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***Correspondence**
Muhammad Naeem Iqbal
Email:
driqbalmn@hotmail.com

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Mycotoxins Produced by Food Spoilage Fungi Pose Risk to Public Health and Food Security

Muhammad Naeem Iqbal*[1,2], Asfa Ashraf[1,2]

[1]Association of Applied Biomedical Sciences, Narowal (51770), Pakistan.
[2]PSM Academy, Narowal (51770), Pakistan.

Abstract:
Fungal contamination of food and agricultural products is a widespread issue worldwide, especially in underdeveloped nations. Mycotoxigenic fungi have the ability to infect food and produce potent mycotoxins that, if consumed, can have harmful health effects. Fungal growth not only deteriorates food quality and decreases food security, but it also causes food spoilage. Mycotoxins, which are harmful substances produced by certain fungi, pose a serious threat to human health and food security. In this issue, Al-Jobory (2025) detects multiple mycotoxins in 95% of sun-dried Wazef samples, mostly produced by *Aspergillus* and *Penicillium* species. The propensity for fungal spoiling and the pervasiveness of multi-mycotoxin contamination combine to provide a perfect storm of nutritional deterioration and health hazards. Future analyses of the food products will present chances to investigate the dangers of consuming food preparations tainted with fungi.

INTRODUCTION

Mycotoxins are low-molecular-weight secondary metabolites produced by fungi. These potentially hazardous compounds pose a risk to both public health and food security (Gurikar *et al.*, 2023; Iqbal *et al.*, 2021). In this issue, Al-Jobory detects multiple mycotoxins in 95% of sun-dried Wazef samples, mostly produced by *Aspergillus* and *Penicillium* species. Multi-mycotoxin contamination and the propensity for fungal spoilage cause nutritional degradation and health risks (Al-Jobory, 2025). The following perspective examines the various hazards posed by mycotoxins, their extensive effects, and the urgent need for innovative, equitable remedies.

Mycotoxigenic fungi can produce one or more mycotoxins and are found in a variety of crops, including cereals like corn, maize, wheat, soybeans, fruits, nuts, coffee, cocoa, and spices (Al-Jobory *et al.*, 2017; El-Sayed *et al.*, 2022; Humaid *et al.*, 2019). Environmental factors that are crucial for fungal colonization and mycotoxin production include temperature, pH, water activity (aw), and nutritional substrate. These factors can significantly affect fungal growth and the types and amounts of mycotoxins produced (Daou *et al.*, 2021).

There are both immediate and long-term health risks associated with mycotoxins (Goessens *et al.*, 2024). Long-term mycotoxin exposure dramatically increases the incidence of hepatocellular cancer, especially in hepatitis B patients. Rarely, acute aflatoxicosis can cause liver failure to occur quickly. Fumonisins have been connected to neural tube malformations in developing fetuses and esophageal cancer, whereas other mycotoxins, including ochratoxin A, are nephrotoxic and may harm the kidneys. Deoxynivalenol, also known as "vomitoxin," impairs immunological and intestinal health, making malnutrition worse, especially in young infants. The insidious nature of mycotoxins lies in their chronic, low-level exposure. The everyday use of contaminated staples by populations in impoverished countries, where nutritional diversification is restricted, results in developmental delays, decreased immunity, and stunted growth. Even in industrialized countries, where regulations are more stringent, trace contamination in processed foods raises questions about potential long-term health effects, especially for vulnerable populations (Zahir *et al.*, 2025).

Mycotoxins decrease the availability and safety of the food supply, which compromises food security (Mafe and Büsselberg, 2024). In impoverished nations, where fungal contamination can result in post-harvest losses of up to 30%, mycotoxins worsen economic instability and famine. Contaminated crops are often discarded or relegated to animal feed, which can transfer toxins into the food chain via meat, milk, and eggs (Emmanuel *et al.*, 2020). Strict mycotoxin laws in prosperous countries safeguard consumers, but they disproportionately hurt small-scale businesses that cannot afford testing or mitigation tools. The issue is made worse by climate change, as unpredictable rainfall and rising temperatures foster the growth of fungi.

A diversified approach is required to address mycotoxins, yet existing methodologies have major obstacles. Monitoring and detection are equally imperative yet expensive. Mycotoxin detection at trace quantities is possible with refined methods like liquid chromatography-mass spectrometry, but such tools are uncommon in developing nations. Although there are quick and economical testing kits accessible, their precision and usability are constrained (Hooda *et al.*, 2023). Sensitive and quick mycotoxin detection is accomplished by combining monoclonal antibodies (mAbs) with nanoparticles, mainly magnetic nanoparticles (MNPs) and gold nanoparticles (AuNPs). These methods are superior to conventional methods because they permit multiplexed detection, shorter analysis times, and probably lower detection limits (Boshra *et al.*, 2024; Iqbal, 2020; Iqbal *et al.*, 2018; Ling *et al.*, 2021; Sharma *et al.*, 2024). The pervasive hazard of mycotoxins demands immediate consideration from communities, governments, and scientists alike as the globe struggles with population escalation, climate change, and stressed agricultural systems.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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