The European Commission's Knowledge Centre for Global Food and Nutrition Security

Mycotoxins and risks for food and nutrition security

Headlines

- African countries are frequently and widely affected by mycotoxin contamination of feed and food stuffs
- Mycotoxins have effects on humans and livestock at many levels
- Long-term mycotoxin control is often inadequate or unsustainable in developing countries

Background

Mycotoxins, some of which known as one of the most potent carcinogenic and mutagenic substances, are produced by fungi which can contaminate various agricultural crops and food substances. More precisely, they are secondary metabolites produced by the toxigenic strains of fungi and may enter the human food-chain via direct routes (i.e., via the consumption of contaminated crops or via consumption of animal products originating from livestock which were fed fungal contaminated feed) or via indirect routes [12]. The main mycotoxin-producing fungi are species of the *Aspergillus*, *Fusarium* and *Penicillium* genera. The mycotoxins considered most relevant for nutrition security with respect to their impact on public health are aflatoxins, fumonisins, ochratoxin A and trichothecenes such as deoxynivalenol. Of these, the aflatoxins and fumonisins have been reported most frequently and widely in foodstuffs in Africa. In developing countries, mycotoxins pose a major risk to nutrition security, and contribute to food and feed losses [3].
Fungal mycotoxin develops mainly during the crop growth and harvest stages, and is triggered by factors such as extreme weather conditions (drought, heavy rainfall), pests, certain soil conditions and genotypes, soil saturation, high temperatures, and poor transport and storage hygiene conditions [2], [7].

Several teams are working on improved weather conditions risk early warning based on crop and mycotoxin growth models [8], [9]. In Africa, the APHLIS (African Postharvest Losses information System) is developing an early warning system for mycotoxin climate risk (https://www.aphlis.net).

Consumption of food products containing minute doses of mycotoxins over a long time period cause chronic effects, whereas large doses thereof in a short period of time result in acute toxicity and death [1], [2]. Through numerous clinical, experimental and epidemiological studies the exposure to mycotoxins (mainly through the food/feed chain) has proven carcinogenic, cytotoxic, estrogenic, genotoxic, hepatotoxic, immunosuppressive, mutagenic, nephrotoxic, neurotoxic and teratogenic effects on humans as well as on animals [3] [4]. For humans, the biological basis for the effects is the interference in metabolic key functions of the cells caused by the presence of mycotoxins.

Economically speaking, mycotoxin contamination impacts on food availability (quantities of food of appropriate quality) which may directly result in hunger and malnutrition of the local population [3] [5]. Given stricter food safety regulations with regard to mycotoxin standards in developed countries should result in increased efforts in prevention of mycotoxins with a clear benefit of heath of the domestic population whilst also increasing the export possibilities [4]. In addition, mycotoxins outbreaks can lead to a ban on import goods from a given region, thus creating additional economic challenges.

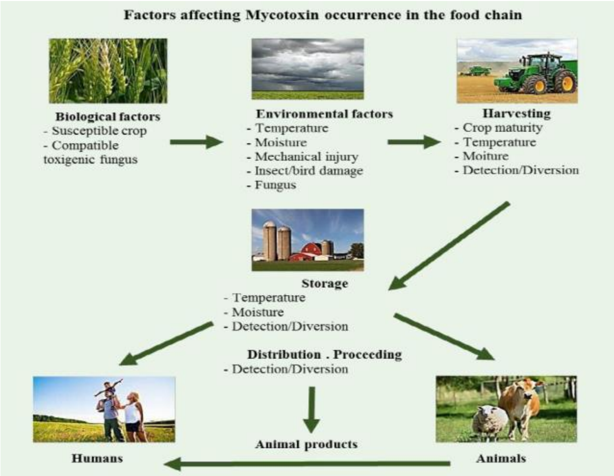

Figure 1 – Factors which affect mycotoxin occurrence in the food chain [6]

Moreover, socio-economic factors (e.g. inaccessibility of appropriate materials and equipment, inadequate marketing and transport systems, insufficient governmental policy and regulations, and lack of awareness) increase the likelihood of mycotoxin contamination [2]. Increasing climate variability and occurrence of extreme weather events also aggravate the risk of mycotoxin contamination, for example through the impact of higher temperatures on grain storage [8].

Due to the known dangers of mycotox in food and feed contamination, many African countries have launched prevention, control and monitoring strategies to reduce these risks. Nevertheless, in various countries the necessary information with regard to public health significance, occurrence, prevention and control of mycotoxins is still missing. In addition, better mycotoxin contamination-related databases and more frequent/extended tests are generally desirable as there is often only limited mycotoxin exposure risk assessment and data, largely due to a lack of detailed data on country-wide food consumption patterns and limited technical expertise to monitor and assess mycotoxin levels. [1] [4].

Mycotoxin Control

Mycotoxin control is important for the health of both the population and the economy of the affected country. The competitiveness of agricultural exports is diminished by mycotoxin contamination. Generally speaking, strategic interventions should be made to reduce mycotoxin-producing fungi to acceptable levels, as these fungi are extremely pervasive and not easily eradicated [2].
Darwish et al. (2014) highlight that mycotoxin control on the African continent involves: (a) mold growth prevention in crops, (b) sanitisation of mycotoxin-contaminated foods (as a secondary strategy) and (c) continuous monitoring of mycotoxins in agricultural crops, human food and animal feed.

Several actions have already been identified with respect to mycotoxin control, such as physical approaches [14] [15] (e.g. sorting, chemical approaches, fungicide application), biological approaches (e.g. use of atoxigenic fungi), and education of the local population about the dangers and control of mycotoxins via workshops, seminars and media campaigns [11] [19].

Although many mitigation strategies have been recognised and reported, many of these present sustainability challenges over long time periods, especially among the poorer population for whom exposure to mycotoxins is generally highest [1], [2], [17], [18].
In response to the continuous demand for improving the control and reduction of mycotoxin contaminations, efforts are being made to harmonise regulations and strengthen legislation at the global level. In this context, the Mycotox Charter initiative was launched by MycoKey (integrated and innovative key actions for mycotoxin management in the food and feed chains), an EU-funded project, in 2018 [16].

Also in 2018, the Codex Alimentarius Commission (established by the Food and Agriculture Organization and World Health Organization) adopted a number of food standards, guidelines and codes of practice regarding mycotoxins in food and feed, with the aim of contributing to food safety, food quality and fairness in the global food trade [13].

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