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The Need for Integrated Approaches to Address Food Safety Risk: The Case of Mycotoxins in Africa

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1. Mycotoxins and food safety: The big picture – why should we care?

Across Africa, staple crops notably maize and groundnuts as well as sorghum and millet are often heavily contaminated with several mycotoxins produced by diverse fungi. This degree of contamination occurs due to agronomic, sociological, climatic, and institutional challenges. Over the last 70 years, maize has largely replaced sorghum, millet and cassava as source of calories in Africa (IARC 2015). Comprehensively addressing these challenges has proven difficult. There is no silver bullet that will help to manage the incidence and severity of mycotoxin contamination.

The World Health Organization estimates that over 500 million of the poorest are exposed to unsafe mycotoxin levels, most of whom live in sub-Saharan Africa. Starting in childhood, chronic exposure leads to increased mortality and morbidity. Lack of access to urban and international markets contributes to rural poverty, constrains economic growth and promotes gender inequality. In Africa, the constraints from this problem limit personal, societal, and national development opportunities. Mycotoxin contamination is a serious obstacle to 15 of the 17 Sustainable Development Goals.

Of particular economic and toxicological importance are aflatoxins and fumonisins. Aflatoxins frequently contaminate groundnut, tree nuts and spices, while fumonisins additionally contaminate maize and sorghum. Aflatoxin exposure results in acute toxicosis mainly in children, a substantial cancer burden and is associated with child stunting. Fumonisin is a potent cancer promoter, is associated with child stunting and may contribute to birth defects. Aflatoxin is potently immunosuppressive (IARC 2015; JECFA 2017; 2018). The fatalities from consuming highly contaminated maize have been recorded since the late 1960s until recently in Eastern Africa (Kamala et al. 2018; JECFA 2018). To put this into perspective, globally, acute aflatoxin exposure may cause hundreds of deaths while chronic exposure causes nearly a-third of all of the liver cancer cases in Africa (Gibbs et al. 2015). In some parts of Africa, zearalenone contamination may be a concern (Logrieco et al. 2018). The feeding of highly contaminated crops affects animal health and productivity, thus lowering the supply of protein (JECFA 2018).

The health impact of exposure is grossly underreported due to lack of coordinated monitoring and medical surveillance. Mycotoxins are neglected as major public health problems and their control is inadequately funded and not prioritized by many African governments.

Researchers at the World Bank reported that aflatoxin contamination prevents the redevelopment of a groundnut export market in Europe (Diaz Rios & Jaffee 2008). Europe has been able to meet its import needs by switching to China and the USA (Boonsaeng et al. 2008). Africa has the potential to revive its share in the global market as the major net exporter of groundnuts in the decades to come. Europe is the largest peanut importing region and Africa could be competitive if a compliant supply chain was built. Recently, the African Union Commission (AUC)-Partnership for Aflatoxin Control in Africa (PACA) estimated the losses from aflatoxin-related cancer cases in Africa to exceed $100 million USD (PACA 2018).

Changes in climatic patterns also have serious implications for food safety and security in Africa (UNEP 2016). Unseasonable rain, drought and high temperatures increase the risk of aflatoxin and fumonisin contamination (Medina et al. 2014).

2. Mycotoxin mitigation

As with any other food safety challenge, the mycotoxin problem demands use of strategic, comprehensive efforts to reduce the health, trade, income, and food security challenges. Interventions that address the entire food value chain—from farms/households to industries, traders, national storage systems, regulators, and relevant agencies, are needed. Such strategies should consider using pre- and post-harvest resistant crops, good agricultural practices, improved storage, biocontrol, as well studies of domestic economic losses are needed. More effort is needed to promote public-private partnerships, harmonized regional standards, and certification; this is highly dependent on political will. Certain traditional processing (e.g., hand-sorting, nixtamalization) and dietary (e.g., diet diversification) interventions at the household level and mechanical processing (e.g., optical-sorting, dry milling) at the industrial level can also reduce mycotoxin contamination. Without multi-pronged, *sustained* efforts, it will be impossible to achieve improved food safety and lowered food security risks.

At present, mycotoxin control measures are poorly adopted due to constraints such as lack of awareness, inadequate implementation of food monitoring regulations, weakness of relevant agencies, and lack of funds. Mycotoxin mitigation requires time and financial commitment that needs to be rewarded with a good return on investment. There is also a need for a stronger involvement of the health-sector in promoting practical mycotoxin management interventions.

3. Five key messages

a. Investing to protect human lives
There is an urgent need for relevant agencies to recognize mycotoxins as a major public health problem and to prioritize its control. Investments to develop holistic sustainable and effective interventions should be developed and set in motion. Country governments should lead and commit to these investments as well as drive fund raising initiatives from different sources for practicable community- and technology-based control approaches. Critical is the development of public-private partnerships to share knowledge, expertise, technology, and financial resources to scale-up mycotoxin mitigation technologies and strategies in a holistic manner.

b. Implementing innovative and resourceful technologies through partnerships
Practical technologies need to be scaled-up or widely disseminated in order to reach farmers. The implementation of cost-effective, practical mycotoxin control solutions at both pre- and post-harvest stages need to be supported by institutional (e.g., development of mycotoxin-conscious markets), policy (e.g., testing facilities), training, and sensitization actions. Use of comprehensive management strategies have greater chances of succeeding compared to using valuable practices in isolation (Bandyopadhyay et al. 2016). However, holistic interventions are critically dependent on coordinated actions between farmers, governments, development partners, researchers, agricultural organizations, policy makers, health-sector, and other relevant stakeholders.

c. Enabling policy frameworks and regulations
In order to establish effective policies and regulations for mycotoxins, quality and reliable data are requisite. Generating such high-quality data require research and meticulous interpretation of the outputs. Multi-disciplinary collaboration and contribution of data generators/researchers to the policy-making process coupled with the commitment of the policy makers may enhance compliance and adherence to regulations made.

d. Monitoring of effectiveness of mycotoxin management
The efficacy and usefulness of implemented mycotoxin intervention strategies should be adequately and transparently monitored by promoting an enabling environment for feedbacks, especially among the often-overlooked stakeholders such as farmers and rural households, in order to improve upon existing control methods. This is also dependent on availability of standard setting institutions and harmonized regional standards.

e. Transparent and responsible data sharing
Harnessing data that is continuously generated by several stakeholders offers to boost the mycotoxin control approaches by promoting collaboration. A coordinated repository system that promotes open, transparent, and responsible data sharing among stakeholders will further aid in the fight against the mycotoxin menace.

Key words: Consumer health and protection; Food safety; Fungal toxins; Mycotoxin control; sub-Saharan Africa

REFERENCES

Bandyopadhyay, R., Ortega-Beltran, A., Akande, … & Cotty, P. J. (2016). Biological control of aflatoxins in Africa: Current status and potential challenges in the face of climate change. World Mycotoxin Journal, 9:771–789.

Boonsaeng, T., Fletcher, S. M., & Carpio, C. E. (2008). European union import demand for in-shell peanuts. Journal of Agricultural and Applied Economics, 40:941–951.

Diaz Rios, L., & Jaffee, S. (2008). Barrier, catalyst, or distraction? Standards, competitiveness, and Africa's groundnut exports to Europe. Agriculture and Rural Development Discussion Paper 39, World Bank.

Gibb, H., Devleesschauwer, B., Bolger, P. M., Wu, F., Ezendam, J., Cliff, J., ... & Adegoke, G. (2015). World Health Organization estimates of the global and regional disease burden of four foodborne chemical toxins, 2010: a data synthesis. F1000Research, 4.

International Agency for Research on Cancer (2015). IARC Working Group Report No. 9, Lyon

JECFA (2017) Evaluation of certain contaminants in food. Eighty-third report of the Joint FAO/WHO Expert Committee on Food Additives. WHO Technical Report Series 1002: WHO and FAO 2017.

JECFA 2018) Joint FAO/WHO Expert Committee on Food Additives (JECFA). 2018. WHO FOOD ADDITIVES SERIES: 74 FAO JECFA Monographs 19 bis.

Kamala, A., Shirima, C., Jani, B., Bakari, M., Sillo, H., Rusibamayila, N., … & investigation team. 2018. Outbreak of an acute aflatoxicosis in Tanzania during 2016. World Mycotoxin Journal, 11:311–320.

Logrieco, A. F., Mille,r J. D., Eskola, M., Krska, R. ….& Leslie JF (2018) The Mycotox Charter: Increasing awareness of, and concerted action for, minimizing mycotoxin exposure worldwide. Toxins 10:149

Medina, A., Rodriguez, A., and Magan, N. 2014. Effect of climate change on A*spergillus flavus* and aflatoxin B1 production. Frontiers in Microbiology, 5:1–7.

UNEP (2016) UNEP FRONTIERS 2016 REPORT: Emerging issues of environmental concern. United Nations Environment Programme, New York