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Review Article

Fungus and the Threat of Mycotoxin Poisoning

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Introduction

Fungi can be detrimental to humans and some animal species. Mycotoxins are byproducts of fungal contamination, occur naturally, and they have the potential to cause deleterious effects in humans and animals (World Health Organization [WHO], 2021). There are several groups of mycotoxins that are metabolites of molds and fungi. Certain mycotoxins are commonly found in cereals, wheat, corn, rice, some nuts (i. e. peanuts, almonds, walnuts, and pistachios), soybeans, and sunflower seeds. Spices such as chili peppers, black pepper, coriander, turmeric, and ginger have also been found to have Aspergillus contamination [1].

Mycotoxin production is proliferative in warm, moist, and humid environments during the plant growth cycle and during plant storage [1]. According to Puri, Shingh, and Tiwari (2019), contamination of food with mycotoxins is a major problem that affects people worldwide. Chronic ingestion of mycotoxins can cause damage to the biologic system of humans in that the infection has been associated with diseases of the liver. Also, long-term exposure has been known to be carcinogenic [2]. A few of the mycotoxins that are known to cause disease in humans and some animals include aflatoxins, ochratoxin A, patulin, and fumonisins (WHO, 2021). Mycotoxins are volatile and can disturb the intestinal microbial environment. A threat to humans is posed when the intestinal microbial environment is altered. When the natural intestinal microbial colony is dysfunctional the immune response is often impaired. Disruption of the immune response in humans can result in the initiation of an opportunistic fungal infection that can overwhelm the human body [3].

Aflatoxins

One of the most harmful mycotoxins is aflatoxins. Aflatoxins are secondary metabolites of the specific fungi in the Aspergillus species (Aspergillus flavus and Aspergillus parasiticus). The growth of the Aspergillus species is common in grains, hay, in the ground, and in conditions where decomposition of vegetation occurs (WHO, 2021). Aflatoxins have been found to contaminate foods such as wheat, rice, and milk products. Diseases that affect the liver and cancer have been associated with ingestion of large amounts of Aflatoxins [2].

Ochratoxin A

Ochratoxin A is a common mycotoxin that has been found to produce inflammation in the liver of humans and animals. Ochratoxin A is most commonly produced by certain Aspergillus and Penicillium species and are also known to be nephrotoxic [2,4], conducted a study on young ducklings to determine the effects of Ochratoxin A on the liver. Ducklings were given a weight-dose of Ochratoxin A for a period of two weeks via oral gavage. An analysis of the microbes found in the cecum and the liver was performed on the ducklings. After the two-week treatment with Ochratoxin A, the findings of the study indicated a large amount of gram-negative bacteria in the cecum and liver, and inflammation of the liver was also observed [4].

Patulin

Patulin is another common fungal metabolite that has detrimental effects on humans. Patulin contamination has been

observed in certain fruit and fruit juices, mainly, apples and apple juice [5]. Patulin is also produced by certain Aspergillus and Penicillium species and can cause such gastrointestinal problems as nausea and vomiting in humans [2]. Mycotoxin production by fungi is widespread and affects people of all regions of the globe. According to Pal, Singh, and Ansari (2017), the annual global expenditure associated with mycotoxins has been millions of dollars. In other words, the cost to prevent mycotoxin production and care for humans and animals affected by the mycotoxins has been enormous.

Fumonisins

Fumonisins are metabolites of a fungal species called fusarium. The fumonisin mycotoxin has also been known to cause severe illness in humans. The intestinal mucosa can be damaged by the fumonisin mycotoxin and skin irritations have also been observed in people with contamination by this mycotoxin [2,6] reported that fumonisin contamination of food products is vast due to the ubiquitous nature of the fusarium fungi. Also, Cendoya, Chiotta, Zachetti, Chulze, and Ramirez (2018) reported that some of the products affected by fumonisin growth are rice, wheat, barley, maize, rye, oats, and millet. Corn and tortilla products have also been affected by the fumonisin mycotoxin contamination [7].

Since mycotoxins are associated with liver damage, damage to the immune system [3], damage to the kidneys [2], and have been known to alter gene DNA, resulting in cancer [2], individuals must be cautious when buying, storing, and consuming foods. Puri et al. (2019), suggested that proper handling of foods such as grains, should include making sure they are dried thoroughly before being stored in a non-moist, non-humid environment. In addition, to restore microbial homeostasis of the intestinal tract, an intake of probiotics has been noted to have health promotion properties (Liew & Mohd-Redzwan, 2018).

The World Health Organization (2021) has urged individuals to be vigilant in the selection of foods and the minimization of mycotoxin ingestion. All foods, especially nuts, grains, and dried fruit, should be thoroughly inspected for discoloration, mold, and damage because these are signs of mycotoxin contamination. Food should be stored at temperatures that are not too hot or humid. Also, food should not be kept for long time periods before using. Careful inspection of food before the purchase and consumption are strategies to help alleviate illnesses related to mycotoxin ingestion. If there are signs of mycotoxin contamination, the food should be discarded immediately (WHO, 2021).

Acknowledgement

None.

Conflict of Interest

No conflict of interest.

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