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Editorial

Increased Health Impact of Aflatoxins Due to Climate Change: Prospective Risk Management Strategies

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Acronyms and abbreviations
AF=Aflatoxin

Naturally occurring mycotoxins are an important challenge since they are present in many kinds of foodstuffs. Various types of agricultural products, especially ones with rich carbohydrates, are vulnerable to fungi growth and their important secondary metabolites known as mycotoxin (Iqbal et al., 2016). Mycotoxin formation is directly dependent on climatic conditions, i.e. temperature, humidity, and precipitation are key factors for development of toxigenic mould. They may contaminate food prior the harvest, or during the post harvest storage, and also marketing. Aflatoxins (AFs) as the most toxic mycotoxins are secondary metabolites of the fungi belonging to *Aspergillus* species, mainly *A. flavus* and *A. parasiticus*. AFs are reported in several agricultural crops, mainly maize, soybean, peanuts, pistachio, wheat, cottonseeds, etc. worldwide (Battilani et al., 2016). *A. flavus* as thermotolerant fungi adapts easily to warmer climate, and may therefore become more problematic than the other mycotoxin-producing moulds (Herrera et al., 2016). Currently around 20 different types of AFs are known, and the major ones are AFB_1, AFB_2, AFG_1, AFG_2, and AFM_1 (Iqbal et al., 2016).

AFs were first isolated 40 years ago after outbreaks of disease with deadly consequences at animals. Some of the pronounced toxicological effects of AFs with range of consequences are acute illness, cancers, immunologic suppression, nutritional interference, and even death (Williams et al., 2004). Numerous studies have shown that AFs influence on 6 of the 10 most important health risks for the developing countries, which is notified by the World Health Organization. AFs are recognized as carcinogenic mycotoxins by International Agency for Research on Cancer (IARC, 2002), classified as Group 1 carcinogenic, and therefore are among the most strictly legislated mycotoxins worldwide (Assunção et al., 2018). Furthermore, besides the negative health impact, AFs cause significant economic implications that include trade difficulties due to recall or rejection of products. In 2016, mycotoxins as food safety hazard were reported for maximum residue levels exceeding in 489 notifications from European Union countries, most of them related to unauthorized AF presence (Assunção et al., 2018).

Until few years ago, AFs were matter of concern mostly for tropical and/or subtropical countries where favorable climate conditions are present for fungi development. However, a research revealed increased levels of AFs in some parts of temperate Europe and the United States (Herrera et al., 2016). Such outbreaks had been reported in 2013 for Romania, Serbia, as well as Croatia (Kumar et al., 2017); and also in 2002 and 2012 for Italy and Southern Europe (Battilani et al., 2016), suggesting that Europe may not be AFB_1 free. This is associated to the changed climate temperature which increases and provides the optimal condition for production of AFs.

Thermotolerant fungal species such as *A. flavus* may therefore become more problematic than other mycotoxin-producing fungi in temperate European countries. Therefore, the fact that AF contamination is probably to be spread in parts of the world which were considered as AF free may have strong consequences on risk management strategies.

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The possible change in patterns of AF occurrence in food, as consequence of climate change is a matter of priority that probably needs more anticipatory actions as well as novel management approaches. In this regard, the latest proposed management and control strategy was the biocontrol of toxigenic strains of *A. flavus* (Kumar et al., 2017). As biocontrol agents, *Bacillus subtilis*, *Lactobacillus* spp., *Pseudomonas* spp., and *Ralstonia* spp. were proposed effective for control and management of AFs in maize (Kumar et al., 2017). Even more, some commercial products based on a toxigenic *A. flavus* strains were developed and are already available. Using *Trichoderma* spp. in groundnuts reduced the AFs up to 90% indicating that biological control is emerging as an effective and promising tool for management of AF. Another approach for AF control might be prediction of future temperature trends and anticipation of potential control options (Assunção et al., 2018). Considering the presumed scenarios for temperature increase, it is very likely that the scientific community is already prepared to predict and estimate the potential risks and human exposure to AFs in future conditions of changed climate. Namely, there are available reliable analytical techniques to determine toxins in different food products; to provide models for anticipate the contamination levels of food products and assess the human exposure; and to derive the potential health risks (Assunção et al., 2018). Considering the climate change and its unequivocal health impact and also real risk in global level, there is an urgent need for the continuous characterization of the associated risks, developing new strategies and approaches for their management, and thus prevent some of the potential outcomes. Another important perspective is understanding and readiness of the policy makers at global and national level to take actions and support studies that could significantly contribute towards implementation of successful management strategies, aimed to minimize the impact of AFs for human health.

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