotic Sensitivity. The result obtained showed that 100% of the fufu samples analysed were contaminated by various bacteria. The isolated bacteria were *Escherichia coli*, *Bacillus cereus*, *Staphylococcus aureus*, and *Shigella* spp. All the food samples had varying levels of bacterial growth ranging from  $1.43 \times 10^7$  CFU/ml to  $4.73 \times 10^7$  CFU/ml. All of the sampled food had bacterial counts above the microbiological acceptable limits. Susceptibility result showed that high percentage of bacterial isolates were resistant to Augmentin (100%), Septrin (100%), Amoxicillin (75%), Pefloxacin (75%), Streptomycin (50%), Gentamycin (50%), Sparfloxacin (25%), Chloramphenicol (25%), but were however susceptible to Tarivid/ Ofloxacin (100%), Ciprofloxacin (75%), Sparfloxacin (75%), Chloramphenicol (75%), Streptomycin (50%), Gentamycin (50%), Pefloxacin (25%), and Amoxicillin (25%). This study showed the presence of multi-antibiotic resistant gene which could result in serious health concern; therefore, food handlers of street vended fufu need to maintain high processing standards.

## Antibiotic residues in broilers sold in Antananarivo, capital of Madagascar, in 2019

**RAJAOBELINJATOVO Nirinarisoa Patricia, HARIMALALA Andriambelo Nirina, TSIRINIRINDRAVO Herisetra Lalaina, ANDRIANARISOA Blandine, RANDRIAMPARANY Tantely, RANDRIAMIARISOANDRAIBE Heritiana, ANDRIAMADY Hasinarimanana<sup>2</sup>**

Breeding is a predominant and profitable activity in Madagascar. Currently, the poultry sector totals around 35 million head of poultry, according to the FAO. Intensive breeding is the most common form, but breeders resort to the use of feed and veterinary products to speed up the rate of production, which accentuates the presence of antibiotic residues in meats. They train several risks for public health. The objective of this study is to find and / or confirm contamination via the presence of antibiotic residues in broilers. Surveys of breeders in the capital were carried out as well as samples from a slaughterhouse and butcher shops. Also, 163 samples were taken, including 58 and 105 respectively in the Itaosy slaughterhouse and in the butcher's shops. The samples were then analyzed at the National Veterinary Diagnostic Laboratory using the "Rapid test for the presumptive detection of antibiotic residues" method, certified by AFNOR. Surveys of breeders have shown that no training or monitoring of veterinarians is allocated to them, and good breeding practices are not respected. Analyzes carried out revealed the presence of antibiotic residues in 12 samples out of 163, that is a rate of 7.36%.

## Food Safety Education and Awareness on Veterinary Drug Residues

**L. Bohloa, M. Molomo**

Safety of food from animal origin has significant effect to food security because meat and animal products such as milk, eggs etc contains high risk of foodborne pathogens, zoonotic agents, chemical and antibiotic residues as well as antimicrobial resistance (AMR) which is a global public health issue. Animal foods play an important role in the diet of man. Nutritionally they are important sources of protein of good quality and excellent sources of vitamins and minerals. Most Basotho farmers are animal producers and providers of food of animal origin, especially within the country, but lack good practices as far as the veterinary drugs usage is concerned. The consumers of animal products observe simple keys to safe and healthy food but despite all that, the great challenge of veterinary drug residues being consumed by human remains. Awareness creation through educational campaigns for users and consumers as well as the implementation of measures to force people to test food for antimicrobial residues, pathogens and other chemicals using high technology in the laboratories will result in healthy nations.



# POSTER ABSTRACTS

## Situation of Uncontrolled Antimicrobial Consumption in Poultry Production in Mozambique

C. Menezes

Mozambique's poultry production in the last 10 years has been on the rise with import of poultry meat decreasing every year. In 2021 the production was about 135 708t, while in 2011 the production was 40 503t. The intensive production system cannot do without the use of antimicrobials due to various stress factors and diseases. In Mozambique, the system for the use of antimicrobials in animal production is still a major challenge, as the legislation that regulates and controls the use of veterinary drugs is still in its infancy, although some progress has been made. Currently, any producer or non-producer can easily purchase and administer a veterinary drug to animals. Thus, there is an abusive use of antimicrobials without respecting the withdrawal period. This could, among others contribute to development of antimicrobial resistance and is a danger to public health. Some studies done in poultry in Mozambique showed that the most used antimicrobials are sulfonamides, fluoroquinolones and tetracyclines. From the collected samples, it was observed that 6.8% of fluoroquinolone residues were above recommended levels in a total of 47 samples, while tetracyclines residues were detected in 100% of the 19 samples analyzed, although, below the maximum recommended limit. The study demonstrates the presence of antimicrobial residues in meat and offal from chickens slaughtered in Maputo Province and raises awareness of associated risks to consumers. Some progress has been made to improve the consumption of safe foods, including: 1) design of a National Action Plan Against Antimicrobial Resistance 2019–2023; 2) initiating surveillance activities in 2022; 3) mandatory presentation of a Certificate of Analysis of imported drugs, and registration in the countries of origin and in SADC, while working on the national drug registration system in the country; 4) launching the analysis of residues of veterinary drugs, metals and aflatoxins following the “building laboratory analytical capacity” with the help of the IAEA.

## Effect of Thermal Treatment on the Concentration of Antibiotics in Milk

M.M.A. Elhag, T.A.M. Alawad, A.A.A. Behairy, S. Saleem, A.M.A. Hammad

Intensive animal farming for human consumption leads to unethical and extensive use of antibiotics in veterinary medicine and medicated feed. Hence, improper administration by farmers and veterinarians lead to accumulation of antibacterial residues in animal originated foodstuffs and adversely affect consumer's health. Therefore, this study was designed to determine the effect of thermal treatments such as pasteurization and boiling on the concentration of some commonly used antibiotics like Tylosin (TYLO), Enrofloxacin (ENRO), Ampicillin (AMP), and Oxytetracycline (OTC) in fresh cow milk samples obtained from the farm of Khartoum University, Sudan. Beside the determination of which type of antibiotic is more affected by the thermal treatments according to kinetic degradation rate constant (k). The Raw cow milk samples (free from antibiotics) were collected from the Farm of Khartoum University. Spiked with three different concentrations (3, 6, 9 ppm); prepared from the selected antibiotics. Each concentration of antibiotic was subjected to two different thermal treatments, pasteurization and boiling. The sub-samples were extracted using Liquid Chromatography-Mass Spectrophotometer to measure the percentage degree of reduction and the values of kinetic degradation rate constant (k) for all concentration of each antibiotic at the two thermal treatments. The results obtained showed that the initial different concentration of the selected antibiotics was decreased among all types of thermal treatments. Based on the degradation percentage the pasteurization was more effective in the reduction of the initial concentration of all antibiotics. Based on the k-values, the boiling treatment was higher than pasteurization. In addition, boiling for 10 min was more effective than 5 min for antibiotics under study. A significant different ( $p=0.002$ ) between pasteurization treatment and boiling for 5 min and non-significance difference ( $p=0.09$ ) between pasteurization and boiling for 10 min. TYLO was more affected by pasteurization (49.3 - 15%) than boiling (30.4 - 14.6%). And more affected by pasteurization than OTC (46 - 35.3%), ENRO (44.6 - 32%), and AMP (30.6 - 26.6%). The range of k-values (0.0224 - 0.005) at pasteurization for TYLO was higher than the other antibiotics therefore, it was less stable. The study revealed that, boiling treatment was more effective in the reduction of OTC concentration (59 - 15.3%), than TYLO (30.4 - 14.6%), AMP (29.3 - 23.3%) and ENRO (11.6 - 6.2%). OTC had a higher k-value (0.122 - 0.089) and higher degradation percentage (DP) at boiling when compared with the other antibiotics, therefore it was less stable. ENRO and AMP had the lowest DP (11.6 - 6.2%), (30.6 - 26.6%) by boiling and pasteurization respectively when compared with the other types of antibiotics. The study concluded that thermal treatments reduced the concentration of the antibiotics added to the milk. Based on the k-values, boiling treatment was more effective in the stability of antibiotics and based on DP, the pasteurization was more effective than boiling in the reduction of the concentration of all types of antibiotics. OTC was the least stable than the other antibiotics by boiling. Whereas TYLO is the least stable by pasteurization. AMP and ENRO was the most stable at both thermal treatments in comparison with OTC and TYLO. Therefore, according to the type of antibiotics and type of thermal treatments, the result varies.

# POSTER ABSTRACTS

## Antibiotic Resistance Pattern of ESBL and non ESBL E.coli in Raw Milk from Informal Processors

S. Chimuti, D.T. Mugadza, P.K.M. Njage, V. Ntuli

The sale and consumption of raw milk is a common sight in both rural and urban communities of Zimbabwe. Enterobacteriaceae isolates from raw milk produce beta lactamases which hydrolyses the beta lactam ring of the beta lactam drugs causing antibiotic resistance which has increased worldwide. 254 samples from four critical sampling locations were collected, analysed and confirmed using series of biochemical tests and Vitek 2 Compact. Antimicrobial sensitivity testing of the isolates was done using 7 antibiotics basing on the use and class. Isolates were analysed for ESBL (blaCTX-M, blaTEM and blaSHV) and STEC (stx1 and stx2) genes using PCR. Isolates were further tested for haemolysis using Sheep Blood agar. Most of the isolates 43 (72%) were resistant to Ampicillin and 20 (33 %) were resistant to Ertapenem. A total of 47 (87%) of the E. coli isolates showed resistance to Ceftazidime (third generation cephalosporin beta lactam antibiotic). A total of 29 (54%) of the E.coli isolates were phenotypically detected as ESBL producing. 8 (29%) samples amplified for blaCTX-M at 655 bp. 12/54 (22%) amplified for shigatoxin 1 (stx1 gene) at 348 bp. 16/54 (30%) were detected as gamma haemolysis. 25/54 (46%) were detected as alpha haemolysis. 30/54 (56%) were detected as beta haemolysis. Ertapenem (Carbapenems) is the last line of drug and has a broad spectrum of activity than other beta lactams and cephalosporins. This is a worrisome observation because E. coli is becoming resistant to drugs of choice and one may succumb to a very simple infection like E. coli. Besides the absence of other resistance genes such as blaTEM and blaSHV, the isolates have other virulence factors because 56 % showed complete haemolysis (beta-haemolysis). Considering the grave scenario of antibiotic resistance from the isolates, it is high time informal milk producers should have better milk handling practices.

## Effects of smoking methods on the nutritional composition, heavy metal and polycyclic aromatic hydrocarbons (PAHs) on three smoked fish species consumed in Cameroon

NSOGA Jean Valéry François, Ndomou Mathieu, Manz Koule Jules Christophe

Smoked fish contributes to the food security of populations through its richness in nutrients and its accessibility to low-income households. In Cameroon, 80% of artisanal maritime fishing and inland fishing production is distributed in the smoked form and several processing methods exist. This study aimed at assessing the effects of smoking methods on the nutritional composition, heavy metals and polycyclic aromatic hydrocarbons (PAHs) on smoked *Ethmalosa fimbriata*, *Esox lucius* and *Gadus morhua*, commonly consumed in Cameroon. Four smoking kilns were used for this purpose: Half-metal drum, Banda, Altona and an Improved Altona. Proteins, lipids and minerals were obtained according to AOAC methods. The heavy metal content was determined by an EDX 7000 Spectrophotometer, and PAHs by gas chromatography-mass spectrometry (GCMS). The results showed that protein and lipid content varies from  $60.55 \pm 1.07\%$  to  $65.68 \pm 0.78\%$  and  $8.21 \pm 0.18$  to  $14.26 \pm 0.09$ , respectively. Minerals and heavy metal order content were  $\text{Ca} > \text{K} > \text{Mg} > \text{Fe} > \text{Na} > \text{Zn} > \text{P} > \text{Cu} > \text{Mn}$  and  $\text{Cd} > \text{Pb} > \text{Hg} > \text{As}$ , respectively. Total PAHs concentrations varies from  $22.87 \mu\text{g/kg}$  for improved Altona to  $863.14 \mu\text{g/kg}$  for Banda kiln. Benzo(a)Pyrène was also above the critical limits of  $2 \mu\text{g/kg}$  of the European Standard for half-metal drum, banda and altona kilns. This study showed that each smoking method had a variable impact on the quality of the smoked fish. The improved altona smokehouse have positive influence on the acceptability and nutritional aspects of fish.

## Mycotoxins, pesticides and heavy metals in cocoa cultivated in Cameroon: contamination levels and postharvest practices

Biloua Dorothee Marcelle, Amada Brahim, Ngo Ngwem Marcelline Carine, Bang Njenjock Blixen Bolie, Baleba Mbang Roger, Medoua Nama Gabriel

Purpose: To characterize the production system of cocoa in the department of Lékié, Centre region, Cameroon, and to identify the impact of this system on the quality of the merchant beans, a cross-sectional survey was conducted in 165 cocoa farms located in 33. Using a semistructured questionnaire, farmers were asked to provide detailed information about their agricultural and post-harvest practices. Additionally, samples of cocoa beans (1 kg/farm) were collected for the evaluation of mycotoxins (total aflatoxin, aflatoxin B1 and ochratoxin), heavy metals (cadmium and lead) and pesticides (metalaxyl). Mycotoxins, heavy metals, and pesticides were assessed using ELISA kits, atomic-absorption spectroscopy (AAS) and gas chromatography-mass spectrometry (GC-MS), respectively. Globally, 90% of farmers used



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pesticides on their cocoa farm, but 75% did not adhere to official spray recommendations, whilst 62% did not adhere to recommended doses and 40% abandoned packaging in the farm. Concerning the postharvest practices, only 67% of farmers practiced stirring during fermentation, and 25% dried their beans at the edge of road. Levels in total aflatoxins varied from 4.40 – 11.72 µg/kg, with 12% of samples equal or above the maximum residue level (MRL). Levels in aflatoxin B1 varied from 1.16 – 7.43 µg/kg, with 12% of samples equal or above the MRL. Levels in ochratoxin varied from 0.03 – 7.47 µg/kg, with 9% of samples equal or above the MRL. Levels in cadmium varied from 0.04 – 0.07 mg/kg. Levels in lead varied from 0.02 – 0.20 mg/kg, with 3% of samples equal or above the MRL. Levels in metalaxyl varied from 0.01 – 0.3 mg/kg, with 52% of samples equal or above the MRL.

## **Confirmatory Analysis of Per and Polyfluoroalkyl Substances in Biological Fluids, Retail Milk and Infant Formula using UHPLC-MS/MS** **Ovokeroye A. Abafe**

Per- and polyfluoroalkyl substances (PFAS) are persistent organic pollutants (POPs) that are resistant to biodegradation, with half-lives exceeding fifteen years in humans. Human exposure to these compounds through ingestion, inhalation and dermal contact has been linked to cancer, dermal allergies, low infant birth weight, infertility and increased risks of obesity, among others. Challenges in the analysis of PFAS in biological matrices have been widely reported in the literature. In this study, an ultra-high performance liquid chromatography with tandem mass spectrometry (UHPLC-MS/MS) method was developed and validated for the sensitive determination and unambiguous confirmation of residues of PFAS in breastmilk, retail milk, infant formulae and serum. Sample pre-treatment was carried out by a simplified QuEChERS method without requiring dispersive solid phase extraction (dSPE) or any further clean-up. The method was validated in accordance to the requirements of Commission Decision 657/2002/EC with slight modifications. The method displayed good linearity with R<sup>2</sup> ranging from 0.9843 – 0.9998 for all target PFAS. The recovery and within-laboratory reproducibility of the method (n=63) were in the range 60 – 121 % and 5 – 28%, respectively. The decision limit, detection capability and limit of quantitation ranged from 30 – 60 ng kg<sup>-1</sup>, 40 – 100 ng kg<sup>-1</sup> and 5 – 50 ng kg<sup>-1</sup>, respectively. Acceptable matrix effect values in the range -45 to 29 % were obtained, with uncertainty of measurement lower than 25% for all target PFAS. The method displays its suitability for the sensitive and high throughput confirmatory analysis of C4–C14 PFAS in breastmilk, dairy milk, infant formulae and human serum, and can be deployed for the regulatory monitoring of PFAS in the respective matrices.

## **Perceptions Of South African Consumers Towards Ready-To-Eat Meat Products After The 2017-2018 Listeriosis Outbreak** **E. Moholisa**

The study explored the South African consumers perceptions towards food safety of ready-toeat (RTE) meat products, in particular, after foodborne illness out-break. The 2017-18 South African listeriosis out-break in the RTE meat products necessitated the investigation into this matter. This is because food scares reduce consumer confidence of the implicated products, thereby reducing the demand. As a result, this review focused on the factors that influence consumer demand for RTE meats, as well as the challenges affecting RTE meat demands. Lastly, previous research empirical findings on consumer perceptions on food safety after the occurrence of foodborne out-break/food scare. Understanding consumer views following a food scare is critical for restoring and maintaining consumer trust in the food supply chain. Although listeriosis is not the first foodborne outbreak in South Africa, it brought food safety regulatory uncertainties into sharp focus. This review highlighted the negative impact of regulatory uncertainties, which resulted in problems affecting meat industry and ultimately being borne by consumers. Beyond the initial short-run responses from some consumers, particularly risk averse consumers who refrained from eating all the processed RTE meats including products that were not implicated in the outbreak, the extent to which the outbreak has shifted the South African consumer perceptions about the food system is an interesting question that remain to be answered.



# [ POSTER ABSTRACTS ]

## Assessment of the chemical parameters of tea produced in the large tea-growing complexes of Burundi

E. Bisekwa, E. Semenova, B. Audace

Some of the effects of the industrialization of communities are the consumption of different chemicals that result in severe health consequences. The goal of this study was to determine the levels of chemical parameters in the black tea produced in major tea-growing complexes in Burundi. Burundi Tea Office (OTB) is made up of five tea-growing complexes and the headquarters in Bujumbura, such as Rwegura, Teza, Tora, Ijenda, and Buhoro. Black tea samples were collected from 3 major black tea growing complexes (OTB Rwegura, OTB Mabayi, and OTB Jenda). The samples were analyzed for moisture, total ash, water-soluble ash, water extract, alkalinity of water-soluble ash, acid insoluble ash and crude fiber. The analyses were performed in the Soil and Agro-Food Products Analysis Laboratory of ISABU(LASPA). Samples were prepared and analyzed using standard methods as described in East African Community Standard (EAS 28:2000). Statistical studies have been carried out by calculating the correlation between different couple of parameters at t-test applied to check significance. The observed values of various chemical parameters of black tea were compared with standards values recommended by Food and Agriculture Organization (FAO) and EAS. All the chemical parameters analyzed for black tea samples were within the lowest and highest desirable limits set by FAO and EAS. In general, the chemical parameters resulting from black tea from selected potential growing tea complexes were commercially acceptable to highly acceptable chemical requirements and fit export market standards by following the recommended standards.

## Role of Food Testing Laboratories in Food Safety and Food Defense

S. Jaballah, N. Maslah el Hammar

Food security is the continuous access of all people to affordable food that meets their dietary needs and allows them to be healthy and lead an active life. Food safety and food defense are therefore an essential part of the utilization and access components of food security, which has four dimensions: availability, access, stability and utilization. Everyone has the right to have access to food that is safe to eat, nutritious and in sufficient quantity. Upstream and downstream control is necessary to guarantee the safety and wholesomeness of food. Preventive controls solve most food safety problems. In addition, good processing, storage and preservation practices help preserve the nutritional value and food safety, as well as reduce post-harvest losses. Food safety laboratories are on the front line when it comes to protecting public health, as they ensure the safety and quality of products before they are marketed. In addition; they play an important role in ensuring compliance with the regulations on the foodstuffs used, using different techniques and services. An effective system for monitoring and developing analytical capacity remains essential to guarantee the effectiveness and viability of this important link in the health safety chain.

## Setback of Food Safety Regulations and Enforcements in Ethiopia

B.F. Mitiku

Safe foods are necessary for the prevention of food-borne and related diseases. The foods shall be maintained and kept safe along the supply chain till it reaches to the ultimate end user or consumer. The WHO estimates showed that more than 600 million people fall ill and 420,000 die every year from eating food contaminated with bacteria, viruses, parasites, toxins or chemicals. It requires ensuring the safety of the food from “farm to table”, embedding a holistic and coordinated approach that addresses the food safety problems Arising along the value chain. In Ethiopia, different agencies are involved in the execution of food safety regulations and laws, among which the Ethiopian Food and Drug Authority (EFDA), Ministry of Agriculture (MoA) and Ministry of Trade and Regional Integration (MoTRI) are the main players. The coordination and well-functioning of these prominent institutions would have an immense contribution to the improvement of food safety. The main intent of this study is to assess the setbacks of food safety laws and regulations, specifically to evaluate the food safety mandates of regulatory bodies EFDA, MOA and MoTI, and to sort out the challenges that faced during the implementation of the regulations. Primary and secondary data were collected from different sources. The primary data were collected through interview and focus group discussion (FDG) methods while the secondary data were garnered from proclamation, reports, researches, study survey, archives of those entities and reviewed from the literature.



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The finding of the study shows that there are some overlaps in the mandate of those organizations which leads to over or under regulation. EFDA is mandated in regulating the semi-processed and processed foods (Proclamation No. 1112/2019), while the MoA is mandate to regulate raw and semi-processed food products (Proclamation No. 117/1998 and 4/1992). The semi-processed products like packed raw plant and animal base foods such as packed apple, roasted and packed coffee, packed rice processed meat and similar foods fall under the mandate of both organizations. This shows that the two organizations share similar mandate.

Furthermore, the MoTI is mandated to regulate all processed food products (with mandatory standards) locally produced and imported from abroad (Proclamation No.1097/2011) and those tasks also carried out by EFDA. Those overlap of tasks attributes over regulation and causes frustration to the importers and local manufacturers. Those overlap of tasks attributes over regulation and causes frustration to the importers and local manufacturers. Another food safety problem arising include, Mycotoxins (Aflatoxin M1 and B1) in raw and processed milk and peanut butter; heavy metals include lead (Pb), cadmium (Cd) and mercury (Hg) in raw and processed fruits and vegetables. And most of the problems come from raw agricultural produce (including animal products) from feeds, over usage of pesticides, industrial wastes, and other contaminants. Most of the time, EFDA is facing challenges while industrial products are regulated due to contaminants and toxins escalating from raw agricultural produce.

Finally, the study recommends that first of all, the regulatory entities need to sit, discuss and fix the mandate overlaps and work in a harmonized system, secondly, strong monitoring, evaluation and traceability system of the agricultural produce shall be in-placed to prevent the contaminants and toxins coming from raw agricultural produce. Thirdly, national food safety technical committee has to be established by involving key sector agencies to properly lead, monitor and evaluate the overall food safety activities along the value chain.

## **Investigation of bacterial and viral contamination fresh products: cases of shellfish and fresh cut vegetables**

**I. Amri, F. Rahmani, M. Yahya, S. Dhib, F. Hmaeid**

Food safety is an important public health issue. This safety does not only concern regulations or good hygiene practices, but also the conditions in which the population consumes food. Among the important elements that affect food safety is the microbiological quality of the products. Fresh products as shellfish and minimally processed products as fresh cut vegetables are foodstuffs consumed all over the world and endowed with an interesting nutritional and dietary value. They represent in Tunisia a wealth whose economic stakes are important. These foodstuffs may contain a large number of spoilage microorganisms that constitute a potential health risk.

The study main goal was to evaluate bacterial and viral contamination of shellfish and ready to eat salad. Viral concentration was performed using Tris-glycine-beef extract. The evaluation of contamination by enterovirus EV and hepatitis A virus HAV was carried out using quantitative real time PCR. Fifty shellfish samples were analyzed. The hepatitis A virus and the enterovirus were detected in 29 % and 13 % of shellfish samples analyzed, respectively. None of the samples revealed the presence of Samonella. From 17 samples positive for HAV, we found six samples showing a number of E. coli below the European legislation. An important HAV contamination was observed in our study. No correlation between bacterial and viral contamination was found.

A total of 26 freshly packaged carrot salads were analyzed for the total aerobic plate count, Staphylococcus spp., yeasts and molds. None of the carrot salads samples revealed the presence of EV. The mean concentrations of total aerobic plate count, Staphylococcus spp. yeasts and molds were 4.87, 2.08, 7.47 and 2 Log10/25g respectively. These results showed a high bacterial contamination of ready to eat products. This suggest that the contamination of carrot salads might occur through chain transformation.

# POSTER ABSTRACTS

## Developing strategies for reducing post-harvest losses in tomato produce for improved food, nutrition and income security

**J.K. Nzuma, P. Mafirakureva, T. Kamunhukamwe**

Tomato (*Solanum lycopersicum* L.) is an important crop cultivated by smallholder farmers in Zimbabwe for improving livelihoods through income generation and employment creation. However, the good harvest of many farmers does not translate into profit, as most are lost after harvest. Post-harvest loss is a major challenge hampering tomatoes production across many smallholder farming systems and is associated with poor post-harvest handling methods, limited sorting and grading as well as lack of cooling/cool storage. Losses of up to 50% have been recorded in tomatoes between the harvesting and consumption stages of the supply chain. Scientists at SIRDC developed a low-cost post-harvest handling model to assist smallholder farmers reduce losses. Key interventions include use of plastic crates during harvesting and handling, systematic sorting and grading as well as provision of cooling/cool storage to extend shelf life and create market opportunities. Studies comparing use of reusable plastic crates (RUPC) with the traditional practice of using wooden crates and woven buckets show that losses can be reduced by 78% and 80%, respectively with plastic crates. These are now extensively used as replacement for traditional handling materials and are improving farmer earnings by at least 15%. Studies also show that the provision of low-cost storage facilities such as ZECC (zero energy cooling chamber) can extend shelf life of tomato fruit with minimal degradation until the fourteenth day. In contrast, tomatoes stored in ambient conditions showed significant signs of degradation at the seventh day. This subsequently reduces incomes by almost 50%. An integration of these practices (RUPC and ZECC) with systematic sorting and grading can enhance farmer profit margin by at least 10%. Participatory approaches are being used to popularize the post-harvest-handling model for profitability.

## Health risks related to mycotoxins and heavy metals: the case of corn and its derivatives controlled by the National Public Health Laboratory (LNSP) from 2020 to 2022

**F. Nikiema, I. Sangaré, I. Ilboudo, M. Bandé, B. Yonaba, A. Somda, M. Ouedraogo, S. Sawadogo, M. Valian, H. Kangambega, A. Yakoro, E. Kabré**

**Introduction:** Cereals occupy a central place in the diet of Burkina Faso. Thus, among the main plant speculations, maize is becoming increasingly important in terms of domestic consumption, and its health quality is becoming a major concern. What is the retrospective view of the national public health laboratory on the state of aflatoxin and heavy metal contamination of maize over the last two years?

**Materials and methods:** 152 samples of corn grains, and derivatives received and analyzed by the application of the method ISO/DIS-16050.2: 2002 and AOAC 2012 for atomic absorption spectrometry. The parameters were assessed according to the CXS 193-1995 Amended in 2017 of the Codex Alimentarius as well as the Regulation (EC) No. 1881/2006.

**Results:** Out of 152 samples received 62.5% were non-compliant. The corn grains affected by 36.84% aflatoxin B1 against 8.79% for the flour. The corn flour was contaminated by 54.95% of lead against 26.32% for the corn grains. 28.57% for cadmium affected the flour against 5.26% for the grains. The corn derivatives were all compliant for the controlled parameters.

**Conclusion:** These results show that it is necessary to ensure compliance with Good Agricultural Practices (GAP) and Good Manufacturing Practices (GMP), and the general application of the principles of Hazard Analysis and Critical Control Points (HACCP) from production to marketing of corn and its derivatives.



# [ POSTER ABSTRACTS ]

## **Assessment of Heavy metals (Pb, Zn and Cu) contents in the ground coffee marketed in Burundi**

**E. Bisekwa, E. Semenova, B. Audace**

Arabica coffee is an economical import crop, which is contributing to the highest of all export revenues in Burundi. The presence of heavy metals in coffee has become a worldwide concern. The metals are part of major substances with mutational and carcinogenic effects. The aim of this study was to determine the concentration of Zn, Cu, and Pb in the ground coffee from 3 sources. Each sample of ground coffee was coded to conceal the original source. The present study was conducted in the soil and agro-food analysis laboratory (LASPA). The samples were collected from three supermarkets. Assessment of heavy metals in ground coffee Pb, Cu, and Zn was carried out by atomic absorption spectrometry (AAS). The results were subjected to statistical analysis for checking significant differences from different samples using Rstudio-1.0.153. The results indicate that the concentrations of Pb and Zn were present in the lowest concentration for which there were no significant differences between the three sources of samples while the concentration of Cu was found in high concentrations for all the samples analyzed. Results indicate that the concentration of Pb and Zn of all ground coffee samples analyzed are within the heavy metal contaminants limits 1.0 and 5.0 respectively set by East African Community Standards (EAS 105: 2008). Copper content does not meet East African Community Set standards. The variation of Cu content in the ground coffee analyzed may be due to geographical seasonal changes, pesticides used, and the chemical characteristics of the growing regions.

## **Profiling of Heavy Metal Contents in Rice Cultivated in Fadama Areas**

**A.I. Ajai, J. Tijani, H.L. Muhammad, A. Inobeme, N.B. Awe**

Fadama areas are majorly used for agricultural purposes such as cultivation of rice crops and other food crops. The soil of these areas are exposed to heavy metals contamination from anthropogenic activities by which heavy metals are leached into the soil and subsequent uptake by plants cultivated therein and from the plants enter into the food chain. Thus, the determination of metal ion concentrations in soil and crops cultivated therein becomes paramount. The present study investigated the concentrations of heavy metals in soil and rice plants in Fadama farmlands in Kontagora area of, Niger State, Nigeria. Physicochemical properties of soil were determined using standard procedures. Digestion of soil samples was done using concentrated. nitric and hydrochloric acid (3:1). The findings from the study revealed some degree of contamination of the soil and the rice plants cultivated by some of the metal investigated. The contents of the heavy metals in the Fadama soils were 87.40 - 121.40mg/kg, 53.80 - 84.19 mg/kg, 73.05 - 92.01 mg/kg, 1.21 - 2.10 mg/kg and 21.80 - 41.07 mg/kg for Cu, Zn, Mn, Pb and Cr respectively. While in the rice plants the contents were 6.34 - 8.75 mg/kg, 42.10 - 67.05 mg/kg, 5.04- 6.37 mg./kg, 0.46 -0.94 mg/kg and 1.41 - 2.68 mg/kg for Cu, Zn, Mn, Pb and Cr respectively. Values for transfer factor (TF) revealed that Zn had the highest value (0.82) amongst the heavy metals investigated which shows its higher bioavailability for plant uptake. With the exception of Pb, the contents of the other heavy metals (Zn, Cu, Mn and Cr) were higher than the maximum limits based on WHO standards. Further investigations are also encouraged in the study area for possible intervention measures.

## **Mineral contents of pumpkin peel, flesh and seed by microwave plasmaatomic emission spectroscopy and their health risk assessment**

**M. Abeb Yetesha, B.S. Chandravanshi**

Pumpkin is one of un-noticed vegetables otherwise a rich sources of phytochemicals, gaining popularity as its medicinal and nutritional characteristics are equal or even better than those of widely cultivated vegetables and fruits. Pumpkin possesses significant amounts of valuable minerals. The aim of this study was to determine the levels of Na, Mg, K, Ca, Cr, Mn, Fe, Ni, Cu, Zn, Cd and health risk assessment of heavy metals (Mn, Ni, Cu, Zn, Cr, Cd) in the peel, flesh and seed of pumpkins cultivated in Ethiopia, using microwave plasma-atomic emission spectrometry. Dried powdered samples (0.5 g) were wet digested with 69% HNO<sub>3</sub> and 30% H<sub>2</sub>O<sub>2</sub> in microwave digester. The percent recovery for the three parts of pumpkin samples were 90-110%. The mean concentration of metals in pumpkin peel, flesh, seed samples were K (27806, 29531, 10667), Ca (5267, 3190, 2919), Mg (4716, 848, 4668), Fe (158,111, 225), Na (167, 63.1, 171), Mn (28.9, 9.61, 33.4), Zn (24.2, 10.6, 67.5), Cu (8.14, 15.1, 10.8), Ni (3.79, 2.14, 3.44), Cr (0.28, 0.36, 0.69), Cd (0.24, 0.46, 1.39) mg/kg, respectively. Lead was not detected in any part of pumpkins from the three sample

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sites. The hazard index (HI) of pumpkin flesh and seed was less than unity which indicating ingestion of pumpkin is safe from non-carcinogenic risk. The total cancer risk (CRt) due to consumption of pumpkin flesh and seed through Cr and Cd from the three sampling sites are in the range  $1.1 \times 10^{-4}$ - $1.8 \times 10^{-4}$  which is similar to the maximum limit value of  $1 \times 10^{-4}$  indicating a non-risk of exposure to cancer due to the consumption of pumpkin. Pumpkins are good source of essential minerals and free from toxic metal. Consumption of pumpkins is safe from noncarcinogenic and carcinogenic cancer risk.

## Health Risk assessment of trace metals using Total Microwave Acid Digestion followed by ICP-OES analysis of various fish samples from Siavonga, Lake Kariba, Zambia

P.M. Poopedi, Y. Nuapia, H. Richards, M. Monyai, N. Tavengwa, I. Nyambe, L. Chimuka

The aim of the study was to assesses the levels of heavy metals in fish from Lake Kariba in Zambia and to evaluate their impact on fish and human health. Thirteen fish were sampled and muscle tissues excised for analysis of trace metals (Mg, Fe, Zn, Al, Cu, Se, As, Cr, As, Pb and Cd) by acids (HNO<sub>3</sub> and H<sub>2</sub>O<sub>2</sub>) digestion and ICP-OES. All metals were found to be below the maximum limits (MLs) set by WHO/FAO, except for Al. Essential metals were higher, whereas non-essential metals were lower in fish sampled. The mean concentration of trace metals in fish samples were Al, Cr, Cu, Fe, Mg, Mn, Se, Zn were found to be  $118.92 \pm 0.010$ ,  $2.05 \pm 0.014$ ,  $0.19 \pm 0.007$ ,  $11.02 \pm 0.006$ ,  $88.62 \pm 0.111$ ,  $0.97 \pm 0.001$ ,  $0.43 \pm 0.005$  and  $5.84 \pm 0.003$  respectively. The daily metal intake estimates (DIM) for all metals were less than the provisional tolerable daily intakes (PTWI) recommended by FDA. Target hazard quotients (THQ) and Hazard Indices (HI) were less than 1, indicating no health risks from a lifetime of fish consumption. Total cancer risk (CR) due to Cr was higher than  $1 \times 10^{-4}$ , indicating less than 1 in 10,000 carcinogenic risk from a lifetime consumption of Kapenta and Kariba Bream from Lake Kariba, which raises concern over an adverse effect on fish of excess Cr. Long-term exposure to heavy metals through fish consumption poses both potential non-carcinogenic and carcinogenic health risks to the local residents.

## One Health

A.K. Englishbey

As populations continue rise, the sustainability of animal and food production continues to be impacted by the complexity of ensuring animal health, food safety, food security, and wholesome food production [1]. The combination of monitoring both food products and the animal production environment is a lever to increase food safety and quality [2]. Moreover, in vertically integrated animal and food production systems such as poultry and swine production, known correlations have been observed between farm environmental cleanliness and incoming loads of bacterial contamination into food production facilities [3]. The utilization of quantitative indicator and pathogen technologies provide greater insights into intervention efficacy and process control with the use of biomapping and statistical process control parameters [4]. However, without an online data management system, much of the One Health data remains inaccessible and fragmented, therefore, this lack of cohesion across data sources results in a failure to adopt new and innovative technologies, products, and processes [5]. Moreover, the need for a sole source provider for an animal production and food safety management system is foundational to truly aggregate data across multiple testing platforms and technologies to evaluate and support a One Health approach. The complete solution provided by Hygiena™ includes a combination of an environmental monitoring program utilizing ATP, novel indicator organism detection and quantification technologies, and chromogenic pathogen screening, coupled with genetic PCR technologies for detection and quantification of pathogens spanning across live animal production environments, food production facilities, and retail environments to deliver a systematic solution all managed using digital data solutions. This paper would further showcase various studies utilizing the Hygiena One Health Diagnostics solution in practice to support the complexity of factors that influence global animal health, food safety, and food security.



# POSTER ABSTRACTS

## Prevalence and Antibiotics Susceptibility Pattern of Salmonella Species in Smoked Fish Sold in Tamale Metropolis

C.K.S. Saba, A.A. Razak, K.W. Stephen

Fish accounts for about 17% of the animal protein intake globally. However, it has been documented that, fish and fishery products serve as a carrier of food borne pathogens especially Salmonella. The intake of raw smoked fish is mostly practiced in Ghana and could serve as a medium of transmission of Salmonella. Hence this research was carried to determine the prevalence of Salmonella spp. from smoked fish sold in the three major markets in Tamale Metropolis and examined the isolates resistance patterns to various antibiotics. A total of one hundred samples were examined. The samples were enriched on buffered peptone water and inoculated on Modified Semi-Solid Rappaport Vassiliadis, Xylose Lysine Deoxycholate were used to identify the bacteria and Simon Citrate agar were used for biochemical test. The antibiotic test was done by using the Kirby-Bauer disc diffusion test. After the laboratory analysis, 67 (67%) out of the 100 samples were confirmed to be positive for Salmonella of which Cat fish (11.9%), Red fish (11.9%), Mud fish (11.9%) and Chale fish (11.9%) recorded the highest contamination and among the three markets, Central markets had the highest contamination. The resistance patterns of the isolates to the various antibiotics used were; Ciprofloxacin (2.98%), Ceftriaxone (34.32%), Ampicillin (83.58%), Doxycycline (88.05%), Amoxicillin/Clavulanic acid (91.04%) and Oxytetracycline (92.53%). This study revealed that smoked fish sold in the Tamale Metropolis contained Salmonella positive that can cause food poisoning and other gastrointestinal problems.

## Carriage Methicillin-Resistant Staphylococcus aureus in cattle in northern region of Algeria

S.B. Kechih, H.K. Kaddour, D.H. Ammar, N. Amellal, T.M. Hamdi

For several years and in several countries, the carriage of methicillin- resistant Staphylococcus aureus ( MRSA) in humans and animals has posed a serious problem, especially following the confirmation of its possible transfer from animals to humans. and vice versa and especially in places of confinement. The objectives of this work are to determine the carriage of MRSA in cattle and to study their antibiotic resistance profiles . A total of 8000 swabs were taken from this animal species from four department in the center of the country and analyzed at the regional veterinary laboratory of Tizi-Ouzou during the period from 2009 to 2014. The rate of Staphylococcus aureus carriage recorded is 55%, as for the rate of MRSA, it represents 31 % in this animal species. All strains tested were susceptible to vancomycin. MRSA isolates show cross-resistance; i.e. 12% with the aminoglycosides , 31% with cyclins, 16% with quinolones, 19% with macrolides. Methicillin - susceptible Staphylococcus aureus (MSSA) identified from this species mainly show cross-resistance to aminoglycosides, cyclins, quinolones and macrolides, but on the other hand all Staphylococcus aureus isolates were sensitive to gentamicin and cotrimoxazole. The spread of MRSA in different animal species can pose a public health problem requiring the determination and understanding of the characteristics of resistance to antibiotics. In effect ; the application of a screening policy for carrier animals can make it possible to fight against these germs by preventing their dissemination within populations within the framework of the “one health” approach and thus leading to the development of prevention strategies.

## Microbiological quality of street foods and resistance profile of certain bacteria responsible for food poisoning

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**Introduction:** The consumption of street food is increasing with population growth and urbanization. The aim of this study was to evaluate the microbiological quality of the sandwiches sold at Boromo station and to establish the antibiotic sensitivity profile of the isolated germs.

**Materials and methods:** A total of thirty samples of sandwiches were collected. The enumeration of thermotolerant coliforms, Escherichia coli, Staphylococcus aureus, Salmonella and Shigella was tested according to ISO standard methods. The Kirby-Bauer method was used for the antibiotic susceptibility profile.

**Results:** Among the thirty samples, 86.67% (26/30) contained thermotolerant coliforms. The prevalence of Escherichia coli was 20% (6/30), Staphylococcus aureus 16.67% (5/30) and Salmonella enterica arizonae 3.33% (1/30). Antibiotic susceptibility testing showed that: 80% of E. coli were resistant to amoxicillin + clavulanic acid, cefoxitin, ampicillin and norfloxacin; Salmonella was resistant to amoxicillin + clavulanic acid, amoxicillin, and ticarcillin + clavulanic acid; 100% of S. aureus showed resistance to amoxicillin + clavulanic acid and penicillin G.

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Conclusion: The environment of the station and the hygiene of the hands of the saleswomen could have a great implication in their contamination. The presence of faecal contamination indicators reflects a breach of hygiene rules; The uncontrolled use of antibiotics leads to the emergence of resistance. thus leading to the development of prevention strategies.

## **Assessment of the microbiological quality of fish processed artisanally in the municipality of Joal -fadiouth (Senegal)**

**A.B.K. Diouf, K.B. Sylla, A. Diawara**

Artisanal fish processing is one of the conservation methods. The products obtained from this processing contribute significantly to the satisfaction of the population's animal protein needs. In order to contribute to the improvement of the microbiological quality of artisanally processed fish products, we evaluated the microbiological quality of artisanally processed fish in the Commune of Joal - Fadiouth, Department of Mbour (Senegal). Particularly, 2 sites were targeted, the site of Tann which processing conditions were traditional and the site of Khelcom which processing conditions were improved. Our results showed that out of 100 samples collected and distributed equally between the two sites, only 16 were found non compliant, including 13 samples contaminated with salmonella and 11 samples contaminated by *Vibrio parahaemolyticus*. At the Tann site, *Vibrio parahaemolyticus* was found in 3 samples, salmonella bacteria was found in 5 samples and 8 samples were contaminated with both by *Vibrio parahaemolyticus* and by salmonella bacteria. On the other hand, at the improved site of Khelcom, no sample showed a positive result. Thus, from our results we can conclude that the improvement of the sites has a positive impact on the microbiological quality of the finished products.

## **Prevalence and Antibiotics Susceptibility patterns of Salmonella isolated from raw carrot sold in Tamale Metropolis of Ghana**

**O.E. Nignan, A.R. Alhassan, K. Marshal, A.W. Kpordze, C.K.S. Saba**

Most people consume leafy and root vegetable in its raw state or partial cook. However, Salmonella is frequently found in leafy and root vegetables due to its direct contact with the soil and handling from farm to market and this is known to cause gastrointestinal infections worldwide. The aim of this study was to investigate the prevalence and antimicrobial resistance patterns of Salmonella from raw carrot sold in the Tamale Metropolis in the Northern region of Ghana. One hundred and five (105) samples of raw carrot were randomly collected from four major markets. The samples were enriched in buffered peptone water and inoculated on Modified Semi-Solid Rappaport Vassiliadis. Afterwards, the suspected Salmonella were then plated on Xylose Lysine Deoxycholate agar for bacterial identification. The positive isolates were later confirmed with Simmons citrate. The antibiotic test was done by using the Kirby Bauer disc diffusion test method. An antibiotic susceptibility test was carried out using the EUCAST breakpoints and guideline, 2021. Thirty-six (36) of one hundred and five (105) samples were Salmonella positive giving a prevalence rate of 34.3%. The sensitivity test indicated that out of the thirty-six (36) isolates, 3 (8.3%) were susceptible to Amoxicillin, 3 (8.3%) were susceptible to Ampicillin. Also 17 (44.7%) were susceptible to Chloramphenicol, 31 (86.1%) were susceptible to Ciprofloxacin. Moreover, 33 (91.7%) were susceptible to Ceftazidime, 28 (77.8%) were susceptible to Gentamicin and 25 (69.4%) were susceptible to Tetracycline. Therefore, carrots should be properly wash after harvesting on the farm before being sent to the market and appropriate treatment should be applied before consumption in order to reduce the risk of Salmonella infection.

## **MALDI-TOF application in national food safety laboratory for easy, rapid, accurate and cost-efficient food-borne pathogen identification at the veterinary services, Accra – Ghana**

**B. Kikimoto, B. Ouattara, B. Sasu, V. Sedor, H. Ashong, M. Wekem, L.A. Darko**

Matrix-assisted laser desorption ionization-time of flight mass spectrometry (MALDI-TOF MS) has recently emerged as one of the most powerful tools in many well established food safety or Clinical microbiology Laboratories either for the routine identification of food borne pathogens or clinical isolates. The use of the method in the national Food Safety Laboratory for Animal Health is shown to be more rapid, accurate and cost-efficient than conventional phenotypic techniques or molecular methods. The presentation shows the applicability of MALDI-TOF MS for routine identification of foodborne bacteria in the National Food Safety Laboratory for Animal



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Health of the Veterinary Services of Ghana, taking into consideration specific requirements of food microbiological laboratories and the food industry pertaining to the country. Results obtained through the application of MALDI-TOF MS on food samples such as honey, meat from slaughterhouses, poultry from live bird markets and fish from aquaculture farms in Ghana would be presented as evidence. As a developing country, it is not only very important to have such rapid and reliable identification tool for foodborne bacteria, but it is also of crucial importance for food processing and product quality to attain Sustainable Development Goal (SDG) 3, Ensure healthy lives and promote well-being for all at all ages.

## **Integration of Vitek Multi-Tof technology into a food safety microbiology laboratory for improved laboratory efficiency**

**P.B. Ellitson, A.L. Nseu, S. Shiindi**

Matrix-assisted laser desorption ionization–time of flight (MALDI-TOF) mass spectrometry (MS) has revolutionised the identification of microorganisms [1] and is starting to be integrated into routine food laboratories. MALDI-TOF MS systems advantages are fast and accurate identification of most microbial strains [1]. The Namibian Standards Institution (NSI) operates a food and water laboratory in Walvis Bay Namibia, which houses microbiology and chemistry laboratories [2]. Growth in the scope and volume of work of the NSI food laboratory necessitated the laboratory to streamline its laboratory operations and introduce technology to reduce workload and turnaround time. MALDI-TOF MS technology was identified as the suitable technology and commissioned in the Microbiology laboratory in 2014 [2]. This paper examines the road of implementation of the MALDI-TOF MS technology, the benefits of this technology and the constraints faced by a food safety microbiology laboratory serving regulatory agencies and the general market in the SADC region.

## **Study on the Microbial Load of Beans Flour in the South Western Region of Nigeria within 2020 to 2021**

**O.F. Makinde, C.U. Nwachukwu, I.J. Nwadinobi**

The importance of quality of what we consume cannot be over emphasized because access to sufficient amounts of safe and nutritious food is key to sustaining life and promoting good health. Unsafe food containing harmful bacteria, viruses, parasites or chemical substances causes more than 200 food borne diseases, ranging from diarrhoea to cancer. Food safety can be referred to as routines in the preparation, handling, and storage of food meant to prevent foodborne illness and injury from farm to factory to fork. Food products may encounter any number of health hazards during their journey through the supply chain. The safety of what we eat is threatened by numerous pathogens that cause a variety of foodborne diseases such as Coliform which can cause gastrointestinal upset and general flu-like fever, abdominal cramps and diarrhea. Staphylococcus aureus which can cause serious infections such as bloodstream infections, pneumonia. Escherichia coli, one strain of this can lead to kidney failure if not properly handled. Perhaps more worrisome fungal toxins that may be acutely toxic but may also have chronic sequences, such as teratogenic, immunotoxic, nephrotoxic, and estrogenic effects.

The aim of this study is to identify the major food microbial contaminants identified in the beans flour samples from the South West region of Nigeria within the year 2020 to 2021. 108 samples of packed beans flour were analysed within the period, the pour plate analytical method as described in ISO 17025:2017 was used.

The results of the microbiological analysis of packaged beans flour submitted for registration, the aerobic mesophilic bacteria colony count ranged from  $20 \times 10^1$  cfu/g to  $68 \times 10^1$  cfu/g to the approved limit of 1000cfu/g, yeast and mould colony count ranged from  $6 \times 10^1$  cfu/g to  $46 \times 10^1$ cfu/g to the approved limit of 100cfu/g, coliform colony count ranged from 0 to  $22 \times 10$  cfu/g to the approved limit of 0cfu , Escherichia coli ranged from less than 0 to  $8 \times 10$  cfu/g to the approved limit of 1000cfu to the approved limit of 0cfu/g, about 58 percentage were satisfactory, However, handling contribute to the increase of most of the micro-organism present in the processing of the products. Therefore proper packaging, personal hygiene practice and good manufacturing practices are recommended to guaranty beans flour available for human consumption are good and safe.

# POSTER ABSTRACTS

## Maize rhizosphere modulates the microbial community structure and functions to enhance plant health

A.O. Akanmu, S.P. Dlamini, A.E. Fadiji, O.O. Babalola

Metagenomics has been explored in investigating microbiome diversity. However, a paucity of information still exists in its application towards securing plant health. Hence, this study adopts the metagenomics approach to unravel the microbiome diversity and function associated with healthy (LI and MA) and Northern corn leaf blight (NCLB) infected (LID and MAD) maize rhizosphere in the maize growing field at Lichtenburg and Mafikeng, North-West province of South Africa. The extraction of whole DNA from the respective healthy and diseased rhizosphere soils was conducted and sequenced using shotgun metagenomics. A total of 12 bacteria, 4 archaea and 2 fungal phyla were found as predominant across the fields with the use of the SEED subsystem database. The most predominant bacteria phyla included Proteobacteria, Dienococcus-Thermus, Gemmatimonadetes, Chlorobi, Cyanobacteria, Planctomycetes, Verrucomicrobia, Acidobacteria, Firmicutes, Chloroflexi and Bacteroidetes. Archaea consisted of Euryarchaeota, Thaumarchaeota, Crenarchaeota and Korarchaeota, while Ascomycota and Basidiomycota were the dominant fungal phyla. The healthy rhizosphere was dominated by 24 functional categories, while the NCLB infected rhizosphere was dominated by 4 functional categories. Microbial abundance and functional diversity were higher in the rhizosphere of healthy maize (LI and MA) rhizosphere as compared to the NCLB diseased (LID and MAD), in the order LI > MA > LID > MAD. The alpha diversity index evaluated in the healthy and NCLB infected maize rhizosphere of both taxonomic and functional levels showed no significant ( $p > 0.05$ ) difference in the abundance of the microbial community and functions, while beta analysis produced a significant ( $p=0.01$ ). Taken together, the study revealed that the abundance of microbial diversity and their functions influence the potential of the maize rhizosphere microbiome to modulate microbial functions toward managing and sustaining plant health.

## Detection of microbiological contaminant in yogurt, cheese and ham Asmara, Eritrea

T. Mokonnen

Microbiological contaminant in milk and meat product is often found and have impact on the consumer health and economy. This study focus on detection of microbiological contaminant (coliform count, staphylococcus auras count, mould count and total count) in four milk and meat processing plant in the Maekel region of Eritrea from January-March 2020 categorized in to four periods. Microbiological contaminants in cheese, yogurt and Ham were confirmed using colony count methods. Out of 8 cheese, 16 yoghurts and 8 ham analyzed samples during first three months of 2020. 8 samples (100%) of cheese and 8 samples (50%) of yogurt were identified with microbiological contaminants (out of standard) and 8 samples (100%) of ham were found within standard. The results showed that samples were out of standard (maximum limit) due to total count and mould count. From the four processing plant only one was showing the decrease in microbiological contamination in the yogurt sample, for the other processing plant corrective measure was taken by the regulatory body to comply with the requirements. The regulatory body continuous conduct inspection activities and technical advices to the processing plant. Presence of positive samples in processing plant must be taken in consideration to prevent human health. Further studies are needed to be done.

## Aflatoxin contamination of cassava dried root in northern Mozambique

I.T. Chabite

The high contamination level of foods with aflatoxin in the world represents a public health problem, seriously interfering on food system in African countries. In Mozambique, cassava represents a very important dietary source, especially for the population of the northern part of the country, so the quality and safety of this food becomes crucial. For this reason the study focused on research of aflatoxin contamination in dried cassava in this specific region of the country. In Nampula Province it was observed that the drying technique differed between inland and coastal regions, which influences the aflatoxin contamination rate on dried cassava. High total aflatoxin levels were found in Angoche district, with 75 ppb, which represent the coastal region of Nampula province and the lowest level of total aflatoxins contamination found in the districts of Ribáue, with 1.5 ppb, which represent the inland region of Nampula province.



# POSTER ABSTRACTS

## Temporal Trends in Mycotoxin Contaminations in Maize Supplied to Consumers in Eswatini

C. Dlamini, D. Earnshaw, Y. Assefa

Mycotoxin contamination of maize results in heavy economic loss and a potential risk for human being. The Eswatini population depends heavily on maize for nutritional needs. This commodity requires continuous monitoring and care from its site of production by smallholder maize producers and importers through to consumers along the marketing chains. Maize produced locally and imported from neighbouring countries is often contaminated with Mycotoxin, which, after ingestion, pose serious health hazard to the consumers. Mycotoxin can contribute to the causation of liver cancers, immune system disorders, and growth-related issues in children. Moreover, deaths in both humans and animals have also been reported after ingestion of Mycotoxin contaminated food. Although mycotoxin contamination is a major concern in Eswatini, to our knowledge, no study has been conducted on dietary mycotoxins in the country, mainly due to lack of advanced laboratory equipment, inadequate research funds, and limited surveillance systems and expertise. This study places the maize value chain into context, summarizes results of laboratory analyses of maize grain sample for Mycotoxin analysis in the years between 2020 and 2021 and presents the prevalence and diversity of Mycotoxin and discusses the present legislative regulation of maize quality implemented in Eswatini. Publishing results from this study will provide data on the prevalence and diversity of mycotoxin contamination in maize supplied to consumers in Eswatini, create awareness, and stir up interests in other researchers to investigate more on mycotoxin contamination of maize and other agricultural commodities supplied to consumers in Eswatini. There is a need to improve maize production and postharvest handling practices, which are the sources of Mycotoxin contamination in the maize marketed to the consumers in Eswatini.

## Occurrence, importance and control of mycotoxins: A review

B. Kebede

Mycotoxins are poisonous chemical compounds produced by certain fungi. There are five mycotoxins or groups of mycotoxins that occur quite often in food: deoxynivalenol/Nivalenol, zearalenone, ochratoxin, fumonisins and aflatoxins. The fungi that produce mycotoxins in food fall broadly into two groups: those that invade before harvest, commonly called field fungi, and those that occur only after harvest, called storage fungi. There are three types of toxicogenic field fungi: plant pathogens such as *Fusarium graminearum* (deoxynivalenol, nivalenol); fungi that grow on senescent or stressed plants, such as *Fusarium moniliforme* (fumonisin) and sometimes *Aspergillus flavus* (aflatoxin); and fungi that initially colonize the plant before harvest and predispose the commodity to mycotoxin contamination after harvest, such as *Penicillium verrucosum* (ochratoxin) and *A. flavus* (aflatoxin). The favourable conditions for mycotoxins production are instigated with poor hygienic conditions at the time of transportation and storage, high temperature and moisture content and heavy rains. Mycotoxins are distributed in different items such as animal feeds, cereal crops, leguminous plants and animal products. Concentrated animal feed stuffs harbour the highest level of mycotoxins. Noug cake and sorghum was warranted as the main source of aflatoxin contaminant among those concentrated animal feeds. Health effects occur in companion animals, livestock, poultry and humans because aflatoxins are potent hepatotoxins, immunosuppressant, and mutagens and carcinogens. Factors that affect mycotoxins production and contamination can be categorized as physical, chemical and biological. Therefore, African countries particularly Ethiopian governmental jurisdictions should implement and regulate level of mycotoxins in animal feed stuffs and human foods.

## Evaluation of the prevalence of Total and B1 aflatoxins in livestock feed produced by national companies and in livestock markets in Nouakchott, Mauritania

C. Abdelkader, C.T. Dedah, A.A. Val

Contamination of livestock feed by mycotoxins is a growing concern for public health and animal health. Indeed, it generates significant economic losses in livestock and also constitutes a real commercial barrier against the valuation and importation of animal products intended for human consumption. It is in this context that we studied the contamination by Total aflatoxins and Aflatoxin B1 (AFT and AFB1). In food marketed in the livestock markets of Nouakchott For this, a total of 80 cereal samples were taken from the various points of sale at the livestock markets of Nouakchott. The determination of aflatoxins was made by Elisa and HPLC techniques.

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The analysis results obtained by the Elisa technique showed that respectively 40%, 36%, 50% and 64% of the samples analyzed of soft wheat, wheat bran, sorghum and corn are contaminated with Total aflatoxins. Also, contamination by aflatoxin B1 was respectively in 48%, 21%, 50% and 64% of the samples of soft wheat, wheat bran, sorghum and maize. The dosage of the positive samples by HPLC-FLD technique confirmed the contamination of 13% of the samples by aflatoxins (AFT and AFB1). Indeed, this study could be a database for veterinary services and public health services to prevent the harmful effects of aflatoxins on animal and human health in Mauritania.

## **Risk assessment of aflatoxin content in selected foodstuff in the Ghanaian market basket: a case study in GA East district**

**P.A. Dontoh, W.O. Ellis, A. Incoom, C.B. Osei**

The study was carried out in the Ga East district of the Greater Accra region in Ghana to assess the aflatoxins (AF) content in staple commodities on the Ghanaian market food basket and the risk level associated with the consumption pattern to consumers. AF levels were determined on ten (10) commodities from the survey that were prone to contamination using the high-performance liquid chromatography (HPLC) method. The risk associated with consumption of these commodities was determined using the probabilistic approach from the consumption data collected, exposure frequency and duration as well as weights of the respondents on the @ Risk software. The results showed low levels of total AF for gari, cassava dough and rice in the ranges of 0.2-1.0µg/kg, 0.4-1.9µg/kg and 0.4-3.4µg/kg respectively. These commodities had mean for aflatoxins B1 to be 0.07µg/kg, 0.00µg/kg and 0.46µg/kg respectively. Chilli powder, melon seeds (agushie) and corn dough recorded relatively higher total AF levels in the ranges 0.4-11.3µg/kg, 0.4-47.3µg/kg and 1.4- 73.6µg/kg respectively. However, ginger, raw maize, groundnut paste and raw groundnut had relatively very high total AF levels in the ranges 0.6-248.4µg/kg, 1.0-290.2µg/kg, 32.5- 438.7µg/kg, and 0.1-696.1µg/kg respectively. The chronic daily intake determined was 4ng/kg/day. The risk for hepatitis B positive individuals was 1.16, that for hepatitis B negative individuals was 0.038 and that at 25% prevalence of hepatitis B of the whole population was 0.32. This implies that 3 out of every 100 people are at risk of developing hepatocellular carcinoma (HCC). The risk associated with the consumption of commodities contaminated with aflatoxins in some of the commodities in the food market basket is high spurring the need to increase consumer awareness and sensitization.

## **Aflatoxins in Food and Feed in South-West Nigeria**

**M.C. Onwuka, T.G. Adebisi, C. Nwachukwu**

Mycotoxin contamination of foods and feeds remain a great challenge to food safety, public health and economic significance. Mycotoxins occur in various foodstuffs, from raw agricultural commodities to processed foods with varying impacts on food processing. The major group of mycotoxins that contaminate foods and feeds include aflatoxins, fumonisin, patulin and ochratoxins. Several studies conducted to reveal the metabolism of mycotoxins in the body are reviewed. Health implications of mycotoxins upon consumption of adequate doses are diverse. These include sub-acute mycotoxicosis, immune suppression, carcinogenicity, genotoxicity, morbidity and mortality in animals and humans as well as interaction with nutrient assimilation. Mycotoxin contamination of foods has a tremendous effect on international trade, resulting in huge losses. There are regulations, though not in all countries, aimed at preventing and controlling mycotoxins; in some countries, such regulations deal with industrial or processed foods and those meant for exports. Foods sold in the local markets are usually not regulated in terms of mycotoxins. A number of strategies for preventing mycotoxins have been proposed in Nigeria but the awareness for implementation is very low. The use of media to create awareness is therefore a viable option.

The National Agency for Food and Drugs Administration and Control (NAFDAC) in Nigeria is the regulatory body charged with the responsibility of regulating and controlling imported and locally processed foods, drugs and bottled water. NAFDAC therefore ensures that food supplied to the consumer is wholesome and of good quality. The NAFDAC mandate includes the coordination of the evaluation of foods and feeds for mycotoxins to ensure that safe foods are available for public consumption. Annually, the mycotoxin laboratory tests over 2000 samples of food and feed, consisting of nuts and nut products, cereals and cereal products, dried fruits, spices and seasonings, tea, coffee, cocoa and cocoa products, etc. Aflatoxins are monitored using the ELISA technique of Agraquant proprietary method for



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screening. Confirmation of positive samples are done using the High Performance Liquid Chromatography (with Fluorescence Detection). Using 2021 samples as a case study, a total of two thousand, seven hundred and seventy six (2,776) food and feed samples were tested for total aflatoxins, out of which two thousand, five hundred and ninety six samples (2,596) or (93.52%) were positive, while eighteen (18) or (36%) were above the regulatory limit using the HPLC technique. In general, cereal and cereal products constituted the highest number of samples analysed, and 96.78% compliance was observed for the samples.

## **Design of molecularly imprinted polymer materials for the selective extraction of mycotoxin (Patulin) present in food products**

**A. Anene, S.B. Aissa, Y. Chevalier, M. Rebhi, S. Hbaieb**

Since the discovery of aflatoxins in the 1960s, many countries have adopted regulations to protect consumers from the harmful effects of mycotoxins that can contaminate food, as well as to ensure fair practices in food trade. Various factors play a role in decision making processes regarding the setting of limits for mycotoxins. These include scientific risk assessment factors, concentration of mycotoxins in products, and methods of analysis [1].

This paper focus on the case of Patulin, a toxic mycotoxin produced by numerous species of filamentous fungi.

Recent developments have demonstrated that molecularly imprinted polymers (MIPs) had high selectivity and good affinity toward Patulin [2-4]. A molecular imprinting method is based on the polymerization of a functional monomer and a cross-linker around a template molecule [5] (Figure 1).

In this work, MIPs prepared using two functional monomers of very different reactivity in radical polymerization to investigate the criteria for the optimum choice of the functional monomer. MIPs were made of cross-linked poly (methacrylic acid) or poly (maleic acid) bound as thin films to a silica solid support. E-glycol dimethacrylate was the cross-linker. Calculations of the composition drift of the copolymer material from monomers reactivity ratios gave new insights into the control of MIP properties by the choice of the functional monomer. As a consequence of the lower reactivity of maleic acid than methacrylic acid for copolymerization with methacrylic esters, the incorporation of maleic acid is low, the cross linking density is very high, the polymer coating is very thin, and the specific area is high. The final structure of the MIP network with a predominance of isolated functional units closely surrounded by cross-links yields a rigid material capable of preserving the memory of the model molecule of patulin in molecular imprints.

## **Climate-correlated Aflatoxin Contamination of Maize and Groundnuts in Zambia**

**H. Njapau, B. Katati, J. Akello**

Aflatoxin contamination of food crops - common across the African continent, including Zambia – is environment dependent. It is a serious obstacle to several Sustainable Development Goals (SDGs); in particular ending hunger, achieving food security, and improving nutrition and health. Exposure to high doses of aflatoxins causes serious illnesses such as acute liver cirrhosis and death. Chronic exposure may lead to nutritional (stunting) and immunological deficiencies, and liver cancer. In children under the age of five years, with stunting and HIV rates of about 30% and an HIV prevalence of about 10%, , exposure to aflatoxin can exacerbate the severity of these ailments in the Zambian population. Aflatoxin contamination is also a serious obstacle to the competitiveness of Zambia's maize and groundnuts in international trade. Income from trade in agricultural commodities has the potential for lifting millions of Zambian farmers out of poverty. We thus established a monitoring programme in order to determine patterns of aflatoxin contamination of maize and groundnuts across the various climatic regions of Zambia, and identified potential hotspots that would require concerted control measures in order to contribute to the national goal of ensuring safe and nutritious food, and access to premium markets for agricultural produce in order to enhance the wellbeing of the Zambian population.

To date we have determined the aflatoxin content of 355 maize and 182 groundnuts samples collected at harvest from all the three climatic regions of Zambia. In addition, we have analysed 75 postharvest maize samples for aflatoxin. Overall 5.6% of maize and 40.1% of groundnuts samples contained aflatoxin above the

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minimum permissible levels in Zambia (10 µg/kg). Of the violative samples, 5.3% of maize and 26.7% of groundnuts contained aflatoxin above 100 µg/kg. Regionally, aflatoxin contamination prevalence was higher (11.1% maize and 40.9% of groundnuts) in the hotter and drier (< 800 mm rainfall per annum (p.a) and average 30 – 36 oC) southern part of the country (Region I; AEZ-1) than in the wetter and cooler (> 1100 mm rainfall p.a. and average temperature 30 – 32 oC) northern part of the country (4.2% maize & 30.0% groundnuts) (Region III; AEZ-III). Similarly, aflatoxin levels in violative samples were much higher in AEZ-I (11.2 – 329 µg/kg in maize & 16.2 – 6,095 µg/kg in groundnuts) than in AEZ-III (10.2 – 104.3 µg/kg in maize and 11.5 – 4,340 µg/kg in groundnuts). Notwithstanding the observed climatic regions patterns, specific hotspots that require concerted aflatoxin control efforts in maize are Kazungula in AEZ-I; Petauke in AEZ-II and Samfya in AEZ-III. Similarly Sesheke and Mambwe in AEZ-I; Chibombo and Lundazi in AEZ-II; and Serenje in AEZ-III will require closer groundnuts aflatoxin contamination monitoring. When compared to liver cancer rates there appears to be close correlation between exposure to aflatoxin and the cancer rates.

## **Effects of supplementing different levels of vitamin a to aflatoxin B1 contaminated diets on the performance of broiler chickens**

**J.F. Chibanga, D. Banda-Nyirenda, J. Simbaya**

This study was conducted to evaluate the effects of supplementing different levels of vitamin A on the performance of broiler chickens fed on diets contaminated with aflatoxin B1 (AFB1) for 42 days. Conducted as a Completely Randomised Design, the study had 5 treatments, 3 replications and 10 chicks per experimental unit. Control/Treatment A had no AFB1 and vitamin A added. Other dietary treatments were contaminated with AFB1 at 35µg/kg. Except for Treatment B, the rest were supplemented with vitamin A at 3000, 6000 and 11000 IU/kg, respectively. In the Starter Phase, AFB1 significantly ( $P \leq 0.05$ ) reduced feed intake, bodyweight gains and feed conversion ratios. However, in the Grower and Finisher Phases, only bodyweight gains and feed conversion ratios were reduced. This affected final bodyweights and dressing out percentages, where those fed on contaminated diets performed poorly compared to those on Control diets. It was noted that performance of chickens improved significantly with increasing levels of vitamin A supplementation. The toxic effects of AFB1 on feed intake were ameliorated by dietary supplementation of vitamin A at 6000 IU/kg and above. However, amelioration of the deleterious effects of AFB1 on bodyweight gains and feed conversion ratios was achieved when vitamin A was supplemented in the diets at 3000 IU/kg. Levels of AFB1 contamination used in the current study did not cause any death. Contamination of broiler diets with AFB1 also significantly ( $P \leq 0.05$ ) decreased serum concentrations of total protein, albumin, triglyceride and cholesterol. Feeding AFB1- contaminated diets also increased the serum concentrations of alkaline phosphatase, aspartate aminotransferase and alanine aminotransaminase. However, the serum concentrations of alanine aminotransaminase normalized when feed diets were supplemented with vitamin A at 11000 IU/kg. It was thus, concluded that supplementation of vitamin A to AFB1- contaminated rations has capacity to reduce toxic effects of AFB1 in broiler chickens.

## **Convenient Food Safety Testing Technologies: Ensuring food safety in the food production value chain**

**N.R. Dlamini, A. Skepu**

The Food Safety Programme at the Council for Scientific and Industrial Research (CSIR) leverages internal capabilities across the clusters. Food safety is a multidisciplinary field, and the focus at CSIR includes food safety testing and regulatory compliance, production of pure mycotoxins to be used as standards and developing locally produced, convenient on-site testing methods for mycotoxins and pathogenic bacteria. The CSIR Agroprocessing Group within the Advanced Agriculture and Food Cluster works with small and medium enterprises involved in food processing and helps in food product development from locally sourced and indigenous ingredients. The product development process includes quality evaluation of the ingredients and newly developed products for regulatory compliance, and the important aspects are microbial safety, nutritional quality, and shelf stability. The Group also investigates the safety of novel food ingredients such as alternative protein sources from indigenous biodiversity. The Food Safety Group has accredited facilities to produce high purity mycotoxins, using CSIR's proprietary methods. The purified mycotoxins can then be used as standards for food safety testing. There is constant improvement in the production methods to ensure safety of personnel and high quality of the products. The Group is also collaborating on projects that will improve access to food testing facilities by establishing food safety and quality testing mobile laboratories which will leverage on-site testing technologies that are being developed at CSIR. The Next Generation Health Cluster at CSIR has capabilities in developing on-site



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rapid test kits for the detection of mycotoxins and pathogens of concern in food safety. The food safety initiatives at CSIR are supported by Department of Science and Innovation, Technology Innovation Agency and Gauteng Department of Agriculture and Rural Development. A pilot feasibility study of having an accredited food testing mobile laboratory in the SADC has been funded by the World Trade Organisation.

## **Assessment of Aflatoxin and Fumonisin Contamination Levels in Maize and Mycotoxins Awareness and Risk Factors in Rwanda**

**M. Niyibituronsa, C. Mukantwali, M. Nzamwita, G. Hagenimana, S. Niyoyita, A. Niyonshima, C. Hakizimana, L. Ndilu, G. Nyirahanganyamunsi, E. Nkurunziza, P. Sendegeya, G. Niyonteze, J.C. Muhutu, J.B. Shingiro, J. Umuhire, C. Nyirahorana, A.C. Ingabire, A. Nyiranshuti, E. Sibomana, M. Usabyembabazi, E. Munganyinka, A.P. Gasana, I. Kamaraba, J.C. Izamuhaye, E. Nkundanyirazo, C. Ngaboyisonga, C. Bucagu, P. Karangwa**

Mycotoxins are secondary metabolites of fungi that are toxic to humans and animals when consumed in contaminated food and feed. The Rwandan climate conditions like steady temperature and sufficient rainfall favor the growth of fungi leading to high probability of mycotoxins contamination. Mycotoxins get into maize throughout the value chain from the field to processed products. Maize is promoted in Rwanda under the Crop Intensification Program (CIP), for nutrition and food security. The aim of the study was to evaluate mycotoxins (Aflatoxin and fumonisin) levels in maize and assess awareness and factors associated with mycotoxin contamination in Rwanda. Maize samples (227 kg) from season B 2019 were collected in 15 Districts in five provinces of Rwanda after an interview with a representative of the household or cooperative using a structured questionnaire. The samples were analyzed for aflatoxin and fumonisin using Reveal Q+ and AccuScan Gold Reader. From the interview, most of the respondents were not aware about aflatoxin (59.7 %) and 99 % did not know the effect of mycotoxins on human health. The average of aflatoxin contamination in surveyed districts was  $6.69 \pm 13 \mu\text{g/kg}$ . In general, 90.4 % of samples scored below the limit of aflatoxin level regulated in East Africa/Kenya regulation standards ( $10 \mu\text{g/kg}$ ). The levels of aflatoxin ranged between 0 and  $100.9 \mu\text{g/kg}$ . The means aflatoxin levels within districts ranged between  $1.36 \pm 0.5 \mu\text{g/kg}$  and  $13.75 \pm 25 \mu\text{g/kg}$ . Among 9.6 % of the samples containing aflatoxins above the EU and Kenyan regulations standard limit, 5.7 % were above the US standards of  $20 \mu\text{g/kg}$ . Within clusters, the level of aflatoxin more than  $10 \mu\text{g/kg}$  was 5 %, 7 % and 18 % for stores, household and market samples, respectively. From the study, as mechanical damage of grains, moisture content of grains and the temperature of the store house increased, Aflatoxin level also increased. Fumonisin analyzed in maize ranged from 0 to  $2.3 \mu\text{g/g}$  and only one sample from market showed a slightly higher level of fumonisin than the EU and US limit of  $2 \mu\text{g/g}$ . More effort for aflatoxin mitigation is needed at the market level. Farmers need to be aware and taught how they can improve their agricultural system and more knowledge on mycotoxin control is needed. The results point to appropriate measures to recommend for control of mycotoxins in Rwanda and awareness creation.

## **Mycotoxins incidences and interventions in Kenyan food and feed technologies and platforms**

**J.N. Ndung'u, L. Wasilwa, A. Muiruri**

Mycotoxins mainly aflatoxins and fumonisins are toxic fungal metabolites naturally found in food and feed as contaminants during pre and post-harvest periods contaminating key food staples in Kenya, causing recurring acute and chronic public health problems. Kenya is possibly the only region in the world where mycotoxicosis outbreaks has impacted mankind the most in terms of health and in economy platforms due to consumption of cereals like maize. Assessments have found high aflatoxin and fumonisin exposures in adults and children in Kenya while recently epidemiological studies have linked these exposures to health problems like impaired child growth and loss of human life.

Strict regulations on the concentrations of aflatoxins allowed in food and feed exist in Kenya through the technical standards developed by KEBS to monitor contaminations. The applications has though been hampered by loopholes in implementing regulations resulting in the consumption of dangerous concentrations of aflatoxins. A prerequisite to developing viable solutions for managing aflatoxins is understanding the geographical distribution and severity of food and feed contamination, and the impact on lives.

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This review discusses the scope of the aflatoxins problem and management efforts by various players in Kenya. Economic drivers likely to influence the choice of aflatoxins management options include historical adverse health effects on humans and animals, cost of intervention for mitigation of aflatoxins, knowledge about aflatoxins and their impact, incentives for aflatoxins safe food and intended scope of use of interventions. It also highlights knowledge gaps that can direct future management efforts. These include sparse documented information on human exposure, few robust tools to accurately measure economic impact in widely unstructured value chains, lack of long-term impact studies on benefits of aflatoxins mitigation, inadequate sampling mechanisms in smallholder farms and grain holding stores/containers, overlooking social learning networks in technology uptake and lack of in-depth studies on an array of aflatoxins control measures followed in households.

Additionally, the review proposes improved linkages between agriculture, nutrition and health sectors to address aflatoxins contamination. Sustained public awareness at all levels, capacity building and aflatoxins related policies are necessary to support management initiatives.

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# [ POSTER ABSTRACTS ]

## **A preliminary assessment of consumer's exposure to pesticides residues in tomatoes in Zimbabwe**

**T. Matyora, K. Chipere, K. Mushore**

The aim of the study was to assess the level of pesticide residues in tomatoes grown in the Zimbabwe. A total of 100 samples of tomatoes from vegetable vendors, shops, farmers and popular vegetable markets were sampled and analysed. This was done by using a gas chromatography–mass spectrometer mass (GC-MS) and liquid chromatography mass spectrometer (LC-MS/MS) a multi-residue method to analyse 150 different pesticide types. The results from the study indicated that more than half of samples (55 %) of the samples contained 29 pesticides, in which 1 was a metabolic product, 2 pesticides are banned in Zimbabwe. 11 of the pesticides were not registered to be used in tomatoes but other crops like citrus, cotton and ornamentals. The pesticides included acephate, bromopropylate, chlorfenvinphos, fenbutatin oxide, flusilazole, profenofos, spirodiclofen and tetradifon. Omethoate is not registered in Zimbabwe. 2 of the pesticides are classified as highly hazardous pesticides (HHPs), these are methamidophos and a persistent organic pollutant DDT which are banned in Zimbabwe and most countries. DDT is only be used for indoor residual sprays (IRS) for malaria control only, it must not be used in agricultural production. All the results ranged from 0.01 mg/kg to 0.953 mg/kg. No samples exceeded the CODEX maximum residue levels (MRLs) but 49 MRLs of other countries which Zimbabwe exports or has potential were exceeded. The preliminary results of this study provided essential information on the present pesticide contamination status of tomatoes in Zimbabwe. The results are lower than the CODEX MRLs but of great concern is the detection of extremely toxic pesticides like methamidophos and DDT. This can be considered a serious public health concern. The other serious issue is the use of unregistered pesticides for the commodity. There is urgent need for continuous training of farmers concerning judicious use of pesticides and the monitoring of pesticides residues.

## **Exposure assessment of the Kenyan population to pesticide residues through vegetable consumption**

**P.M. Kamuti**

The output of a pesticide residue surveillance program (detection frequency and number of exceeding measures) can lead to unnecessary concern among consumers since they lack information concerning the actual exposure. In this study, the exposure to pesticide residues through vegetable consumption is evaluated based on the 2011-2016 pesticide residue surveillance data of the Kenya Plant Health Inspectorate Services (KEPHIS).

The results indicated that maximum consumers of kales exposure to residues was between 2 to 71 times higher than the corresponding acceptable daily intake (ADI) for the pesticides studied for the total population while for tomatoes consumption only chlorpyrifos exposure was more than 2 times higher than the ADI. However, it was demonstrated that cooking reduced the exposure by an average of 90%. For the probabilistic exposure, results indicated that the exposure of the consumers and the general population (adults) was generally under control even at high or frequent consumption of vegetables. For most of the pesticide residues studied, the exposure is one hundred times lower than the acute reference dose (ARfD) and ADI. In the risk assessment, the results showed that occurrence of pesticide residues in vegetables could not be considered a serious public health problem. Nevertheless, an investigation into continuous monitoring and tighter regulation of pesticide residues in vegetables in the whole country is recommended. The risk assessment study, including the proposed mitigation measures, can be a valuable input for risk managers such as food safety authorities.

## **Pesticide Residues in fruits and vegetables under the Monitoring Programme from 2018 -2021 in Mauritius**

**H. Dowlut**

Farmers in Mauritius use pesticides to protect their crops from pests. Unfortunately, trace amounts of pesticides may remain in or on harvested produce. To monitor the level of pesticide residues in harvested fruits and vegetables as per the limits established by the Use of Pesticides Act (2018) a pesticide residue monitoring programme was carried out by the Food Technology Laboratory and the Pesticide Regulatory Office of the Ministry of Agro Industry and Food Security. Locally produced as well as imported fruits and vegetables were collected from 2019 to 2021 in markets and at farm gate level from different regions of the island and submitted to the laboratory for analyses. A total of 1912 samples were analysed using the QuEChERS method in combination with LC/MS/MS and GC/MS/MS, covering a broad spectrum of

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pesticides (about 160). Samples were considered violative if they contained a pesticide residue above MRL or they contained a pesticide residue not recommended for a commodity. For 2019, 13.1% samples were below MRL, 1.8 % were above MRL, 17.8% had non-recommended pesticides and 66.9% had no detectable residues. For 2020, 23.4% samples were below MRL, 3.3 % were above MRL, 10.9 % had non recommended pesticides and 63.7% had no detectable residues. For 2021, 22.3% samples were below MRL, 3.8 % were above MRL, 15.2 % had non-recommended pesticides and 60% had no detectable residues. Samples of lettuce, green beans, chinese cabbage and tomato had pesticide residues which exceeded the MRL values. Residues of pesticides that were mostly detected were acetamiprid, azoxystrobin, carbendazim, and metalaxyl. Pesticide residues were more commonly found in citrus fruits (mainly imported ones), sweet pepper, chilli and green herbs. Pesticide residues in imported fruits were below the MRL. Most non compliances in the locally produced fruits and vegetables were due to the use of non-recommended pesticides.

## **Agriculture, pesticide analysis and the importance of proficiency testing: An African perspective**

**L. Quinn, C. Swiegelaar, D. Mkhize, N. Nhlapo, D. Claasen, D. Prevoo-Franzsen, M. Fernandes-Whaley**

Agriculture is an essential sector for many African countries, not only to ensure food security, but as a main contributor to gross domestic product (GDP). Furthermore, in some African countries up to 80% of total employment is focused within the agricultural sector. Much of the economic value is directly linked to export outside the African continent. To secure the export market, it is important that laboratories in the African region are competent as testing the commodities to demonstrate that the regulatory requirements of their selected export products are met. This can be challenging, as these requirements evolve with changes to the current scientific knowledge. In many cases the maximum residue levels (MRLs) are decreasing, or new generation pesticides are less chemically stable, making the measurements more challenging. One-way to ensure the quality of the measurements is to continuously participate in proficiency testing schemes (PTSS). These schemes can be tailored to assist with risk assessments when considering changing the MRLs for a specific crop category or reacting to implemented regulatory change. This approach has been applied in South Africa in co-operation with growers' associations and other interested parties. Tailored proficiency testing schemes are also a very useful tool for new laboratories where the precise needs can be addressed such as covering the full scope of analytes measured in one PT. The only drawback being the short shelf-live of such PT materials, as many pesticides are not stable and are especially sensitive to interactions within groups. This paper will reflect on the importance of running a successful PTS for pesticides in fruit towards a stable and effective quality infrastructure, highlighting the lessons learnt and possible areas for concern.

## **Method development for the quantification of pesticides in raw food items from local markets in Mozambique**

**S.L. Muiambo, N.J. Gulamussen , E.F.C. Chauque, I. A. Nyambe, L. Chimuka**

The use of pesticides in agricultural activity has become a common practice in modern society due to their action as pest controllers. However, most pesticides are persistent and cause public health problems ranging from changes in the endocrine system to the development of chronic diseases such as cancer. Since food is one of the routes of entry of these compounds into the organism of animal species including man, a knowledge of the concentration levels of these compounds in common foodstuffs such as vegetables has become imperative. Hence, the present work sought to develop and optimize the quick, easy, cheap, effective, rugged and safe (QuEChERS) technique using the moringa seeds protein as a renewable natural absorbent. Recovery tests were carried out using standard solutions of pesticides p'p-DDT, p'p-DDD, profenofos, cypermethrin and lambda-cyhalothrin. The extraction was done using acetonitrile: methanol (90:10) combination, respectively, and the analysis carried out on a GC-MS (Agilent 7820A), using a separation column (HP 5MS UI: 30 m x 250 µm x 0.25 µm) and helium mobile phase 99.9999%. The analytical recoveries ranged from 86-108% for p'p DDT, 84-94% for p'p-DDE, 104-107% -HCH, 74-110% for -HCH, 69-90% for cypermethrin, 80-94% for profenofos, and 81-114% for 4-Nonylphenol. From these results, it can be concluded that the tested extraction method was efficient for the pesticides investigated considering the open literature suggesting recoveries of 70-120% as optimal. Sample analysis of raw food items including kale, cabbage, tomatoes and fish from the local open markets in Mozambique using the pristine and modified QuEChERS method are currently ongoing.

# [ POSTER ABSTRACTS ]

## **Determination of Pesticide Residue in Soil and Groundwater of Gezira Scheme, Sudan**

**A.M.A. Hammad, R.I.Y. Ali, A.O. Abdelbagi, A.E.S.A. Ishag, A.O. Mohamed, J.H. Hur, M. Laing**

The present study aimed at investigating the level of pesticide residues in soil and water samples from different locations in Gezira Scheme, Sudan, an area known for heavy pesticides use since early 1950s. Eighteen soil and nine water samples were randomly collected from different sites in Gezira Scheme and mixed thoroughly to make composite samples (1 kg or one liter each). The results revealed the presence of OCs (lindane, o-p' DDT, endrin, aldrin, dieldrin,  $\alpha$ -endosulfan), OPs (profenofos, malathion, chlorpyrifos), and the plant growth regulator (ethephon) in soil and water samples. Lindane, o-p' DDT, and profenofos were detected in all soil samples, while the rest were detected in some samples. The pesticide residues detected were higher in north Gezira, except the  $\alpha$ -endosulfan, which was highest in south Gezira Scheme. The levels of endrin, malathion and chlorpyrifos were relatively low in soil samples. Violative levels ( $>$  Codex MRLs) of lindane and o-p' DDT were detected in all water samples (100%); followed by profenofos (80%) and ethephon (20%). The levels of endrin, aldrin, dieldrin,  $\alpha$ -endosulfan, profenofos, and malathion in the water samples were below the detection limits.

## **Use of Standards Enhancement and Increase of Participation of Private Sector in their Development**

**A. Issufo, A. Chionisse, G. Mabjaia**

The topic of the participation of the different parties interested in the standardization process is quite relevant, due to the high need that the country has in the process of elaborating Mozambican standards. So that there can be a contribution at the country level in this process. Having as gains the quality of the standard produced, greater contribution from all interested parties, greater dissemination of information and greater gain for the industry.

## **Development of methods and matrix certified reference materials for toxic and nutritional elements in food**

**A. Botha**

The Inorganic Analysis laboratory supports the Reference Material programme of the National Metrology Institute of South Africa (NMISA) with the development of accurate quantification methodologies and the production of matrix certified reference materials (CRMs) for toxic and nutritional elements in food matrices. The focus of the projects is on the production of CRMs for food matrices that are unique to the African continent or would support the export of African food products to the rest of the world.

In 2021, the laboratory launched its first matrix CRM for toxic and nutritional elements in wheat flour (NMISA CRM006) with certified values for fourteen (14) elements, including Ca, Cd, Co, Cr, Cu, K, Mg, Mn, Mo, Ni, P, Pb, S and Zn and information values for Fe and Na. In 2022, the laboratory will complete the projects for the production of a matrix CRM for toxic and nutritional elements in white maize and a second matrix CRM for toxic and nutritional elements in cocoa powder.

The laboratory is also expanding its measurement capabilities into speciation analysis using ion chromatography (IC) coupled to inductively coupled plasma mass spectrometry (ICP MS). A method has been developed for arsenic speciation in grains and is currently being expanded to arsenic species in fish and seafood. The laboratory is also developing methods for selenium speciation analysis in soils, vegetation and maize with a PhD-project involving a life cycle study on selenium covering three regions in South Africa [1].



# [ POSTER ABSTRACTS ]

## **Providing Proficiency Testing Schemes for Elemental Content in a variety of Food Products: Highlights and Lessons learned**

**S.M. Linsky, D. Prevoo-Franzsen**

During 2018, the National Metrology Institute of South Africa (NMISA) responded to industry requests to coordinate a proficiency testing (PT) scheme to provide an independent assessment of the measurements capabilities of laboratories to measure sodium in response to the mandatory local regulations aimed at the reduction of the sodium content in processed foods. In this proficiency testing scheme, which ran over a period of a year, the NMISA coordinated six studies, covering the main food commodities targeted in the regulations. To ensure maximum benefit to the participants, additional parameters such as nutritious and toxic elements were added as additional parameters for analyses as the PT progressed. After the completion of these PT rounds, the NMISA has since coordinated several other PTs in the area of elemental content in food. Thus far, cereal type of food matrices such as wheat, maize, soya, and cocoa has been the focus of attention, with plans to expand this into other relevant matrices.

Here, results from these PTSs will be shown, illustrating some of the lessons learned in the process along with some success stories. This includes important aspects such as sample homogeneity and the advantage of having externally assigned reference values.

## **Development of Analysis Methods to Determine the Protein and Amino Acid Composition of African Staple Foods Towards Evaluating Their Nutritional Value**

**V. Chiloane, P. Motshwene, D. Prevoo-Franzsen**

Cereal grains are important sources of energy, nutrition and income in Sub-Saharan Africa as they are more accessible compared to animal sources of food. This work therefore sought to develop and implement analytical methods to characterise the crude protein and amino acid composition of five major African staple foods (maize, sorghum, corn-soya, teff, and cassava), as well as to assign reference values for fit-for-purpose reference materials. A 72-h hydrolysis method was successfully optimised and validated to determine acid-stable amino acids. A separate analysis method was also established for the sulphur-containing amino acids methionine and cysteine. The method included performic acid oxidation, followed by acid hydrolysis at 145 °C for 4 h. Hydrolysates were analysed by UHPLC-UV and recoveries between 87% and 117% were obtained.

Staple foods were thus analysed with the optimised methods and the results showed the sum of amino acids was 12.6 g/100 g in corn-soya, 11.5 g/100 g in sorghum, 9.29 g/100 g in teff, 8.16 g/100 g in maize, and 0.660 g/100 g in cassava. These findings matched with crude protein values obtained in this study using an independent Dumas combustion method. Corn-soya had the highest composition of essential amino acids, followed by sorghum and teff. The results for corn-soya are not surprising as the preparation is distributed by food aid initiatives to combat malnutrition. Sorghum and maize showed low concentrations of the limiting amino acids lysine and methionine. Cassava revealed poor concentrations of all amino acids providing evidence the food source cannot reasonably meet nutritional demands. A detailed description of the optimised methods employed, together with a comparison of the protein and amino acid content of these staple foods will be presented.

## **The gap between standards issued by African countries and the International Codex Alimentarius Commission - Egypt's experience in complying with international codex standards and economic return**

**R.M. Sayed**

Members use Codex standards to ensure safe, good quality food to their citizens. By introducing legislation and regulation that is consistent with Codex standards and guidelines governments may reduce the risk of being brought before a WTO Disputes Panel. A Government can adopt its own level of protection, e.g. go beyond or stop short of Codex. If a government chooses a higher level of protection, and in the event of a trade dispute, it may be required to justify the sanitary measure corresponding to its chosen level of protection on scientific, health, or other legitimate grounds. In many countries, most food legislation is already consistent with Codex.

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The compatibility of the Egyptian standard with the international codex standards to an increase in the confidence of consumers and importers in the Egyptian standard products and an increase in the economic return. Moreover, in the absence of Egyptian standard specifications for some products, these imported products can be entered if they conform to the international codex specifications.

Egypt received many notifications from African countries that are not compatible with the international codex standards, which hinders the movement of trade between countries and Egypt attaches the need to follow the international codex standards.

## **Production of Proudly (South) African Mycotoxin Certified Reference Material Calibration Solutions**

**D. Prevoo-Franzsen, N. Nhlapo, M. Fernandes-Whaley**

Mycotoxins are organic contaminants released by fungi, present on various agricultural commodities. These toxins are extremely harmful and strictly regulated, thus their accurate quantification demands the use of reliable certified reference materials (CRMs) to enforce and verify products, protect populations, and avoid technical barriers to trade in food stuffs. The National Metrology Institute of South Africa (NMISA) has prioritised the production of the full suite of mycotoxin calibrators under ISO 17034 accreditation, that are traceable, affordable and more accessible to food and feed testing laboratories on the continent to support the aims and visions of the African Continental Free Trade Agreement (AfCFTA). These mycotoxin CRM calibration solutions are prepared by NMISA from well characterised, high purity, crystalline material, sourced locally. Traceability to the SI units through the amount of substance (mass fraction concentration mg/g) is performed in-house. Due to the high cost associated with these crystalline materials, the indirect or “mass balance” approach [1] to quantify the impurities is not feasible as too much material is required to perform all the measurements, therefore the primary ratio, quantitative nuclear magnetic resonance spectroscopy (Q-NMR) analytical technique was employed to assign the purity of the main component [2].

An overview of the purity assessment, solution preparation, value assignment, homogeneity and stability assessment, and uncertainty estimates of the NMISA mycotoxin CRM calibration solutions will be presented together with results from the international benchmarking of some of these mycotoxin CRMs solutions [3,4].

## **Enhancing Food Preservation Using Irradiation Technology in Tanzania**

**R.A. Kawala, T. Swai, S. Mdoe, T. Mcharo, S.H. Mpombo, S. Mwaminga, E. Kahuluda, R.J. Mwamahonje, L.S.P. Busagala**

Domestic food production is barely sufficient to meet national food needs in Tanzania. But many households experience protracted periods of food shortage which necessitates the farmers to use various traditional food preservation methods to attain long shelf life. Instead of attaining the desired outcome many of the methods contributed to food loss and shorten the market life span of many food products.

In order to address the importance of nuclear technology in solving this problem, Tanzania Atomic Energy Commission (TAEC) proposed the use of irradiation as the alternative preservation method. TAEC conducted pre-and detailed feasibility studies between 2013 and 2021. The studies showed that, food companies, farmers and individuals use conventional or traditional methods for preserving foods, processing and storage.

During the period of study, the market analysis showed that the prime market for irradiation facilities will be attained in agricultural products mostly products used as food and phytosanitary. The projection of the irradiation technology revealed that savings in postharvest losses is possible with the technology at 20% of the consignment value irradiated and the value of local farmers gains is estimated at 15% of the consignment value irradiated.

The feasibility studies proposed the use of e-beam and x-rays as the source of the technology whereby utilization rate of 55% to 90% is assumed from the first five years of operation and the cost calculation per ton is estimated to be US\$25 of the crops to be irradiated. The annual throughput is expected at 59,960 tones and the implementation of the technology has a payback of 18 years based on the net income with positive based Net Present Value and Internal Rate of Return based on the 15 years of analysis. This indicates that using irradiation technology in food preservation may improve food safety and a potential to business community.

# [ POSTER ABSTRACTS ]

## **The total diet study in Senegal: Where do we stand**

**M. Ndiaye**

In Senegal, the possible effect of contaminated food is not known. This is due to the lack of populations' food consumption data as well as the levels of chemical contaminants for health risks assessment. The total diet study (TDS) is a chemical risk analysis tool. It consists of estimating populations' chemical exposure by combining food consumption data and their associated level of contamination. Then, this exposure value is compared to a toxicological value to determine whether this contaminant poses a risk to the population's health. After the risk has been assessed, risk management and communication plans can be developed to manage these risks. The objective of this brief is to provide information on the progress in Senegal and to seek support from regional stakeholders to run the TDS in Senegal. TDS is recognized by the World Health Organization (WHO), as the most cost-effective method to ensure that populations are not exposed to dangerous levels of chemicals. This TDS will enable Senegal to: improve knowledge on risks associated with chemical contaminants and to have a risk management and communication plan related to chemical contaminants in food.

## **Ultra High Performance Liquid Chromatography tandem Mass Spectrometric (UHPLC-MS/MS) Determination of Beta Agonists in Bovine Kidney**

**P. Gatyeni, O. Abafe**

A confirmatory method for the determination of  $\beta$ -agonists in tissue using UHPLC-MS/MS was developed and validated in accordance to standard protocol. In this method,  $\beta$ -agonists (Clenbuterol, Salbutamol, Ractopamine) were extracted from bovine kidney using a modified QuEChERS procedure.  $\beta$ -agonists were separated using a Kinetex 2.6 $\mu$  PFP 100 Å, 50 x 2.10 mm capillary column, followed by identification and confirmation using positive polarity electrospray ionisation (ESI) tandem mass spectrometry. Data were acquired using multiple reaction monitoring (MRM) acquisition mode. Both retention time performance and ion ratio were used as criteria for the confirmation of  $\beta$ -agonist. The regression coefficient of the six point matrix matched calibration curve was generally > 0.97 for all analytes. Decision limit, detection capability, recovery, within-laboratory reproducibility, robustness and stability fell within acceptable limits for all analytes studied. The suitability of the method was confirmed by participation in an international proficiency testing scheme with satisfactory results obtained. The method was successfully applied for the determination of  $\beta$ -agonist and Zilpaterol in commercially sourced bovine tissues.

## **Research of antibiotic residues in milk in the periurban zone of Ouagadougou 2020**

**L.H. Ouermi, S.H. Ouandaogo, I. Bougma**

Antibiotics used in animals are likely to be found in foodstuffs from these animals and constitute a risk to human health. The purpose of this study is to investigate antibiotic residues in milk from dairy farms in the peri-urban area of Ouagadougou. Raw milk is a complete food that provides consumers with essential nutritional elements, but it is likely to contain residues of veterinary drugs and more particularly antibiotic residues following preventive or curative treatments on animals and failure to respect the withdrawal period. From June to September 2020, we conducted a study on 34 samples of raw milk from farms located in the peri-urban area of Ouagadougou. On these samples, analyses at the Laboratoire National d'Élevage were carried out using a qualitative test, namely the premi-test. These analyses revealed the presence of antibiotic residues in 8.82% of the samples. These results show that milk contamination is a consequence of non-compliance with antibiotic use and misuse. The veterinary services of Burkina Faso should better control the sanitary and hygienic quality of foodstuffs of animal origin as well as the use of antibiotics in milk production farms and sensitize farmers on the risks related to the presence of antibiotic residues in consumed milk.



# [ POSTER ABSTRACTS ]

## Evaluation of Veterinary Drug Residues in Meat and Milk in Tunisia

**Z.A. Berriche, K. Nasr, M. Samaali**

Misuse of veterinary drugs generates residues in food of animal origin, particularly in meat and milk. These residues are responsible of various human health issues including immediate toxicities such as allergic reactions or longer-term health problems, such as cancer or disturbance of the human microbiota [1]. Antibiotic residues in meat and milk may also lead to the selection of bacteria with resistance characteristics [2]. Thus, detection of residues by effective and reliable analytical methods is important. The Charm II technique, which is a radioimmunoassay based on the use of radioactive markers, warrants consideration as a sensitive method for the detection of residues in animal origin foods at the recommended limits. This study aimed to screen antimicrobial residues in 49 samples of meat (bovine, ovine and poultry meat) and 28 samples of cow milk collected in Tunisia during 2018-2019, using the Charm II test. Among the 49 meat samples, 2 poultry muscles (4.1%) were suspected positive for tetracyclines, 6 poultry muscles (12.25%) were suspected positive for sulfonamides and 4 ovine muscles (8.16%) were contaminated with macrolides. No contamination with beta-lactams or streptomycin was detected. All cow milk samples were compliant for tetracyclines, sulfa-drugs, macrolides and aminoglycosides and only 2 out 28 samples (7.15%) were suspect positive for beta-lactams. This study's results highlight how important it is to set up effective national food control systems for veterinary drug residues.

## Validation of Charm II Test for Detection and Monitoring of Tetracycline Residues in Tunisian Meat

**M. Samaali, K. Nasr, Z.A. Berriche**

Misuse of veterinary drugs generates residues in food of animal origin, particularly in meat and milk. These residues are responsible of various human health issues including immediate toxicities such as allergic reactions or longer-term health problems, such as cancer or disturbance of the human microbiota [1]. Antibiotic residues in meat and milk may also lead to the selection of bacteria with resistance characteristics [2]. Thus, detection of residues by effective and reliable analytical methods is important. The Charm II technique, which is a radioimmunoassay based on the use of radioactive markers, warrants consideration as a sensitive method for the detection of residues in animal origin foods at the recommended limits. This study aimed to screen antimicrobial residues in 49 samples of meat (bovine, ovine and poultry meat) and 28 samples of cow milk collected in Tunisia during 2018-2019, using the Charm II test. Among the 49 meat samples, 2 poultry muscles (4.1%) were suspected positive for tetracyclines, 6 poultry muscles (12.25%) were suspected positive for sulfonamides and 4 ovine muscles (8.16%) were contaminated with macrolides. No contamination with beta-lactams or streptomycin was detected. All cow milk samples were compliant for tetracyclines, sulfa-drugs, macrolides and aminoglycosides and only 2 out 28 samples (7.15%) were suspect positive for beta-lactams. This study's results highlight how important it is to set up effective national food control systems for veterinary drug residues.

## Validation of Charm II Test for Detection and Monitoring of Tetracycline Residues in Tunisian Meat

**M. Samaali, K. Nasr, Z.A. Berriche**

To satisfy the growing demand of the world population for meat, veterinary medicines are increasingly used in livestock allowing increase in productivity. Nevertheless, antimicrobial residues in meat are associated with several human health problems [1]. Thus, effective national food safety systems to control antimicrobial residues in meat are necessary. The current Tunisian residue control programmes need to be strengthened with reliable methods. In this context, the radioimmunoassay Charm II warrants consideration as a screening test for antimicrobial residues in meat at the recommended MRLs [2]. It is based on the use of H-3 and C-14 labelled radiotracer compounds along with scintillation counter. This work aimed to validate Charm II test for tetracyclines detection in bovine, ovine and poultry muscle, based on the validation criteria defined in the decision of the European Commission 2002/657/CE. The false positive rate, all species combined, reached 5%. Thus, the test was applicable to beef, sheep and poultry meat regardless of the variety and origin of species. Additionally, no disturbance by other antibiotics was observed for the detection of tetracyclines in meat. The test seemed to be specific. The detection capability (CC $\beta$ ) was 100 ppb for oxytetracycline, tetracycline and chlortetracycline. The robustness of the test was also verified. Thanks to successful validations, Charm II test was implemented into the national control plan for antimicrobial residues

# [ POSTER ABSTRACTS ]

in meat. Muscle samples from the Tunisian markets and others as part of the Tunisian residue control plan were evaluated for tetracyclines presence with Charm II test. Only two out of 49 samples (4.1%) were suspected positive. The two suspected samples were poultry meat, reflecting that these drugs could be misused in poultry farming. Hence, Charm II test proved to be a cost-effective radio-analytical tool able to consolidate the efforts of the national residue monitoring network.

## **Antibacterial Drug Residues in Chicken Meat and Eggs from Farms in Selected Ugandan Districts**

**J. Kateregga**

There are reports of irrational veterinary drug use, which could lead to presence of residues in foods of animal origin. The WTO Sanitary and Phytosanitary Measures require of residues of veterinary pharmaceuticals in foods of animal origin are below maximum residue limits (MRLs). This study documented practices, knowledge, attitudes and perceptions of poultry farmers towards drug residues in foods of animal origin and determined the concentrations of the most widely used antibacterials in chicken meat and eggs sold at the farm gate.

This was a cross-sectional study. Selected poultry farmers in Wakiso, Masaka, Mukono and Lira districts were interviewed using semi-structured questionnaires about keeping of treatment records, knowledge and observance drug withdrawal periods as well as knowledge of dangers of residues to health and economy. Chicken meat samples from 97 farms and egg samples from 74 farms were collected at farm gate. Analysis of the samples for antibacterial drug residues was performed by LC-MS/MS with chloramphenicol as an internal standard. The chi-square test and binary logistic regression were used to determine which drug use practices were significantly associated with farmers awareness about withdrawal periods and dangers of residues to human health. Relationships with a p-value <0.05 were considered significant.

Most farmers are aware of drug withdrawal period but many are unaware of dangers that antimicrobial residues pose to human health and women are less aware than men ( $p=0.040$ , chi square). Farmers who had knowledge about WP were 2.11 times ( $p=0.024$ , logistic regression) more likely to know dangers of drug residues on health. Only 51.6% of the poultry farmers keep farm records about drugs administered and treatment outcomes. Only 38% of poultry farmers were of the view that farmers are responsible for supply of drug residue-free chicken meat and eggs. Sulfadiazine, enrofloxacin, doxycycline and tylosin were above detection limit in 40.7%, 17.6%, 67% and 66% of chicken meat and 13.6%, 21.2%, 63.8% and 66.7% of the chicken egg samples respectively. Furthermore, 12.4% and 8.4% of chicken meat and egg samples respectively had at least one antibacterial whose residue concentrations were above EMEA MRLs. Enrofloxacin was the most detected antibacterial and its residues were above the EMEA MRL in 10.3% of chicken meat samples.

These results show the need for a national food safety policy and a national food safety regulatory framework in Uganda. Government extension programs should sensitize of farmers about dangers of drug residues on human health and the economy and their responsibility in ensuring drug residue free foods of animal origin. Drug regulatory authorities should intensify surveillance of drug establishments to minimize access of certain drugs to farmers.

## **Determining the Presence of Macrolides, Sulphonamides and Tetracycline Antimicrobial Residues in Chicken Intestines from Informal Markets of Lusaka District of Zambia**

**G. Nchima, V. Naidoo**

Antimicrobial drugs are vital for treating, preventing, and controlling microbial infections in poultry. Despite these benefits, inappropriate antimicrobials use can result in the accumulation of residues in poultry meat which affect consumer health by triggering allergic reactions, autoimmune reactions, secondary infections, and carcinogenicity. While many countries manage food-borne residues through toxicological assessments, not all tissues consumed are considered. For example, intestines, which are a commonly eaten food either as a delicacy or for financial reasons are not screened. For this study, chicken intestines ( $n=100$ ) purchased from vendors in open markets in Lusaka District, were analysed qualitatively using the Charm II immunoassay technique for the macrolides, sulphonamides and tetracycline antimicrobials. Seventy-six (76) specimens were positive for the presence of either a macrolide, sulphonamide and tetracycline levels above the EU-MRL threshold for

# [ POSTER ABSTRACTS ]

muscle. Further breakdown showed that 51 had a single antimicrobial, 24 had two antimicrobials, and one had all three types of antimicrobials. Sixty-eight (68) samples had sulphonamides, 27 had tetracyclines, and eight had macrolide antimicrobial residues. There was a strong association between antimicrobial residues and samples collected from different markets ( $X^2=79$ ,  $df=57$ ,  $p\text{-value}=0.03$ ). Subsequent risk assessment showed a risk of the consumed antimicrobials being associated with a negative impact on gastrointestinal bacteria in children, adolescents and adults, which required further confirmation. In conclusion, detection of antimicrobial residues in chicken intestines suggests that poultry farmers may not be abiding by the withdrawal periods or that current toxicological assessment do not offer adequate protection in regions where other tissues are consumed in high concentration. Therefore, it is essential to undertake research to establish if high residues could be controlled through the recommended meat withdrawal period from the manufacturers and perhaps even consider setting MRLs for other commonly eaten tissues, such as chicken intestines.

## **Veterinary Drug Residues in Beef, Chicken, and Egg from Ghana**

**C.L. Mingle, G. Darko, N.K. Asare-Donkor, L.S. Borquaye, E. Woode**

**Abstract** The use of veterinary drugs on farm animals has the potential of generating drug residues in edible animal products that may affect public health. Veterinary drug residues in 144 samples including beef, chicken, and egg were measured using ultra- high-performance liquid chromatography in tandem with a triple quadrupole mass spectrometer. Sixty-three percent of the samples had quantifiable multiple detections of veterinary drug residues. The mean amounts of the tetracyclines (tetracycline, oxytetracycline, and chlortetracycline) residues in the samples were 81.35 µg/kg, 76.94 µg/kg, and 234.43 µg/kg, respectively. The mean β-lactam (amoxicillin, cefazolin, and penicillin G) residues were 35.76 µg/kg, 47.02 µg/kg, and 41.02 µg/kg respectively. The mean residues of the sulphonamides (sulfamethoxazole, sulfadoxine, and sulfathiazole) were 103.98 µg/kg, 46.05 µg/kg, and 68.63 µg/kg respectively. The mean fluoroquinolone (enrofloxacin) concentration was 30.19 µg/kg. The mean residue concentrations of salbutamol, erythromycin, prednisone, ketoprofen, and haloperidol were 6.32, 77.18, 23.66, 14.94, and 9.62 µg/kg respectively. The exposure estimations conducted on residues whose concentrations exceeded their maximum residue limits shows that consumers are at risk of acute exposure to tetracycline in egg, and cefazolin, penicillin G, sulphamethoxazole, salbutamol, prednisone, and haloperidol which may be injurious to the health and wellbeing.

## **Determining the standard quality of raw cow milk with associated farming practices in Uganda**

**J. Wandera, S. Opakasi, P.K. Byamukama, A. Mayega**

Dairy Farming which is part of Livestock rearing is responsible for 2.08 billion Litre of milk produced in Uganda and Dairy Development Authority is mandated to ensure the sale of safe and good quality milk. Therefore, a cross sectional study was designed to determine the levels of residues in raw cow milk and establish zero standards for the dairy industry.

Randomly selected farms from the districts of Kayunga, Kyakwanzi and Kiboga were visited and milk samples from 40 farms was collected and tested for Aflatoxin M1 and antibiotics using the Charm II Radio Immunoassay. Farm Management practices were also assessed to understand the residue and toxins results.

The farms from Kayunga (65% of the samples) were found with detectable levels of Aflatoxin M1 while in Kiboga/Kyakwanzi only 15% of the samples were found positive. For tetracyclines, Kayunga had 45% samples positive while Kiboga/Kyakwanzi had 20% samples positive. Also 60% of the farms practiced paddocking with the remainder mixing paddocking and free range. Animal treatment was majorly practiced by self before inviting a professional.

From the results, raw cow milk from kiboga/kyakwanzi farms met the criteria for field standards and controls. Many farms were also identified with detectable drug residues and Aflatoxins M1. Therefore measures to improve the quality of milk and farming practices need to be designed, introduced and implemented at the farms.



# [ POSTER ABSTRACTS ]

## Screening of antibiotic residue in animal tissues and milk in some states in Sudan

E.B. Amna, M.A. Wafa, A.A. Azza, E.A. Tasneem, Y.H. Elmansory

This study was carried out to monitor the presence of antibiotic residue in animal products in four states in Sudan (Khartoum, Eastern Sudan, North Darfur, and White Nile States). A total of 3311 samples (muscle, liver, kidney and milk) were collected on season base from different animal species. Microbiological inhibition assay was used as screening test to detect the presence of inhibition zone using *Bacillus subtilis* seeded in nutrient agar. Our result revealed that 13.34% of the total tested samples were positive showing clear inhibition zone. The percentages of the positive samples were 16.65%, 14.4%, 12% and 11.4% in Darfur, Khartoum, White Nile and Eastern Sudan, respectively. Concerning animal species, cattle showed the highest percentages. While, by organs liver collected from White Nile had the highest percentage 23% followed by Eastern Sudan 21.6%, Khartoum 15.0% and Darfur 14.6%. Muscles showed 18.8%, 8.02%, 6 % and 3.7% in Khartoum, Eastern Sudan, Darfur and White Nile, respectively. Kidney revealed minimum number of positive (10.4% in White Nile and 1.85% in Eastern Sudan). 16.65% of the milk samples from Darfur were positive. Dry summer samples had the highest percentage in Khartoum state (35.8%) than Darfur (27%) and White Nile (18.5%). In wet summer 22.2 %, 11.9%, 11.4% and 10.8% positive were in Eastern, White Nile, Darfur and Khartoum, respectively. In winter 13.4% in Darfur, 6.7% in White Nile and 6.6% in Khartoum state. Generally veterinary drug residues problem and the potential risk factors associated with is a very important issues now days. Data generated will be useful in developing monitoring system for controlling antibiotic residues in animal product to protect human health and to minimize drug resistance.

# ORAL ABSTRACTS

## Public Private Partnership success stories

**P.A. Gouws**

Public Private Partnership (PPP) projects harness both the public and the private sector to provide goods and services which are conventionally supplied by the public sector. This presentation aims to examine the links between university and industry collaboration. The share of co-published research has increased especially in European countries. The Centre for Food Safety (CFS) is a one-of-a-kind applied food science research consortium comprised of Stellenbosch University and the food industry. In collaboration, the CFS provides stakeholders with the opportunity to develop and exchange knowledge, experience, and expertise in the areas of food safety, food defense and food processing. The vision of the CFS is to improve food safety and to provide quality, internationally relevant research and training in all aspects of food safety. Characteristics to consider during the selection of a stakeholder are the relevance of the problem and the complementary nature of resources. It is also important to consider prior experience with industrial partners, as earlier short-term successful partnerships are expected to lead to long-term strategic partnerships. The higher the complementarity of capabilities between partners, the higher the likelihood of mutual trust and the higher the level of mutual commitment. Universities and industry have invariably different motivations for collaborating. It varies from problem-solving; resource sharing and/or information/people access to skills development through education. It is important to identify motivations and common areas before co-working or collaborating. Industry leadership must have a vision but innovation through collaboration is the key to the success for the Centre for Food Safety. Thus, the Centre for Food Safety vision is to improve food safety and provide quality internationally relevant research and training in all aspects of food safety. Examples of such partnerships will be discussed.

## Importance of Quality Infrastructure, an Overview of Roles and Current Activities Within the AU and AfCFTA

**M.L. Lungu**

For any business/industry to thrive in this competitive world it needs among others to be supported by a well-functioning and coordinated National Quality Infrastructure System (NQIS). A well-developed Quality Infrastructure System provides the necessary and much needed support to businesses and enables them to participate in global trade with ease and confidence.

At a higher level, the African Continent has made strides in developing Quality Infrastructure Systems starting with Regional Economic Communities (RECs) like SADC and EAC that have established initiatives addressing Quality Infrastructure Systems and at the Continental level a Platform/Forum called the Pan-African Quality Infrastructure (PAQI) which comprise African Accreditation Cooperation (AFRAC), Intra-Africa Metrology System (AFRIMETS), African Electro technical Standardization Commission (AFSEC) and African Organisation for Standardisation (ARSO) has been established. PAQI is implementing a number of initiatives to support intra-Africa trade and with the current initiative on the Cassava Value Chain Project, PAQI will be making interventions to enhance the safety and quality of the Cassava products and also facilitate export trade.

The African Union (AU) has developed a number of strategies including creation of a “single market” under Africa Continental Free Trade Area (AfCFTA) among others. The objective of AfCFTA is to deepen the economic integration of the African continent, boost intra-Africa trade and encourage diversification and industrialization. Further, the AfCFTA is tasked to implement protocols to eliminate trade barriers. Thus, it is expected that the Quality Infrastructure Institutions will provide their professional and credible services to eliminate trade barriers and contribute to the achievement of the objective of industrialising Africa and economic integration.

It is therefore, important to develop and invest in Quality Infrastructure systems at national regional and continental level so that professional and credible services can be provided to industry/businesses to facilitate trade and economic development.

# ORAL ABSTRACTS

### **The Africa Food Safety Network (AFoSaN) - Food Safety cross-cutting collaborations and capacity building**

**J. Sasanya, E.H. Niang**

An example of networking among food safety stakeholders in Africa as a mechanism for promoting cross-cutting collaborative activities and enhancing capacity building for better service delivery is presented. The food safety control system is still developing in many countries and even where it is well established, multiple institutions often from different Ministries (e.g. Health, Agriculture and Trade etc) may be involved. Mechanisms and initiatives for promoting collaboration among these institutions is required. Food safety is also a transboundary matter. Thus, collaboration among Member States on the continent is also necessary to better promote public health and enhance trade in foodstuff. This presentation discusses a number of activities and initiatives under the African food safety network (AFoSaN) including structural arrangements such as establishment of various committees; trainings; meetings; scientific exchanges and visits; sharing of information and knowledge as well as interlaboratory/proficiency testing schemes among others. It is in the spirit of networking that this second in-person Africa-wide workshop has been organized to contribute towards AFoSaN's expansion and enhancement with support of the International Atomic Energy Agency in partnership with the Food and Agricultural Organization of the United Nations along with other stakeholders.

### **Investing in people: NMISA Scientific Capacity Building Activities**

**M. Fernandes-Whaley, K. Masekela**

Well trained staff are an essential element of producing reliable measurement results. Training is most effective and beneficial when offered by competent, experienced personnel with personal experience in the topic being trained. With the aim of ensuring long-term sustainability of these skills, NMISA will be launching a new training centre focused on the hands-on training of analytical scientists and metrologists in the region.

NMISA's expertise enables the fair and safe trade of products and services by ensuring that weights and measures in South Africa and the region are the same as those anywhere else in the world. In the food safety sector these services take the form of calibrations, regionally relevant reference materials, customised proficiency testing schemes, and training courses. NMISA has partnered with several food safety and metrology stakeholders to facilitate activities that build analytical testing capacity in the region, including the Africa Food Safety Network (AFoSaN), the Association of Analytical Communities – Sub Saharan Africa Section (AOAC-SSA) and the African Regional Metrology Organisation (AFRIMETS).

This training centre leverages our existing Human Capital Development programme (HCD) which continually invests in the skills development of interns, creating a pipeline of scientists through undergraduate and postgraduate bursaries and advancing of qualification profiles of staff members within the organisation.

### **Building the Food Safety Capacity of Agri SMEs in Africa**

**C.M. Muyunda**

Background information: Most entities producing, trading, processing and transporting food products in Africa are small and medium enterprises (SMEs). Yet, realities of agribusiness development and international trade indicate that SMEs face various challenge in realizing their full potential. In the African region, some of the key challenges have been identified as: technology gaps, lack of information, difficulty in meeting food standards, access to finance, high cost of production technology, managerial skills, food handling and safety, and dealing with the prevalence of Aflatoxin and other food contaminants. Considering the above-mentioned challenges, it is important that both public and large private sector stakeholders throughout the African continent collaborated to resolve these challenges.

Problem: Lack of communication and information sharing among SMEs in the region incapacitates SMEs throughout the continent. Due to this challenge, SMEs cannot properly define the policy, market, and technology challenges they face. It is thus crucial to encourage dialogue among SMEs in the continent to help fully define the issues into potential programs that can be formally supported or attended to by various stakeholders.



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Solution and Proposal: Initiatives by UN and bilateral agencies focusing on trade facilitation and food safety capacity building for SMEs are commendable. However, a gap remains on how to integrate these initiatives into an effective capacity building effort, that prepares SMEs at all levels throughout Africa. SME support institutions in Africa, such as PANAAC and others, have proposed to a continent-wide dialogue among SMEs and related partners to fully define challenges that constrain SME growth in the Africa. They propose to convene key partners and stakeholders, possibly online, to refine a strategies for possible support of the UN and other international/ bilateral agencies. From the inputs of the dialogue, it will be possible to develop a long to medium term plan that will guide strategies, programmes and approaches for SME growth in Africa, and consequently a plan for SME growth on the African continent.

## Veterinary pharmaceuticals and their influence on food safety standards

**S. Darkaoui, A. Teko-Agbo**

Veterinary medicines are essential elements for maintaining animal health, whether livestock or pets, and linked to the wellbeing of people and planet as healthier animals will provide more food, labor, fertilizer, companionship and assistance. Their contribution will be central to efforts towards achieving the United Nation's Sustainable Development Goals (UN SDGs) by 2030.

The Market Authorization of veterinary medicines aims having safe, effective and high quality products in the most resource-efficient manner while ensuring the protection of the end consumer and the environment. The process of applying for a Market Authorization includes the submission of an extensive and detailed dossier, which consists of data that supports the safety, quality and efficacy of the product. It is good to mention that the last two decades registered big efforts for standards harmonization and legal requirements at international or regional levels or even centralized registration system.

Uncontrolled use or use of counterfeit or substandard veterinary medicines can lead to residues in animal products or antimicrobial resistance in the case of antimicrobials. For mitigating such risk, withdrawal periods are defined and Maximum Residues Limits (MRL) are set regarding toxicological properties of the drug and the consumption pattern of the animal product within the country or the region. Also, good veterinary practices should always be observed by practitioners.

To better manage the risks resulting from veterinary medicines for animal health, the consumer and the environment, authorities shall apply controls all along the value chain of the veterinary medicines covering:

- Legal framework;
- Market Authorization of veterinary medicines
- GMP/GDP inspection of manufacturers or importers;
- Good use practices of veterinary medicines;
- Market control in order to detect falsified, substandard or smuggled products;
- Farm/livestock inspection for the control of records of use of veterinary drugs;
- Control at slaughter houses for withdrawal period respect;
- Veterinary drugs residues surveillance plan;
- Antimicrobial resistance surveillance plan;
- Pharmacovigilance system.

# ORAL ABSTRACTS

### The Importance of Mitigating Pesticide Residues in the African Food

L. Suguiyama

The use of chemical pesticides in integrated pest control programs requires a careful scientific evaluation of its risks, namely for protecting human health and the environment in Africa. Although the use of chemical pesticides may result in potential residues in treated food crops, it is imperative that these residues, normally in small traces or parts per million, are deemed as “safe” with reasonable certainty. Many efforts are being undertaken in recent years to minimize or mitigate pesticide residue in African food crops. This presentation focuses on the potential presence of chemical residues in food crops, what are deemed as “safe,” the promotion of safer pest control tools (e.g., the use of biopesticides), and some of the current programs being promoted and implemented in Africa.

### Rapid screening for antimicrobial residues in food of animal origin

W. Reybroeck

To ensure chemical food safety, food of animal origin (milk, meat, fish, eggs, honey, ...) is monitored on the presence of antimicrobial residues. Different approaches are possible but the most cost-effective and easiest approach is still based on the use of screening tests. With such methods, food is screened for a substance or class of substances at the level of interest, namely at the maximum residue level for authorised substances, or at the reference point for action for prohibited or unauthorised substances.

Month by month, new rapid tests, mostly based on dipstick technology, are developed and become available. Where originally most tests were developed for the screening for  $\beta$ -lactam or tetracycline residues, nowadays a wide range of antimicrobial residues belonging to different antibiotic families could be detected with rapid tests within 10-15 minutes. Even multiplex detection systems, reporting about >100 molecules exist. Some kit manufacturers focussed on limiting the test time to a few minutes, others improved the detection capability, simplified the test protocol to a single step, made incubation at ambient temperature possible, or developed reader applications based on smart phone technology,...

The (il)legal use of antimicrobials in animal husbandry could also be checked by the monitoring of faeces, feathers, saliva, blood,... with screening tests and hence preventing the destruction of non-compliant food. Some of these tests could even be performed at the farm. Finally regarding validation, in case people use commercial reagents with a fixed test protocol, they can copy and use validation data from the initial validation and only need to perform a less extensive transfer validation on condition they use the same test protocol as the originator laboratory. In this way they can save a lot of time and money.

### The regulatory framework for the use of pesticides in crop production – The case of Mauritius

S.D. Soboron

The Use of the Pesticides Act has been enforced since September 2018 to regulate, monitor, and control the use of pesticides. The Pesticides Regulatory Office was specifically established for the enforcement of the Act. The main objective of this legislation is to protect human health and the environment from the damaging risks associated with pesticide use. This includes protection of pesticide users, consumers, the public and crops.

The main functions of the Pesticides Regulatory Office as laid down in section 6 of the Act are as follows:

- to regulate, control and monitor the use of pesticides in or on any agricultural produce
- to develop strategies for the sound, use and management of pesticides and for risk reduction associated with the use and disposal of empty pesticide containers
- to keep relevant information on pesticides
- to devise a Pesticide Code of Practice
- to advise the Minister on any matter related to the use of pesticides.

The paper will focus on the implementation constraints that countries might face while regulating use of pesticide which is one way of ensuring food safety.

# ORAL ABSTRACTS

## **A survey of pesticide residues in maize and tomatoes in eight African countries**

**W. Jiang, J. Sandahl, J. Dubois, S. Reddy, L. Suguiyama, V. Picado, M. Flavin, A. Neigh, A. Gore**

A total of 879 samples of maize (431) and tomatoes (448) were collected (in 2021) from markets in 8 African countries and analyzed for pesticide residues. Forty-five percent of the maize samples and 69% samples of the tomatoes contained pesticide residue levels above 0.01 parts per million (ppm). Eleven percent of samples exceeded the country's national MRLs and between 9 and 42% of samples did not comply with international MRLs that could be associated with trade (Maize: 12% Codex; 12% US; 18% EU; Tomato: 10% Codex; 9% US; 42% EU).

## **WAPRC experience with harmonization of pesticide guidelines and requirements**

**B. Gnonlonfin, S. Ouedraogo**

The West African Pesticides Registration Committee (WAPRC) has been established by ECOWAS Regulation C/Reg.03/05/2008 on harmonization of the rules governing pesticides registration in ECOWAS region, in order to implement the Common regulation on behalf of the ECOWAS Commission. It's roles, organization and functioning are detailed by ECOWAS' enabling regulation C/Reg.02/06/12. The WAPRC has been adopted and customized, as regional body in charge of pesticides registration and the coordination of pesticides management for 17 countries in West Africa and the Sahel, following the tripartite agreement in the field of pesticides signed between ECOWAS, UEMOA and CILSS in 2018. WAPRC's members have been nominated and had their inaugural meeting in March 2022 during which members have adopted harmonized tools and technical procedures for pesticides registration and management in the Sahel and West Africa. This presentation will provide more information on WAPRC's organization, functioning and its requirements.

## **Monitoring and risk assessment of pesticide residues in selected herbal medicinal products in Ghana**

**P. Osei-Fosu**

The high patronage of herbal medicinal products in Ghana for the treatment of diverse disease conditions raises concerns about patient safety, given that much of the raw materials for production are obtained from the wild or farmlands potentially exposed to varied agrochemical residues. Therefore, the work sought to investigate the contamination of herbal medicinal products with pesticide residues and assess the potential risk posed to patients. As a result, validated gas chromatography with mass spectrometry as a detector was used to determine forty-two pesticides in thirty herbal medicinal products. The performance parameters of the method such as linearity, accuracy, and precision were found as acceptable. Pesticide residues such as chlorpyrifos and/or bifenthrin were found in 4/30 herbal medicinal products. Specifically, 3/30 herbal medicinal products contained only one pesticide, while 1/30 was contaminated with both pesticide residues. The levels of pesticide residue contamination ranged between 2.5 and 5.0 µg/kg. The acute hazard quotient and chronic hazard quotient for the two pesticide residues were evaluated and ranged between 0.21 and 0.92% and between  $8.21 \times 10^{-4}$  and  $5.88 \times 10^{-3}\%$ . The detected pesticide residue levels are below the maximum residue limit values, which may not cause acute and chronic health risks due to intake of the selected herbal medicinal product. Nevertheless, patient safety and potential public health risk can be reduced by regular monitoring, and regulation of pesticide residue levels in herbal medicinal products.



# ORAL ABSTRACTS

## Establishment of maximum veterinary drug residues (MRLs) and risk assessment

E.S. Mitema

In animal husbandry veterinary drugs are used to alleviate disease conditions and improve production. Following treatment, these drugs and associated metabolites can be retained in animal tissue. Thus, leading to veterinary drug residue in edible tissues and animal products. These drug residues can pose potential health hazards like anaphylaxis, reproductive disorders, tumorigenic, and genotoxic effects among others. Establishments of maximum residue limits (MRLs) for various veterinary drugs are required to ensure consumer safety and promote international trade. The purpose of the current review is to outline the various risk procedures undertaken to ensure safety of veterinary drug residues in various edible tissues.

Risk is defined as the probability of an adverse outcome when edible animal food with levels above recommended MRLs of a veterinary drug residue is consumed. Risk analysis of veterinary drugs involves three components: risk assessment, risk communication and risk management.

Risk assessment is the scientific process of evaluating safety of veterinary drug residue to consumers. Risk assessment utilises toxicological tests to establish an acceptable daily intake (ADI). ADI is an estimate of the amount of veterinary drug residue that can be ingested daily over a lifetime without appreciable health risk and is usually expressed as mg/kg b.w./person/day. From toxicological studies, a scientific judgment is made concerning the adverse effect that is of most relevance to humans, and the highest dose at which that effect does not occur under experimental conditions – referred to as the No Observed Adverse Effect Level (NOAEL) is noted. A NOEL (No Observed Effect Level)/ NOAEL is defined as the highest dose level of a drug tested that produces no observable effects. The NOEL, as determined through toxicological, pharmacological, microbiological, or epidemiological observations, incorporating a safety factor of 100, is used to determine an ADI (equation 1).

$$ADI = \frac{NOEL}{10 \times 10} = mg/kg.b.w/day = \mu g/kg/day \dots\dots\dots \text{equation 1}$$

The safety factor is comprised of two equal components: a factor of 10 for both interspecies and intra-species variation. MRLs are established from ADIs, considering food consumption and Joint Expert Committee on Food Additives (JECFA) estimates. These estimates assume that an average person will consume 300 g of muscle, 100 g of liver, 50 g of kidneys, 50 g of fat/skin, 100 g of eggs and 1.5 L of milk. MRLs are therefore set for individual tissues and products.

Risk management on the other hand refers to the action taken on the hazard from an assessment. Risk communication refers to the exchange of real time information, advice and opinion between experts and people facing threats to their health, economic or social wellbeing. The ultimate purpose of risk communication is to enable people at risk to take informed decisions to protect them and other vulnerable people. It is concluded that to ensure safety of veterinary drugs to consumers, establishment of MRLs is important for international trade among member state countries.

# ORAL ABSTRACTS

## **Occurrence of Veterinary Drug Residues in Food Products of Animal Origin (Meat, Milk, Eggs, Honey) in Malawi: A Survey of Commercial Products on the Market and Some Selected Farms**

**S.M. Kuyeli, J.P. Kothowa, H.S. Muhango**

Veterinary drug residues are one of the major problems for food contamination. Quality of food from animal products is widely a concern since veterinary drugs play an important role in the field of health for both humans and animals. The use of veterinary drugs in food producing animals has the potential to generate residues in animal derived products (meat, milk, eggs and honey) and poses a health hazard to the consumer. Increasing occurrence of antibiotics residues, and antimicrobial resistance among the human population have become key in human health related issues and the environment, nature and quality food, which is also a concern on one health concept. The major public health significances of drug residue are development of antimicrobial resistance, hypersensitivity reaction, carcinogenicity, mutagenicity, teratogenicity, and disruption of intestinal normal flora. However, there is limited information on the magnitude of veterinary drug residues occurrence in meat, eggs, meat products and milk in Malawi and this survey is looking at generating this information and creating a national database. This study is aimed at generating data on the prevalence of veterinary drug residues in eggs, milk, meat and meat products available on the markets across the country. High risk shops, producers and farms will be sampled (eggs, broiler meat, milk). The samples will be taken through qualitative analysis using Charm II Analyzer, a radio-immuno receptor assay method for screening of antibiotics in tissues to. Only positive samples will be analysed quantitatively using HPLC and/or LC-MS/MS to determine the levels of veterinary drugs. Electronic questionnaire (Epicollect) will be administered to assess some risk factors. Data will be instrumental in strategizing the monitoring and regulation protocols on food safety especially on veterinary drug residues in livestock products.

## **Green-Sample Preparation -Liquid Chromatography-Mass spectrometry for Food Safety**

**M.M. Nindi, B.E. Gebreyohannes, S. Dube-Nindi**

Food safety and quality are an integral part of global trade, food security and consumer protection. The presence of undesirable and dangerous substances such as veterinary drugs, mycotoxin and pesticides are of great concern to human health, global international markets, and the economies of the producing countries. Sources of these contaminants in food products are raw materials, transportation, processing (process-induced toxicants) and packaging. Sensitive and selective analytical methods play a very important role in monitoring these compounds in biological matrices. This presentation will focus on the development of green sample preparation and/or clean-up methods such as dispersive liquid liquid microextraction (DLLME), fabric phase sorptive extraction (FPSE) and supported liquid membrane (SLM) which have inherently high enrichment factors. The developed sample preparation methods were coupled to LC-Obitrap HRMS for the determination of several veterinary classes and mixed contaminants in animal feed and food products. The potential of these sample preparation techniques will be demonstrated.

## **Key Differences in the Procedures for Assigning Tolerances as Compared to MRLs**

**H. Erdely**

Several different governing bodies have methods for evaluating and assigning maximum allowable limits for residues of drugs used in food-producing animals. Those values assigned by the United States Food and Drug Administration are called tolerances. The talk will focus on some of the key differences in the procedures for how U.S. tolerances are assigned compared to MRLs.

# ORAL ABSTRACTS

### **Food Safety is Everyone's Responsibility: A Need for Embracing the One Health Approach**

**F. Ejobi**

The 21st century has ushered unprecedented challenges to food systems world over. We now live in a much more complex and interconnected global society. Our food systems are everyday becoming more complex and more vulnerable to both intentional and unintentional contaminations and changing microbial communities. The scale and complexity of food safety challenges demand that we must move beyond the comfort and confines of their own disciplines, professions, and mindsets and explore new organizational modes of team science. The One Health approach, though not entirely new, has re-emerged and presents us a great opportunity to work together to tackle the ever fast-paced food safety challenges.

The intent of my presentation is to stimulate debate and to emphasize the need for us to embrace and promote the One Health approach in tackling real-life food safety issues we are now facing. My paper also presents some examples of real food scares in the recent past in my country, Uganda. It also outlines some achievements that Uganda has registered in promoting and practicing the One Health approach when responding for some public health events. There is an African proverb that says: *"If you want to go fast, go alone; if you want to go far, go together"*. In union there is strength; likewise in One Health there is strength. Together we can ensure that our food is safe!

### **Foodborne Microbial Hazards and Risk Analysis: Assessment, Management and Communication**

**L. Anelich**

The World Trade Organization is the international body that deals with global rules of trade between nations. Rules for global trade in food are embedded in the Sanitary and Phytosanitary Measures (WTO/SPS) and the Technical Barriers to Trade Agreements (WTO/TBT). The SPS agreement requires a risk-based approach in the development of regulatory standards and states that these may not be stricter than international standards, as developed by the Codex Alimentarius Commission (CAC) for human food, unless scientific evidence is provided as justification.

The majority of countries in Africa are signatories to the SPS and TBT Agreements and are thus committed to follow the rules outlined in these Agreements. Furthermore, the African Union has embarked on establishing a Food Safety Authority for which a strategy is currently being finalised. The harmonization of food safety standards is high on the African agenda in order to facilitate and enhance food trade on the continent according to the African Continental Free Trade Agreement that was launched in January 2021. However, food safety standards differ greatly across the continent. These are often historical in nature and should be modernised to reflect risk-based management at national authority level. This presentation will discuss the importance of risk-based decision-making in developing appropriate microbiological food safety standards, which in turn, will emphasise all the elements of the Risk Analysis Framework.

### **Burden of Disease from Drug-resistant Infections: Monitoring and Evaluation of Fresh Produce in Nigeria**

**O.A. Olusegun, E. Areo**

There has been recent increase in global diseases and researchers have diverted interest in fresh produce as versatile route of Antimicrobial Resistance. Though, fresh produce is growing in consumption rate owing to their nutritional and health benefits yet, life threatening recurring food-borne illnesses are linked with them. This study deliberated on the role of fresh produce in contribution to the burden of food borne disease, as well as effective or sensitive monitoring and evaluation methods. Food safety issues related to fresh produce (fruits and vegetable) along the value chains (majorly pre-harvesting, harvesting and supplying) and possible source of contaminants are scrutinized. Moreover, emphasizes was made on the need to interrelate combine approach to minimize emerging life-threatened foodborne diseases associated with consumption of fresh produce. The 'One Health' concept ensure monitoring the challenge and safety of fresh produce in relation with the antimicrobial resistance bacteria (ARB), starting from farm to consumers' table. The most common detected ARB were E. coli, followed by Salmonella paratyphi and Listeria monocytogene mainly detected in lettuce, cucumber, and carrot. The produce contamination occurs along the pre- and post-harvest chain with poor agricultural and manufacturing practices by the stakeholders.



# ORAL ABSTRACTS

### Investigation of Antibiotic Resistance from Foodborne *E. Coli* Isolated from Poultry Meat in Mbare

T. Chigiya

*Escherichia coli* is a food-borne pathogen of public health interest contaminating poultry meat worldwide. Most *Escherichia coli* are non-toxic and are in fact an integral part of the intestinal flora which can contaminate meat during slaughtering. The pathogen is a pollution indicator, and its pathogenic strains are a serious public health concern causing significant morbidity, mortality, and economic losses. Food testing at central laboratories is currently only being conducted on meat and meat products for export only, the high cost of the tests leads to meat sold locally not being tested. This research therefore focused on investigating antimicrobial resistance of *E. coli* isolated from poultry meat on the local market. A total number ( $n = 300$ ) samples were obtained from retail stores (37), vendors (210) and butcheries (53) in Mbare, a high-density suburb in Harare. From the study 100% of the collected samples were contaminated with *E. coli*. Antibiotic sensitivity test for isolates was done using the disc diffusion method with eight different gram-negative antibiotics which showed different resistance patterns. Resistance to Penicillin was (99.7%), Tetracycline (80.7%), Ciprofloxacin (49.7%), Trimethoprim Sulfamethoxazole (43.7%), Ampicillin (36.7%), Ceftriaxone (7.3%), Ertapenem (3%) and Cefepime (2.7%). Two *E. coli* isolates were found resistant to all antibiotics in the study and 7.3% of the isolates are possible ESBL producing bacteria. Modern chicken farming involves the use of sub therapeutic levels of veterinary drugs for growth promotion and increased feeding efficiency, rather than treatment and prophylaxis. This sub therapeutic application leads to the emergence of antibiotic resistant zoonotic bacteria that can be passed to humans through the food chain.

### Quantitative Microbial Risk Assessment for *Listeria monocytogenes* in Milk Sold at Informal Retail Points in Uganda

J. Rubakuba

The purpose of this study was to quantitatively determine the microbiological risk associated with *Listeria monocytogenes* in milk sold at informal retail points in Uganda. The modular process risk model served as the basis for a quantitative microbial risk assessment (QMRA) model. Where data was missing or incomplete, findings from other published studies, or assumptions based on expert opinions were used. Simulations were conducted using Excel spreadsheet (Microsoft Corporation) with @Risk add-in program (version 7, Palisade, Newfield, NY). Monte Carlo simulations were carried out three times with 1,000 iterations. Exposure assessment considered expected milk contamination from milk vendors, microbial growth during transportation and storage, destruction steps, consumption frequency, serving size and consumption preferences. The differential risk between consumption of boiled milk and raw milk was considered. The probability of illness due to *Listeria monocytogenes* was modelled using the Exponential Dose Response Model. Further, a sampling plan to monitor the prevalence of *L. monocytogenes* in milk sold at informal retail points was suggested, and PROMETHEE GAIA 1.4 Academic Edition software; a multi-criteria decision aid (MCDA) software was used to evaluate and identify the best possible mitigation strategies.

The results indicated that the mean probability of illness from consuming milk sold at informal retail points contaminated with *L. monocytogenes* was ( $6.58 \times 10^{-4}$  for raw milk and  $7.69 \times 10^{-7}$  for boiled milk) for the more susceptible population. The sensitivity analysis showed that reducing the d-value and increasing the boiling time will reduce the exposure per serving of milk. The multi-criteria decision methodology identified licensing and training informal milk vendors as the most affordable and effective risk management options.

The publication these findings could be useful for risk management decisions in a data-poor context of a developing country like Uganda.

# ORAL ABSTRACTS

## **Food Safety Risk Analysis, a Cornerstone for Effective Food Safety System in East African Community: A Perspective towards a Regional Risk-based Food Safety System**

**T. Hagenimana, J.P. Hategekimana, G.O. Abongo, O. Kamana, M.O. Athanasia**

Food risk analysis remains the cornerstone to provide a framework for the risk-based food safety system. The present research paper aimed at evaluating the effectiveness of food safety system, and the foundational role and opportunities of risk analysis concept in East Africa Community (EAC). The study was done through the explorative review of the literature on global food safety framework, food safety systems and food safety risk analysis, and the food safety system in developing countries with a focus on the EAC. The effectiveness of the EAC food safety system was evaluated to identify challenges in the EAC food safety system with reference to the US effective food safety model. The role and opportunities of risk analysis were evaluated on counterparts of identified challenges, and its implementation feasibility and opportunities in the EAC food safety system. The EAC food safety system showed many gaps and challenges and was ineffective. While the concept of food safety risk analysis was found a key factor in attributes of effective food safety system, it could help the EAC food safety system to become effective, and to respond to the current and future food safety needs at the African continent and global levels. With several opportunities and potentials for the EAC, the risk analysis concept can be integrated in the EAC food safety system. Therefore, a strategic approach and model of the integration of risk analysis concept was proposed and could be recommended to the EAC: it is the establishment of a functional and dynamic EAC- Centre of Expertise in Food Risk Analysis (EAC-CREFRA).

## **Risk Management for Mycotoxins Scoped in the First Total Diet Study in Nigeria**

**A. O. Adegboye, A.N.S B. Adebayo, J. Ogungbamigbe, C. U. Nwachukwu, S. Olagunju, H. A. Makun, O. Adetona, A. D. Oyedele, H. Makama, U. A. Sulaiman, J. Omojokun, S. Denloye, E. Obi, O. E. Orisakwe, M. Sulyok, R. Krska, P. Verger, L. Ingenbleek, J-C. Leblanc, C. M. Adeyeye**

National food safety data are essential contributory factors to the elaboration of global standards by the international standards setting bodies like Codex Alimentarius Commission. This study reports the mycotoxicology data from a Total Diet Study, the first carried out in Nigeria and explores the various attendant risks giving mitigative measures. Food samples (3456) were purchased from wholesale markets in two study locations (Kano and Lagos). The study sites selection was selected due to two distinct stable diets. One based on grains/cereals and one on roots/tubers. Samples were prepared as eaten, pooled, and homogenised to consistent forms, weighed, preserved, and transferred to testing laboratories. One hundred and two (102) homogenised samples were analysed for mycotoxins through LC/MS-MS analysis. Quantification and Recovery were carried out and the results showed mean concentrations of mycotoxins in the homogenised samples: aflatoxins (0.1-64.5µg/kg) and Ochratoxin A (0.13-2.655µg/kg). Staple foods such as peanuts and peanut oil contributing 83.15% to aflatoxin B1 while Ochratoxin A was mainly found in rice and cashew nuts. Maize was the largest contributor to fumonisins occurrence with fumonisin B1 detected in 97% of the homogenised maize samples. Citrinin and aflatoxin B1 had the highest occurrence in all matrices (38%). This study indicated that aflatoxins were the most prevalent mycotoxins at dietary concentrations associated with exposures unsafe for consumers. Maize, peanuts and peanut oil were the highest contributors to dietary mycotoxin exposure in Nigeria.

## **An Overview of the USDA FSIS Annual Product Sampling Plan and Laboratory Support**

**L. Rozier**

The United States Department of Agriculture's Food Safety and Inspection Service (FSIS) uses many tools to verify domestic industry compliance with food safety regulatory requirements including use of an annual sampling plan and high-throughput laboratory testing. This presentation will provide an overview of the FSIS Annual Sampling Plan and laboratory support.

# ORAL ABSTRACTS

## Prevalence of Diarrhoea among Children Under Five Years of Age in Association with the Status of Drinking Water Sources at Bububu, Zanzibar

W.M. Ali, E.S. Kigadye

This study aimed at determining diarrhoea prevalence among children under-five years of age in association with the status of drinking water sources at Bububu, Zanzibar. A cross sectional study based on both community and hospital-based case control that use quantitative methods conducted from March to May, 2018. Data were collected from 97 mothers/caregivers of the children selected purposively when attending selected hospitals for treatment. A check-list was used to collect primary data in hospitals for Diarrhoea prevalence. Laboratory experiments were carried out to assess quality of drinking water sources. Most Probable Number (MPN) count per 100 ml was measured from drinking water sources. The prevalence of diarrhoea was 61.9% (95% CI=1.28-1.48), this was significantly associated with; drinking water storage, drinking water sources and belief that water is safe from the source ( $p < 0.05$ ). Pathogenic bacterial contamination was found to be high (100%) in harvested rain water and (67.2%) borehole water sources compared to (50.0%) piped water sources ( $p < 0.05$ ). Health education and drinking water treatment could have a significant importance on the reduction of diarrhoea prevalence among under-five children in the study area.

## Incidence of foodborne pathogenic bacteria causing food borne illness and their control to enhance food safety

A.A. Hammad

Food safety and quality are an important issue to consumers, governments, and producers worldwide. Every year millions of people are affected and thousands of them die due to foodborne illness. A variety of foodborne pathogenic bacteria are frequently linked to humans and animal's diseases. Foodborne pathogenic bacteria have been incriminated for most of the human illness, hospitalization, and death caused by consuming food contaminated with them or their toxins. Foodborne illness still represents a worldwide public health and economic problems. The most common foodborne pathogenic and zoonotic bacteria causing infections illnesses and food poisoning are *Salmonella species*, *Campylobacter jejunii*, pathogenic *Escherichia coli*, *Listeria monocytogenes*, *Staphylococcus aureus*, *Yersinia enterocolitica*, *Aeromonas hydrophila*, *Shigella dysenteriae*, *Vibrio cholera*, *Vibrio parahaemolyticus*, *Klebsiella pneumonia*, *Bacillus cereus*, *Bacillus anthracis*, *Clostridium perfringens* and *Clostridium botulinum*. This oral presentation will highlight on these foodborne pathogenic bacteria as causative agents of foodborne illnesses, corresponding illnesses, outbreaks, food involved in outbreaks, transmission, notification, responses to outbreaks, as well as ways to prevent and control infections including irradiation.

## Mycotoxin and Food Safety Education: An Imperative for Improved Health and Economic Prosperity in Africa

H.A. Makun

Food safety and insecurity, malnutrition and poverty are severe interdependent development challenges in Africa. Almost half of Africa's population is living below the poverty line (48.5%), suffers from chronic hunger (75%) and malnourishment (226.7 million-20.5%) and these figures are highest in Central and West African regions. Food production increases resulting from agricultural initiatives are compromised by food borne diseases; to this effect, much effort is already deployed to address the threat from mycotoxins, major biotic constraints to food security causing losses in crop yield, human productivity (40%) and in export, and lowered performance of animal husbandry in addition to the direct human health impacts of increased incidence of cancers, growth stunting in children, reduced life expectancy and death. Other threats, such as salmonellosis, entero-haemorrhagic, hepatitis A, acute and chronic mycotoxicoses, cholera, heavy metal poisoning, and the threat of antibiotic resistance arising from improper use of veterinary drugs, and chronic pesticide and industrial chemical residue exposure need urgent attention. These pervasive problems, which affects fetuses, pregnant women and children at a disproportionately high rate, require transformative science, engineering and policy solutions brought about by an innovative interdisciplinary and knowledgeable workforce. Such a labour force can only be created within a global partnership framework of shared academic and research resources to conduct exposome based public health interventions for food borne pathogenic microbes, mycotoxins, pesticides and veterinary drug residues, heavy metals, cyanide and polychlorinated biphenyls and other emerging chemical residues in food and feed towards ensuring a safe, controlled and sufficient food supply that will support public health and economic growth.



# ORAL ABSTRACTS

The Africa Centre of Excellence for Mycotoxin and Food Safety (ACEMFS), the Team Coordinator of the West African Food Safety Network (WAFOSAN) and member of the African Food Safety Network along with its 46 academic and sectoral partners across the globe is currently training a skilled and innovative work-force that will address the huge food safety burden in Africa. It offers master and doctoral degrees in Food Safety to 138 students from 15 African countries and educates via workshops over 800 African food value chain actors. ACEMFS fosters impactful interdisciplinary research to implement an integrated fit-for-purpose interventions against food borne diseases along the entire value chain from farm to fork. The intervention strategies include but not exclusive to developing early warning systems, fit-for-purpose good agricultural and food processing codes of practice, drought, pest and mycotoxin resistant cultivars, phytofungicides, bio competitively eliminating mycotoxin producing fungi at the farm, nanobased mycotoxin feed binder and detoxifiers, and portable detection systems. These objectives address the five sustainable development goals of poverty reduction, zero hunger, good health and wellbeing, and quality education, and gender equality by 2030.

## **Quantitative analysis of mineral nutrients and heavy metals in a variety of rice consumed in Madagascar and Assessment of Dietary Intake**

**N.N. Andriamahenina, H.N. Ravoson, M. Harinoely, N.N.F. Andrianirinanantsoa, E.O. Rasoazanany, L.V. Rakotozafy, N. Rabesiranana**

Rice (*Oryza sativa* L.) is the most prevalent cereal crop in Madagascar and remains to be the staple food of Malagasy people. Food is mainly composed of macronutrients and micronutrients that are essential to achieve a well-balanced diet. However, food may contain toxic elements that are harmful to the consumer's body. The study aims to assess the nutritional intake and the chemical contamination of rice samples sold in local market in Antananarivo.

The essential major elements namely sodium, magnesium, phosphorus, chloride, potassium, calcium and trace elements including toxic metals such as chromium, manganese, iron, copper, zinc, selenium, iodine, arsenic, cadmium, lead and mercury are quantified using Polarized Energy Dispersive X-Ray and Atomic Absorption spectrometers as well as a Direct Mercury Analyzer.

The rice consumed in Madagascar is divided into three varieties according to its color, namely red, pink and white rice. According to results, i) red rice appears to be generally good source of essential major and trace elements. Indeed, the comparison of the red rice contents with the Recommended Dietary Allowance (RDA) reveals that P, Mg, Mn, Fe, Cu and Zn requirements are met: the ratio  $C_{mean}/RDA$  ranges from 55 to 167%; ii) in rice-based foods, the daily requirements of Ca, K, Na, Cl and I are far from being met: the ratio  $C_{mean}/RDA$  ranges from 5 to 24%. Consequently, additional intakes through ingestion of vegetables and meats that are served as a side dish are necessary; iii) the consumption of rice, whether red, pink or white, does not present any risk with regard to toxicity especially for the arsenic, cadmium, lead and mercury.

To conclude, this study could contribute to solve the problem of malnutrition in southern Madagascar, where it is necessary to improve the population nutrition through governmental policies.

## **Determination of Lipophilic Marine Biotoxins in Shellfish using Triple Quadrupole LC-MS/MS in Senegal**

**E.M.M. Niang, E.K. Penoukou, F. Diome, P.M. Faye, Y.D. Diop, A. Teko-Agbo**

A study was conducted in Senegal to determine the contamination prevalence of oysters by lipophilic marine biotoxins. This study was conducted to obtain information related to food safety necessary to understand the challenges of the shellfish sector. To this end, 31 batches were collected and analyzed with the EU reference method of determination of okadaic acid, pectenotoxin-2 and yessotoxin marine biotoxins by LC-MS/MS. The protocol was based on a fixed extraction procedure followed by LC separation, with an acidic mobile phase and detection by mass spectrometer. The results made it possible to highlight the mapping of oyster production areas in Senegal and the production techniques used. The results also showed the absence of diarrheal toxins in the oyster extracts analysed. To protect public health and to guarantee the food safety of bivalve molluscs, adequate regulations on biotoxins must be adopted and a monitoring program for lipophilic marine biotoxins in molluscs should be initiated in Senegal.

# ORAL ABSTRACTS

## Status and risk assessment of food items sold in open markets in major cities of SADC countries for metals: case studies of Zambia, DRC, Mozambique, and South Africa

**L. Chimuka, T. Ramalepe, F. Miyanza, H. Richards, N.J. Gulamussen, E. Chaque, I. Nyambe**

Heavy metals in food are still a concern especially in developing countries where legislation is not fully implemented. Thus this study assessed the distribution, levels of heavy metal and health risk associated to these metals in raw food sold in the open markets in Kinshasa (Democratic Republic of Congo) and Johannesburg (South Africa). 120 food samples were purchased in the markets in both Kinshasa and Johannesburg. The various food samples constituted of cabbage, beans, beef and fish. Ten trace metals: Al, As, Cd, Cr, Cu, Hg, Mn, Pb, Se and Zn were analysed in the raw food. The study results revealed that the food collected in the Johannesburg market contained a higher level of As, Cd, Cr, Cu, Hg, Mn, Pb, Se and Zn than the food samples collected in the Kinshasa market. The food from Kinshasa market, however, contained a higher level of Al than that from Johannesburg market. Vegetables were found to contain the highest metal values especially cabbage samples from Johannesburg ( $75.12 \pm 5.67$ ,  $18.31 \pm 3.45$ ,  $17.29 \pm 2.03$ ,  $15.70 \pm 1.67$ ,  $4.14 \pm 1.08$ ,  $3.93 \pm 0.12$  and  $1.41 \pm 0.97$  mg kg<sup>-1</sup> for Zn, Mn, Cr, Cu, Pb, Cd and Se, respectively), and from Kinshasa ( $52.10 \pm 3.45$  mg kg<sup>-1</sup> for Al). While Fish from Johannesburg showed the highest As and Hg content of  $12.04 \pm 2.23$  and  $0.86 \pm 0.1$  mg kg<sup>-1</sup>, respectively. The obtained results showed that the concentrations of most studied metals were exceeding the recommended maximum acceptable levels proposed by the Joint FAO/WHO Expert Committee on Food. The combined Target Hazard Quotients (THQ) was calculated to estimate the human health risk to Congolese and South African population who are eating these various food stuffs. The higher combined THQ values of beans, cabbage, beef and fish consumed in both cities suggest a possible adverse health effects though more studies are needed to ascertain this.

## Aflatoxins determination by liquid chromatographic methods and occurrence of Aflatoxin B1 in animal feed from the North-Western area of Morocco

**N. Alahlah, M. El Maadoudi, N. Bouchriti, R. Triqui, O. El Ouahabi**

Aflatoxins are secondary metabolites produced by *Aspergillus* genus. They are considered as natural contaminants in feed and food products. Their impact in the global trade and health has been reported in several papers from several countries. Morocco, with a favorable climate for *Aspergillus* proliferation, is indeed concerned by this issue. To manage the risk associated with this contamination, at analytical level, Moroccan laboratories working under the National Office of Food Safety –ONSSA- have optimized and validated chromatographic methods for aflatoxins determination.

In this paper, we expose aflatoxins method analysis adopted by the Regional Laboratory of analysis and research-Tangier, ONSSA, their optimization and then the application of HPLC-FLD method to determine the occurrence of aflatoxin M1 in milk and animal feed collected from the northwestern area of Morocco.

## Determination and human exposure assessment of per- and polyfluoroalkyl substances in farmed marine shellfish in South Africa

**O.A. Abafe, T.B. Chokwe**

The consumption of seafood is established as a major pathway of human exposure to perfluoroalkyl substances (PFAS). However, data on their concentrations in marine shellfish and the exposure of the African population to PFAS through the consumption of shellfish is lacking. In this study, the concentrations of 15 PFAS were measured in four species of farmed marine shellfish by using a validated UHPLC-MS/MS method. The obtained concentrations were used to determine the human daily intake and hazard quotient of PFAS through the consumption of marine shellfish. PFPeA, PFOS, PFHxA and PFTeDA were the most prevalent compounds with detection frequencies of 94, 88, 76 and 71%, respectively. The  $\Sigma 11$ PFAS concentrations (in ng g<sup>-1</sup> wet weight (ww)) ranged from 0.12 – 0.49, 4.83 – 6.43, 0.64 – 0.66 and 0.22 ng g<sup>-1</sup> ww in abalone, mussel, oyster, and lobster, respectively. The prevalence of perfluoroalkyl carboxylic acids (PFCAs) reflects the current contamination profile of PFAS in farmed shellfish. The estimated daily intake for  $\Sigma 10$  PFAS through the consumption of marine shellfish ranged from 0.05 – 1.58 ng kg<sup>-1</sup> bw d<sup>-1</sup>. Overall, the hazard quotients for these compounds were low, indicating that these compounds do not pose a health risk to the South African population through shellfish consumption. This study provides background data for future studies on the occurrence of PFAS and other emerging contaminants in the African coastal environment.

# ORAL ABSTRACTS

## Human exposure to extractables and leachables from single-use plastic food contact materials: a disposable sorptive sampler, UHPLC-IMS HRMSE and GC×GC-TOFMS

M. Wooding, G. van Niekerk, Y. Naudé

**Introduction:** Four million tonnes of plastic are produced annually around the globe, of which 36% is single-use items such as straws, polyethylene terephthalate (PET) bottles, polypropylene (PP) food packaging and polystyrene (PS) take-away containers.<sup>1</sup> Plasticisers are added to these plastic food contact materials (FCMs) to promote flexibility but have been found to leach into food and drink<sup>2</sup>. Plasticisers occur at trace concentrations, rendering their detection and regulation a challenge.

**Method:** This study provides a simple detection and quantification method for extractable and leachable (EL) compounds that emerge from FCMs. FCMs were exposed to ambient conditions, elevated temperatures, UV/Vis radiation and microwaving to simulate various everyday use scenarios. Detection and quantification of ELs migrating out of plastic FCMs using an in-house developed PDMS loop for sorptive extraction is reported for the first time. Sampling was followed by analyses with comprehensive gas chromatography – time of flight mass spectrometry (GC×GC-TOFMS) and ultra-performance liquid chromatography – ion mobility spectrometry – high resolution mass spectrometry (UPLC-IMS-HRMS).

**Results:** Diethyl phthalate, a known endocrine disrupting chemical (EDC), was detected in levels up to 167 µg per single-use food contact material. Other EDCs detected included several phthalates and plasticisers, as well as bisphenol A. Toxic compounds released upon microwaving plastic FCMs included styrene, styrene oxide, benzonitrile and hydrogen azide. Toxic hydrocarbons sorbed onto plastic FCMs during vehicle transportation included nonadecane and pentadecane. LODs and LOQs for LC analysis ranged from 0.014 µg/L (Octabenzene) to 7.4 µg/L (Irganox 1076) and 0.042 µg/L (Octabenzene) to 22 µg/L (Irganox 1076), respectively. Extractable and leachable target compounds were detected in water stored in single-use FCMs in concentrations ranging from 0.019 to 25 µg/L.

**Conclusion:** The combination of UHPLC-IMS-HRMSE and GC×GC-TOFMS provided the resolving power and sensitivity necessary to detect a wide volatility range of ELs emerging from plastic FCMs at trace levels.

## NMISA Radioactivity Standards Laboratory capabilities for measurement of radionuclides in food and water

J. Lubbe, M.W. van Rooy, M. J. van Staden

NMISA's Radioactivity Standards Laboratory maintains South Africa's national measurement standard for radioactivity. Importantly, primary measurement standards obtained from absolute measurement methods are checked for uniformity and equivalence by regular participation in international and regional key comparisons. Due to the fleeting nature of radioactivity, the absolute standardizations are maintained through the calibration of secondary standard instrumentation. This traceability chain of activity measurements is disseminated to the user community via these instruments. Public awareness and concern about the impact of radioactive contamination in food and the environment has reached a high level, which will undoubtedly affect regulations concerning the import, export, and manufacturing of products in many countries.

This presentation concentrates on measurements of radioactivity in food and water, using two different methods and instrument types; an HPGe detector and a commercial liquid scintillation counter. Results of participation in some recent International Atomic Energy Agency (IAEA) world wide open proficiency tests using these measurement methods and instruments will be provided.

NMISA is SANAS accredited for gamma-ray spectrometry (including low-level measurements) which can be undertaken with a vertical HPGe detector. This detector is energy-calibrated with primary gamma-ray sources. The efficiency is calibrated through Monte Carlo modelling. Various matrices in various geometries can be analysed. Samples are most commonly analysed for the following radionuclides: Co-60, Cs-134, Cs-137 (in milk, water, fish, green leafy vegetables, grain/ wheat flour, fruit juice concentrate etc.) and I-131 in milk.

A commercial liquid scintillation counter is available for detecting small amounts of alpha, beta and gamma radioactivity. This computer-controlled benchtop analyser is calibrated with primary H-3 (tritium) standards and is used as a secondary standard facility to measure H-3 in water.



# ORAL ABSTRACTS

## From Heavy Metal to Toxins: the Grand Challenges of Food Analytical Chemistry

Z. Mester

In this presentation characterization challenges for heavy metals, aquatic biotoxins and mycotoxins in food and feed industries will be reviewed along with ongoing standardization efforts with a special focus on certified reference materials (CRMs).

Heavy metals - Total metal, metal species, physical forms of metals (metallic macro-, micro and nano- particles) content are key safety parameters of food and feed. Determination of total metal content meeting regulatory limits is typically possible using state of the art atomic spectroscopy instrumentation however it is still a significant challenge when there is no access to such laboratory infrastructure. An overview will be given of primary measurement methodologies and challenges along with elements of recent interest associated with advanced technologies such as Ga, In, REEs. Total metal content is often not an appropriate indicator of the actual risk posed by heavy metals in food. Chemical form of metals, speciation such as mercury vs methylmercury, extractability of metals (e.g. water vs enzyme vs acid leachable metal content) and physical form of metals in the form of various sizes of particles. An overview will be given on key metal species, leaching based bio-accessibility and nano material analysis challenges in food.

Mycotoxins - Mycotoxins are priority contaminants and of high concern especially in warm and humid growth and storage conditions impacting food and feed safety. Mycotoxins small molecular compounds (usually below 1000 Da), are highly stable, prone to bioaccumulation. Hundreds of mycotoxins and metabolites have been identified most of them falling into the categories of aflatoxins, ochratoxins, fumonisins, trichothecenes. In regulatory practice the focus is on about a dozen compounds making the field more manageable. Although mycotoxins although treated as a "class" from an extractability, detection etc point of view these are very different. Main characterization approaches will be discussed along with the use of standards and reference materials.

Aquatic biotoxins - Aquatic biotoxins are chemicals produced naturally various freshwater or marine algae or bacteria species and accumulate in vertebrates and invertebrates such as shellfish which when consumed cause illnesses such as paralytic shellfish poisoning (PSP) and diarrhetic shellfish poisoning (DSP). This varied class of chemicals represent a significant characterization challenge. Major approaches for bio- biochemical- and chemical assaying of aquatic biotoxins will be discussed along with the standardization efforts and access to- and use of- appropriate calibrants.

## The Stockholm Convention List of Pops is Growing – Possible Consequences for African Food Laboratories

J. de Boer

Introduction: The Stockholm Convention of the United Nations (UN) was set up at the end of the last century to stop the production and use of persistent organic pollutants (POPs), and to get rid of (often illegal) stockpiles of these compounds. Twelve compounds were initially included in this list, with good hopes to reduce the list with time. However, it has appeared that measures to discard the stocks of these POPs, such as polychlorinated biphenyls (PCBs) and pesticides such as dieldrin were hard to install or were less effective than planned. Consequently, many plans have been made on paper, but little has been done in practice.

Results and discussion: Stockpiles of organochlorine pesticides (OCPs) can still be found, certainly in Africa. Meanwhile new POPs have been added to the list. Additional pesticides were added such as the hexachlorocyclohexanes (HCHs) in 2009, endosulfan in 2011. Also, industrial compounds based on bromine or fluorine were added, such as the flame retardants polybrominated diphenylethers (PBDEs) and hexabromocyclododecane (HBCD) in 2009 and 2015, respectively, and the perfluorinated alkyl substances (PFAS) perfluorooctane sulfonate (PFOS) in 2009 and perfluorooctanoic acid (PFOA) in 2019.

Due to a new opinion of the European Food Safety Authority (EFSA), the maximum weekly intake of PFOS and PFOA has been reduced by a factor 100-1000. This has raised serious problems with drinking water quality and fish consumption in several European countries, as well as in the USA. These compounds are now globally so widespread and are also found in Africa. A recent UNEP study for the Global Monitoring Program showed values of up to 6 ng/L for the sum of PFOS and PFOA in surface water from Kenya and average levels of 1-2 ng/PUF in air samples in Africa.

Conclusion: More attention for these compounds will be needed in Africa.

# ORAL ABSTRACTS

## Chemical and Biochemical Methods for Detection of Food Fraud

Z. Mester

In the presentation an overview of the analytical technologies used in food fraud and food provenance detection will be provided. The most commonly implicated food categories in food fraud cases include meat/fish, oil and grain crops, alcohols and high sugar foods. Opaque or falsified provenance of foods and food ingredients is also global problem.

Chemical and biochemical methodologies used to address food fraud and provenance questions include, nucleic acid based techniques, gas and liquid chromatography, molecular, elemental and isotope ratio mass spectrometry, nuclear magnetic resonance spectroscopy and various optical spectroscopy approaches (IR, RAMAN). Analytical approaches based either on determination of specific chemical/isotopic or biochemical markers or on finger printing and mapping requiring databases against which identification could be made.

## Efficient Process Techniques in Detecting Food Fraud and Efficacy in Methods of Food Authenticity

G.G. Danjuma

One of the most pressing and active fields of food research and regulation is food fraud and authenticity. It is a growing epidemic in Nigeria that has resulted in the deaths of many people, primarily children, the elderly, and persons with impaired immune systems. Food fraud and authenticity are monitored using a variety of instrumental techniques such as chromatography, mass spectrometry, elemental and isotopic analysis, molecular spectroscopy, and molecular biology. However, these analytical methods used to confirm food authenticity are not always easily accessible and are frequently too expensive, and yet food fraud continues in a variety of locations in Nigeria due to the large gap between lab, consumer, and market. As a result, the purpose of this review study is to look into the current challenges of food fraud in Nigeria, determine the levels of risk it poses to Nigerians' health and well-being, and propose measures to combat it at the local and international levels by regulatory and government agencies, based on the need for "hand-held" devices to be used in the field for rapid adulteration testing with the ability to detect subtle differences between genuine and fraudulent food and beverage. Appropriate teaching programs and new self-authentication mechanisms should be created for customers. The notion of providing consumers with a gadget for detecting adulteration in food stores is of interest to food safety specialists and has grown tremendously. Traceability and transparency of where consumer products originate from, how they were cultivated, and how the food and agriculture sectors are ensuring safety, equity, and sustainability, which should create transformation in the food system, and implementation tools such as traceability that can create improved market visibility and understand the environmental, economic, health, and social externalities of agricultural production.

## The Value of Proficiency Testing – Examples from the QUASIMEME Program and the UNEP Interlaboratory Studies on POPs

J. de Boer

**Introduction:** Twenty years of interlaboratory studies on persistent organic pollutants (POPs) under the Stockholm Convention in Africa and globally have shown how important this tool is for laboratories. To produce reliable results in POP analysis, about 20% of the analysis time should be invested in quality assurance and quality control (QA/QC). Being the only blind test, interlaboratory studies are one of the essential tools in QA/QC.

**Results and discussion:** Four large interlaboratory studies on POPs have been organized by the United Nations Environment Program (UNEP) between 2016 and 2021. The results show that analytical methods of Africa laboratories need further improvement. Some laboratories can produce reliable results, but many still struggle to obtain good data. This can only be made visible by interlaboratory studies. Now, the future of this program is undecided. However, there are other possibilities for African laboratories to participate in such schemes. The QUASIMEME (Quality Assurance of Information for Marine Environmental Monitoring) proficiency testing organization nowadays offers interlaboratory studies also outside the marine environment. The testing schemes are up to date with the latest POPs, including the flame retardants polybrominated diphenylethers (PBDEs) and hexabromocyclododecane (HBCD), the perfluorinated alkyl substances (PFAS) perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) and even chlorinated paraffins. In addition, microplastics analysis in food are also supported by this scheme.

**Conclusion:** African laboratories need a boost in quality of their analytical methods for POPs. It is not possible to achieve such an improvement without participation in international interlaboratory studies.

# [ ORAL ABSTRACTS ]

## **NMISA Reference Materials and Proficiency Testing Schemes, making it relevant to Africa**

**D. Prevoo-Franzsen, L. Quinn, N. Nhlapo, D. Claasen, C. Swiegelaar, D. Mkhize, A. Botha, M. Linksy, M. Fernandes-Whaley**

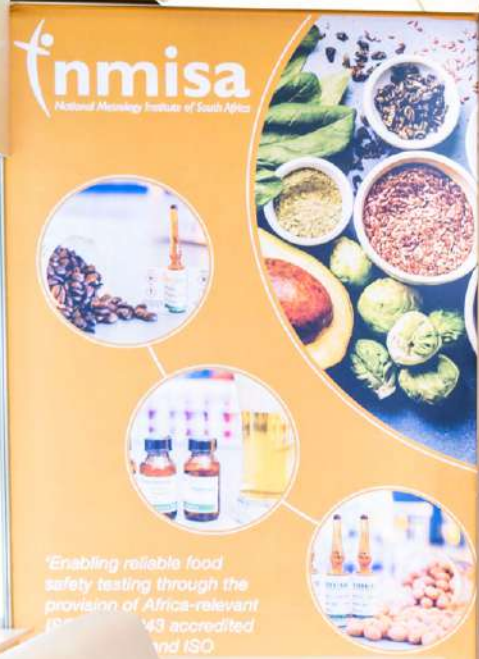
The National Metrology Institute of South Africa (NMISA) has been delivering certified reference materials (CRMs) and proficiency testing (PT) schemes within South Africa and the Africa Food Safety Network over the past 5 years. These services were aimed at supporting testing needs for priority food contaminants such as mycotoxins, pesticide residues and heavy metals in regionally relevant agricultural commodities such as white maize, ground nuts, cassava, avocados, wheat and cocoa. NMISA's participation, within the international metrology network through various capacity building activities, has culminated in the implementation of metrological traceability for these services.

The availability of locally produced metrologically traceable PT reference values have proven invaluable for consistent evaluation of PT performance, in addition to determining root-causes for differences in laboratory results, allowing for continuous improvements within the laboratories. Overviews of PT schemes that focused on food safety and quality challenges within the region will be presented.

### Acknowledgements:

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## Top 5 Exhibitor views:

Microsep/Waters

NMISA

Microsep/Hygiena

Separations

LECO Africa

**184**  
App  
downloads

**12,182**  
App views

**52**  
Active users

**70**  
Total questions  
views

## Top 5 Speaker views:

Dr Godfrey Bahiigwa

Dr James Sasanya

Prof. Jacob de Boer

Dr Maria Fernandes-Whaley

Dr Francis Ejob

## Top 5 Poster views:

Accreditation

Food Control

Mycotoxins

Microbiological

Quality Assurance, Standards  
and PTs



14

Total pieces of coverage

R955,119.88  
AVE

5,167,738

Audience reached for June

100%

Positive tone

92.86%

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100%

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## BROADCAST COVERAGE

PUBLICATION	HEADLINE	LINK
SABC News 24 Hour Channel (1)	Africa Food Safety Workshop - Nozi Miya updates (Interview with CEO Mr. Ndwakhulu Mukhufi)	<a href="#">Link</a>
SABC News 24 Hour Channel (2)	Discussing the Africa Food Safety Workshop underway in Emperors Palace (interview with Dr. Maria Fernandes-Whaley)	<a href="#">Link</a>
SABC News 24 Hour Channel (3)	Africa Food Safety Workshop - Food security still a threat to African countries (interviews with Dr. Laura Quinn)	<a href="#">Link</a>
SABC News 24 Hour Channel (4)	Food fraud tops the agenda at the Africa Food Safety Workshop - Nozi Miya updates (interview with Dr. Wynand Louw)	<a href="#">Link</a>
GrootPlaas (kykNET)	Africa Food Safety Workshop - Food security still a threat to African countries (interviews with Dr. Laura Quinn)	<a href="#">Link</a>
RSG Landbou	Interview with Dr. Angelique Botha by Lise Roberts	<a href="#">Link</a>





## ONLINE COVERAGE

PUBLICATION	HEADLINE	LINK
Sabcnews.com	A multi-sectoral approach to food safety recommended at Africa Food Safety Workshop in Johannesburg	<a href="#">Link</a>
Maroela Media	Voedselveiligheid in Afrika skep vele uitdagings	<a href="#">Link</a>
Agri Focus Africa	Africa Food Safety Workshop 2022 brought together world-class African experts and scientists to improve public health and trade	<a href="#">Link</a>
Food Focus	Africa Food Safety Workshop 2022 brought together world-class African experts and scientists to improve public health and trade	<a href="#">Link</a>
South Africa Today	Africa Food Safety Workshop 2022 brought together world-class African experts and scientists to improve public health and trade	<a href="#">Link</a>
Show Me	Africa Food Safety Workshop 2022 brought together world-class African experts and scientists to improve public health and trade	<a href="#">Link</a>
My PR	Africa Food Safety Workshop 2022 brought together world-class African experts and scientists to improve public health and trade	<a href="#">Link</a>
Food & Beverage Reporter	Memorandum of understanding between NMISA and NIS of Egypt	<a href="#">Link</a>
Green Economy Journal	Africa Food Safety Workshop 2022 brought together world-class African experts and scientists to improve public health and trade	<a href="#">Link</a>
BuyPE.co.za	Africa Food Safety Workshop 2022 brought together world-class African experts and scientists to improve public health and trade - Press Release	<a href="#">Link</a>
MyZA	Africa Food Safety Workshop 2022 brought together world-class African experts and scientists to improve public health and trade	<a href="#">Link</a>



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