

10 Facts You Should Know About Aflatoxins

1 Aflatoxins are highly toxic compounds produced by a fungus

Aflatoxins are naturally occurring toxins produced by certain fungi, most importantly *Aspergillus flavus* and *A. parasiticus*. These toxins mainly accumulate on crops and grains in tropical regions. Aflatoxins occur most frequently when there is dry weather when crops are near maturity, when high moisture is present during harvest, and when crop drying and storage is inadequate. Countries in latitudes between 40°N and 40°S—which includes all of Africa—are affected by aflatoxins.

2 Aflatoxins impact staple crops in many parts of Africa

Overall, information on aflatoxin prevalence in Africa is limited. But available data indicate that aflatoxin levels often exceed established tolerance limits in the key staples of maize, groundnuts, and sorghum.ⁱ Aflatoxins also can enter the human diet through livestock products when livestock are fed contaminated feed. It is estimated that an African adult consumes about 400g/person/day of maize-based foods, compared to less than 10g/person/day in developed countries, which increases exposure to aflatoxins.ⁱⁱ Aflatoxin contamination directly impacts household food and nutrition security and disproportionately affects the less-privileged segments of society. When contaminated food is withdrawn from the supply chain, for instance, that directly impacts the amount of food available. Also, many smallholder farmers sell their best crops and consume any that are discolored or moldy, thus increasing their risk of consuming high levels of aflatoxins.

3 Eating aflatoxin-contaminated food has negative health impacts for humans

If aflatoxin-contaminated crops are consumed by humans, aflatoxin poisoning (i.e., aflatoxicosis) can occur. Ingestion of these toxins at very high levels can result in acute aflatoxicosis, which is a failure of the liver that can lead to death within one to two weeks of exposure.ⁱⁱⁱ Also, aflatoxins have been classified as human carcinogens by the International Agency for Research on Cancer. Chronic exposure to even low levels of contamination in crops consumed regularly causes liver cancer and can suppress the immune system. Children are affected through breast milk and direct consumption of weaning foods. Some experts suspect an association between aflatoxin exposure and child growth stunting.^{iv} Evidence also suggests that chronic exposure to aflatoxins by newly infected HIV+ people could suppress their immune systems.^v

i Publicly available, unpublished review, by Abt Associates, of previously published data on aflatoxin prevalence in maize, sorghum, and groundnuts.

ii M. Adetunji, et al., Fungal and bacterial metabolites of stored maize (*Zea mays*, L.) from five agro-ecological zones of Nigeria, *Mycotoxin Research*, May 2014, 30 (2): 89–102.

iii A. Obura, Aflatoxicosis: Evidence from Kenya, *Aflatoxins: Finding Solutions for Improved Food Safety*, Focus 20, Brief 2 (Washington, DC: International Food and Policy Research Institute, November 2013). Available at: http://www.ifpri.org/sites/default/files/publications/focus20_02.pdf.

iv J.L. Leroy, Child stunting and aflatoxins, *Aflatoxins: Finding Solutions for Improved Food Safety*, Focus 20, Brief 4 (Washington, DC: International Food and Policy Research Institute, November 2013). Available at http://www.ifpri.org/sites/default/files/publications/focus20_04.pdf.

v P.E. Jolly, et al., Association between high aflatoxin B1 Levels and high viral load in HIV-positive people, *World Mycotoxin Journal*, August 2013, 6 (3): 255–261.

4 Aflatoxins can have negative economic impacts and affect trade

Many countries have established regulations to limit exposure to aflatoxins, typically ranging from 0 detectable to 30 parts per billion. When crops don't meet these standards, they can be rejected, sold for a reduced price, or not sold at all. Many African countries do not have policies, standards, or regulations to control aflatoxins, and those that have them do not enforce them well. Currently, it is estimated that Africa loses nearly \$450 million USD annually in lost trade due to aflatoxin contamination.^{vi}

There are also costs associated with meeting standards—for example, for testing and disposing of or storing rejected shipments. Similar economic losses may occur in domestic markets if consumer awareness about the problem rises and/or if regulations are either tightened or more strictly enforced. Strong, consistent, and enforced standards result in improved economic benefits in the long term because they support larger and more stable markets for aflatoxin-free products, which incentivize aflatoxin-control technologies and may result in a reduced disease burden.

5 Accurate detection of aflatoxins at low cost is difficult but possible

Aflatoxins are difficult to detect without the use of complex technology and proper analytical methods. In order to understand the extent of aflatoxin contamination and effectively incentivize aflatoxin control, high-quality and quick information about aflatoxin occurrence and distribution is important, but largely lacking in Africa. Diagnostic tools need to be available to measure aflatoxins at multiple points along the value chain, from the farm to the table. Currently, available diagnostic technologies—including rapid diagnostic strips and ultraviolet absorption assessments—are typically expensive and are not portable enough to be used in the field.^{vii} Some promising new technologies are being developed. These include near infrared spectroscopy, an “electronic nose” that can predict and semi-quantify aflatoxin levels and could be available on a mobile phone, and paper microfluidics, which uses inexpensive paper and printing capacity to develop a “lab on paper.” Yet new, suitable diagnostic tools are needed so that researchers, regulators, government decision makers, and the private sector can effectively address aflatoxin control.

vi T. Oztzaki, J.S. Wilson, and M. Sewadeh, What price precaution? European harmonisation of aflatoxin regulations and African groundnut exports, *European Review of Agricultural Economics*, 2001, 28: 263–283.

vii J. Harvey, et al., Improving diagnostics for aflatoxin detection, *Aflatoxins: Finding Solutions for Improved Food Safety*, Focus 20, Brief 19 (Washington, DC: International Food and Policy Research Institute, November 2013). Available at: http://www.ifpri.org/sites/default/files/publications/focus20_19.pdf.

6 *Good agricultural practices at planting, harvest, post-harvest, and processing can reduce aflatoxin contamination*

A number of existing agricultural practices can reduce aflatoxin contamination or prevent low levels from becoming problematic. During planting, farmers can use aflatoxin-resistant planting materials, including those developed through both conventional and transgenic breeding. Biological control products, such as aflasafe™, have been proven to reduce aflatoxin-producing fungi in the soil through the use of native, non-aflatoxin-producing strains of *A. flavus* that out-compete the toxic strains. Irrigation, fungicides, herbicides, and insecticides can result in overall improvements to plant health (by reducing plant stress), resulting in resistance to the aflatoxin-producing fungus.

After harvest, contamination can occur if a crop is not dried right away or if it is stored when too moist. Once crops are harvested, measures to control the moisture content, such as solar drying techniques and laying crops on tarps, can prevent increased contamination. Prior to storage, sorting and discarding crops with physical flaws and deformities, such as visible mold or damaged shells, is important. Sorting out insect-infested grain at harvest can also reduce contamination, as can improved storage. Additional care during transportation, processing, and distribution to keep crops dry is important and can go a long way toward developing safe agricultural products.

7 *Individuals can take several measures to reduce exposure and minimize impact*

One very simple step that individuals can take to reduce their exposure to aflatoxin is to diversify their diet, where possible. Rice, sorghum, and pearl millet have significantly lower aflatoxin contamination. A family that consumes a diverse diet reduces their daily and long-term intake of aflatoxins, as well as decreasing their dependence on products that may be contaminated by aflatoxins. It is suspected that hepatitis B and aflatoxin have a synergistic effect, resulting in higher risk of negative impacts from both afflictions. Therefore, individuals who are at risk of being exposed to aflatoxins should receive the hepatitis B vaccine to prevent hepatitis B, which will reduce any compounding effects of aflatoxin.

8 *Policy action is needed*

Regulations can provide incentives for aflatoxin-control technologies through demand for aflatoxin-free food. Therefore, effective policies, regulations, and standards are needed to establish a robust regulatory foundation to address aflatoxin issues. Country-specific standards are needed that account for consumption patterns and build on existing regulatory frameworks, such as those put forth by the World Trade Organization's Sanitary and Phytosanitary Agreement and the Codex Alimentarius Commission. Adequate support for compliance and enforcement with national regulatory codes is also needed.

Comprehensive, multi-sectoral approaches are required to control the complex aflatoxin problem and improve the health, income, and livelihoods of African farmers, farm households, and consumers. Actions are needed at all levels (national, regional, and continental) to reduce aflatoxin prevalence and exposure in Africa.

9 *More research is needed*

While much is known about aflatoxins, additional research on prevalence, impacts, and control technologies is needed. Information on the prevalence of aflatoxins across Africa can help decision makers, regulators, and public health officials target interventions. The Partnership for Aflatoxin Control in Africa (PACA) is working to address this need by establishing an electronic data management system, including an online aflatoxin prevalence map for Africa, through the Africa Aflatoxin Information Management System (AfricaAIMs). AfricaAIMs will work with partners and train country teams to collect and enter data directly relevant to policy makers and other stakeholders at multiple scales.

Additional research is also needed on new technologies to control aflatoxins along major value chains. This could include additional research on aflatoxin-resistant planting materials, storage and drying techniques, and other commercial processing techniques. Efforts at development and commercialization of local and regional biocontrol products should also be pursued further. Research is also needed on safe disposal and alternative use of unsafe commodities, such as for biofuels or in blended feeds. Blended feeds can conform to safe standards for finishing feeds, which can have slightly higher levels of aflatoxin without harming animals.

Finally, a number of policy and regulatory questions could benefit from additional information gathering. Information on the impacts of regulations and how to most effectively incentivize the production of safe crops is important. For example, adjusted national food safety standards could be based on ranges of consumption of different commodities, which considers the tolerance level of the consumer.

10 *Work is already being done toward an Africa free from the harmful effects of aflatoxins*

Many organizations are working to improve our knowledge about aflatoxins, identify innovative technologies that prevent contamination, scale up and share existing technologies, and coordinate policy actions. PACA is a collaboration that aims to protect crops, livestock, and people from the effects of aflatoxins by providing leadership and coordination for Africa's aflatoxin-control efforts, acting primarily as catalyst, facilitator, partnership and knowledge broker, project developer, and information clearinghouse. PACA will also advocate for the establishment of enabling policies and institutions, increased investment, and the mobilization of resources, and should ultimately act as a grant maker to support priority aflatoxin-control activities. Numerous public and private funders are supporting projects to research, prevent, and control aflatoxin contamination. A wide range of activities are catalogued on an interactive map of aflatoxin-control activities across Africa, available here:

www.aflatoxinpartnership.org/?q=activities-in-africa.



Together we can work toward a vision of Africa free from the harmful effects of aflatoxins.