FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA

AFRICA CENTRE OF EXCELLENCE FOR MYCOTOXIN AND FOOD SAFETY

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FOOD SAFETY IN AFRICA

INTRODUCTION

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%)1, suffers from chronic hunger (75%) and malnourishment (226.7 million-20.5%).

These figures are highest in Central and West African regions

Food production increases resulting from agricultural initiatives are compromised by food borne diseases;

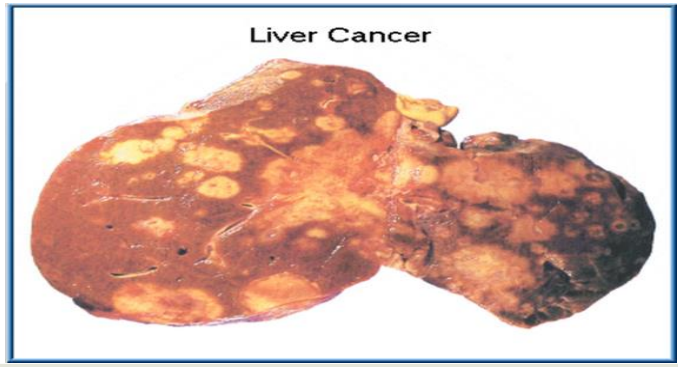
Aflatoxins

- 7761 liver cancer cases in Nigeria (Maize)

- Annual HCC due to AFB1 in sorghum (6014 for HBsAG-, 27439 for HBsAG+); Maize- (7761) in Nigeria

- Children died in Ibadan after eating kulikuli
  - Death via liver cirrhosis and cancer (of 215 persons in Kenya after consuming contaminated maize in 2014)

  Low (chronic effects) concentrations (>200 µg/kg)
  - Liver cancer and growth stunting
  - Immunosuppression (aggravates malaria, HIV & Pneumonia)
  - Increase still birth, neonatal mortality



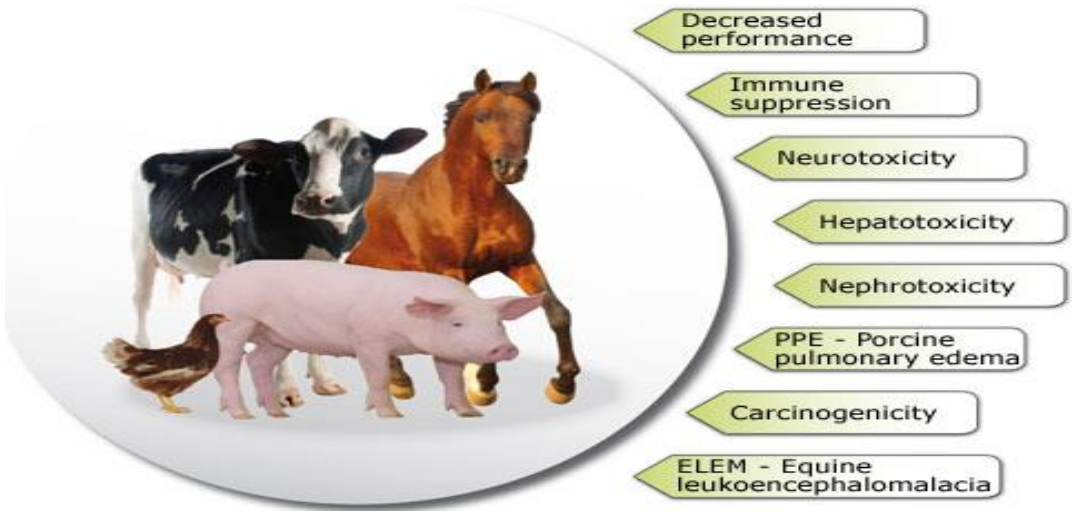
Ochratoxins

Stoev et al. 2009 (Mottled or enlarged and pale in mycotoxic porcine nephropathy)

Health Impact

- Danish porcine nephropathy
- Endemic Balkan nephropathy **(low value of range were found in Nigeria)**
- Group 2B carcinogen
- Immunosuppressant
- Structurally similar to phenylalanine tRNA complex so inhibits protein synthesis
- Liver impairment
- It is in synergy with citrinin, fumonisin and penicillic acid

Fumonisins



- Human oesphageal cancer in parts of South Africa, North Eastern Iran and China,
- Human upper gastrointestinal tract cancer in Northern Italy
- Neural tube defects in human babies
- **Unacceptable levels found in Nigerian Maize**

Zearalenone

- An oestrogenic toxin that causes infertility in animals especially in swine
- Abortion in animals
- Associated with outbreaks of precocious pubertal changes in children in Puerto Rico,
- Has been suggested to have a possible involvement in human cervical cancer in Middle East

Trichothecenes (Deoxynivalenol –DON)

- Reduced weight gain

- Vomiting and feed refusal

Other Mycotoxins

- Sterigmaticystin-Carcinogenic
- Ergot alkaloids-lost of hands and feet and death
- Moniliformin-Cardiac permeability
- Patulin-gastrointestinal disturbance and possibly carcinogenic
- Rubratoxins –Liver toxin
- **Citrinin- kidney toxin**
- **Cyclopiazonic acid –affects organs originating from ducts**
- **Penicillic acid-hepatotoxicity, mutagenotoxicity, genotoxicity in mice**
- **Alternaria mycotoxins-affect liver, kidney and may be a factor in the aetiology of oesophageal cancer**

Economic impacts of mycotoxins

- FAO statistics estimates that 25% of world's food crops are lost to mycotoxin yearly and a substantial part of the wastage is in Africa.
- African countries including Nigeria loss $670 million annually in order to meet European Union regulation on aflatoxins (Otuki et al. 2001).
- National Agency for Food and Drug Administration Control destroyed aflatoxin-contaminated food worth more than US$200,000 (SFI, 2005).
- Between 2007 and 2016 there were rejections of Nigerian produces at EU borders due to aflatoxin level which culminated to the imposition on import ban restricting export of five major agricultural produce from Nigeria to any European Union member country. This ban caused *a decline of ₦671.1 billion or 34.6%* non-crude component of trade including processed and unprocessed food items (National Bureau of Statistics).

Africa loses 40% labour productivity in Africa due to diseases and deaths exacerbated by AFs (Miller, 1995).

But how does one assess the economic losses following increased pre-five mortality rates, and the death of the primary school pupils in Ibadan, and people in an Indian village and two districts in Kenya after eating moulded food contaminated with aflatoxin?

OTHER FOOD CONTAMINANTS

TOXIC METALS, CHEMICAL RESIDUES

Heavy Metals-Cadmium, Lead, Mercury, Arsenic-494,550 deaths (Lead poisoning a recurring decimal in illegal mining sites in Nigeria)

Pesticides Residues-346,000 deaths per year

Veterinary Drug Residues-Antimicrobial resistance 700,000-2m deaths

Food Borne Pathogens-422,000 deaths yearly globally

Polychlorinated Biphenyls-Human carcinogens

HCN in cassava based foods-22,000 killed yearly in Africa

Economic Impact

- Non adherence to CODEX standards set for antibiotics cost over 3.2 billion dollars in global beef trade as at 2003.
- The economic impact of pesticides in non target organisms including human beings is estimated to be approximately $8 billion in developing countries but the figure is as high as $9.6 billion in USA alone.
- China Economic weekly estimates economic losses due to cadmium yearly to be about $3 billion.

Africa Center of Excellence (ACE) for Mycotoxin and Food Safety

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Professor Hussaini Anthony Makun (Centre Leader)

VISION AND MISSION

Vision

To be a global food safety training and research authority in order to realize sustainable and secure health for humanity.

Mission:

The creation of the Africa Center of Excellence (CoE) for Mycotoxin and Food Safety will create learning opportunities and research results to address Africa's shortage of expertise and applicable solutions to ensure a safe, controlled and sufficient food supply that will support economic growth and public health.

EDUCATION, TEACHING AND LEARNING

Postgraduate Mid-Career Postgraduate Diploma, MSc and PhD Programme (curricula have been developed by academic and sectoral partners in June 2019 with contribution from Ghent University

- ✓ Food Safety
- ✓ Toxicology
- ✓ Molecular Biology and Bioinformatics

Table 3: Training of Farmers, manufacturers, consumers,
1. Occurrence and Health Impacts of Mycotoxins, Food Borne Pathogens, Heavy Metals, Veterinary Drug and Pesticides Residues in Food Chain
2. Integrated Approach for Prevention and Control of Mycotoxins, Food Borne Pathogens, Heavy Metals, Veterinary Drug and Pesticides Residues Contamination in Food Value Chain
3. Cost Effective and Improved Food Processing, Preservation and Postharvest Technologies Suitable for Developing Countries for Elimination of Mycotoxins, Microbial and Chemical Residues Contaminants in Food
4. Economic impact of mycotoxins on food and feed industry and mitigation strategies
5. Clinical signs of mycotoxins in livestock and transmission to food

Table 4: Short Term Courses for Industry and Government food Regulators
1. ICT Application on Food Safety
2. Application of Innovative Technologies for Reduction of Contaminants in Foods
3. Food risk analysis
4. Microbiological and chemical laboratory testing methods
5. Good agricultural and manufacturing practices
6. Good aquaculture practices
7. Food inspection training
8. Commercial sterile packaging training
9. Pest and Insecticide Management
10. Food regulations: policy and management
11. Economic impact of mycotoxins on food and feed industry and mitigation strategies
12. From sampling to analytical tools: state-of-the-art in mycotoxin determination
13. Exposure assessment of mycotoxins

EDUCATION, TEACHING AND LEARNING

85 students from eleven countries (Nigeria, Niger, Ghana, Sierra Leone, Cameroon, Democratic Republic of Congo, Kenya, Ethiopia, Uganda, Malawi and Britain (most imperative among ACEs)

minimum of 50 for mid-term professional career,

25 train the trainer (one each from the 25 countries in the Central and West Africa) and

150 farmers and industry workers annually. Revenue will be generated from tuition and

1. **Genomic surveillance of fungi using molecular based techniques, and proteomic and metabolomics for identification of novel fungi**

2. **Mycotoxins analysis using LC/MS/MS, HPLC and GC/MS**

3. **Mycotoxin Exposure and Risk Assessments Studies** using biochemical and molecular toxicological tests.

4. **Developing Predictive Mathematical Models and Early Warning Systems**

5. **Varietal Selection and Breeding of Drought, Pest and Mycotoxin Resistant Cultivars**: Varietal selection and breeding of drought, mycotoxin, pest, resistant food crop

6. **Identifying genes encoding for resistance to drought, pests and mycotoxins** for producing transgenic crops via genetic modification techniques.

7. **Biocontrol of fungi and mycotoxins**: Identification of indigenous endemic non mycotoxins producing fungi for bioexclusion of the mycotoxigenic. Identifying fungal antagonists and endophytes

8. **Developing Phytofungicides:** Isolating essential oils and other plant products with both insecticidal and fungicidal potential

9. **Developing multi-Nanobased mycotoxin feed binder and detoxifiers**

10. **Food portable mycotoxin detecting system**

11. **Developing Codes of Practice for Prevention and Control of Mycotoxin**: specific and effective integrated technology for the prevention and control of mycotoxin in susceptible food products from farm to fork.

12. **Regional Surveillance of Chemical Residues (**Heavy Metals, Veterinary drug and pesticide residues) and Hydrocyanic Acid in Cassava Products:

13. **Infectious diseases** –COVID 19 and Lassa with AFD grant of 1.5 Million Euro

MYTOX-SOUTH PARTNERS

Prof. Sheila Okoth (UNairobi) & Dr. Johanna Lindahl - Dr. Delia Grace (ILRI, Kenya)

Prof. Loveness Nyanga (University of Zimbabwe, Zimbabwe)

Dr. Limbikani Matumba (LUANAR, Malawi)

Prof. Ashagrie Woldegiorgis (University of Addis Ababa, Ethiopia)

Dr. Lindy Rose (Stellenbosch University) **&** Prof. Patrick Njobeh (UJ) **&** Prof. Mulunda Mwanza (NW-University, South Africa)

Dr. Happy Magoha **&** Prof. Martin Kimanya (Tanzania)

dr. Richard Echodu (Gulu University, Uganda)

Prof. dr. Andrea Patriarca (Buenos Aires University) & Prof. Sofia Chulze (Cordoba University, Argentina)

Prof. Obadina Adewale (Fed. Agricultural University of Abeokuta), Prof. Atanda Olusegun (…), Prof. Hussaini Makun (Federal University of Technology Minna) **&** Prof. **Yemisi Jeff-Agboola (Medical University Ondo State)**

PROF Sarah De Saeger and Dr Marthe De Boevre

- 1st Mycotoxicologist
- 8th Food Safety expert
- CoE in Mycotoxicology and Public Health
- Involved in the grant writing that established ACEMFS and this is continuous
- Involved in the development of curricula for food safety, toxicology and Molecular Biology and Bioinformatics
- Instrumental to recruitment of Joseph Kumphanda (Malawi)

- Recruited many Industry/Sectoral partners for ACEMFS (**BIOMIN, NRC Egypt, etc**)
- Develop an research and innovation agenda to produce safer foods
- Supervision of 3 postgraduate students (Student/staff exchange Ghent)
- Member of International Scientific Advisory Board
- Jointly organize workshops and training sessions (ACEMFS in Belfast)
- They will be teaching ACEMFS courses

ACEMFS

WORLD MYCOTOXIN FORUM IN BELFAST

INTRODUCED THE AFRICA CENTRE OF EXCELLENCE FOR MYCOTOXIN AND FOOD SAFETY TO THE WORLD MYCOTOXIN COMMUNITY DURING THE MYTOX SOUTH SESSION

INTRODUCED THE AFRICA CENTRE OF EXCELLENCE FOR MYCOTOXIN AND FOOD SAFETY TO BELGIUM TRADE MISSION AT THE GHENT UNIVERSITY SESSION

RE

- Signed Memorandum of Agreement to continue the academic and research collaboration

46 PARTNERS AND ACKNOWLEDGEMENT

REPUBLIQUE DE COTE D'IVOIRE

Union- Discipline- Travail

MYTOX SOUTH

Biomin
Naturally ahead

National Research Centre

WORLD FOOD PRESERVATION CENTER
EDUCATION - INNOVATION - PRESERVATION

NAFDAC

INTERNATIONAL FOOD SAFETY TRAINING LABORATORY NETWORK

CEDEAO ECOWAS

AHMADU BELLO UNIVERSITY

UNIVERSITY OF ABUJA FOR UNITY & SCHOLARSHIP ABUJA

UNIVERSITY OF AGRICULTURE ABEOKUTA KNOWLEDGE FOR DEVELOPMENT

KNOWLEDGE FOR SERVICE

NIGERIAN INSTITUTE OF MEDICAL RESEARCH NIMR Research for National Health

SCIENTIA SPLENDET ET CONSCIENTIA

NORTH-WEST UNIVERSITY
YUNIBESITI YA BOKONE-BOPHIRIMA
NOORDWES-UNIVERSITEIT

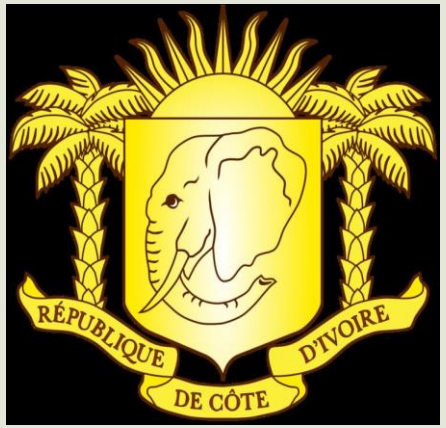
The Nelson Mandela African Institution of Science and Technology Arusha Mt Kilimanjaro 2009 NM AIST Academia for Society and Industry

UNITY SERVICE LEARNING

FLORIDA AGRICULTURAL MECHANICAL UNIVERSITY HEAD HEART HAND FIELD 1887

GHENT UNIVERSITY

UNIVERSITY OF JOHANNESBURG



- FAO/WHO COORDINATIN G Committee for Africa (CCAFRICA)

- Madako Farms and Veterinary Services Bosso

- Marketbridge
- Minna

THANK YOU