



Aflatoxin and Its Effect on Living Biological System

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Aspergillus flavus and *A. parasiticus* are cosmopolitan fungi associated with grain moldiness produces aflatoxin which contaminate food of humans and feeds of animals. The food crops such as cereals, pulses, nuts, oilseeds (Njapau *et al.*, 1998), almonds, figs, spices and dairy products. The economic impact of aflatoxins is very high and immensely affects human, animals, crop and livestock health. Besides *Aspergillus* spp. there are other groups of fungi viz., *Fusarium graminearum*, *F. moniliforme*, *Penicillium* sp. and *Diplodia maydis* produces mycotoxigenic compounds which are detrimental to health of humans and animals. Besides *A. flavus* and *A. parasiticus* there are other major species of *A. nomius*, *A. pseudotamarii*, *A. bombycis* and *A. ochraceoroseus* are contributing to the production of mycotoxigenic compounds in food grains (Frisvad *et al.*, 2005).

On the basis of structure, so far 16 closely related aflatoxin compounds categorised viz., B₁, B₂, G₁ and G₂ are the major four among them Aflatoxin B₁, B₂, G₁ and G₂ classified as potent human carcinogens according to International Agency for Research on Cancer (IARC) (IARC, 1993). AFB₁ is considered as most important human carcinogenic agent causes reduced growth and immune disorders in infants and children (Turner *et al.*, 2003).

Effects of aflatoxin on living biological system

The aflatoxin producing fungi are ubiquitous in soil and widely spread across the globe. The toxin contaminate food commodities severely affect the food supply of humans and animals feed. The risks associated with aflatoxins are many such as toxicity, affects respiratory system, cause cancer, affect liver, digestive tract and immune suppression (**Table 1**). Therefore, there is a great demand to understand the permissible limit of aflatoxin production during pre-harvest and post-harvest. Many authorities set its limit for the trade purposes (**Table 2**). Severns *et al.* (2003) noticed that most of the agricultural commodities such as wheat, walnut, corn, cotton, peanuts and tree nuts were prone to *A. flavus* contamination which is deleterious to human and animal health and results hepatotoxicity, teratogenicity, and immunotoxicity (Roze *et al.* 2013). Romani (2004) reported that B₁, B₂, G₁, and G₂ aflatoxins were recognised as highly poisonous toxins and acts as an inflammatory agents routed through mucous or cutaneous and respiratory tract. The outbreak of aflatoxin contamination in the feed of dog was noticed in the northwest region of India and also death toll increase was reported in human beings (Reddy and Raghavender, 2007). Aflatoxins have been characterised as carcinogens (AFB₁) for humans. Despite of intensive research on aflatoxin management in agricultural commodities, still there is a threat to global food security and human health (Seo *et al.*, 2011). Jaimez (2000) reported the level of toxicity

associated with aflatoxin varies with the types present, with the order of toxicity being AFB1 > AFG1 > AFB2 > AFG2.

Table 1 Effects of aflatoxin on plants, animals, poultry and humans

Sl. No.	Name of aflatoxin	Effects on various organisms	Reference
1.	Aflatoxins B1 and B2	Ducks death due to Turkey X disease and acute liver toxicity in pigs and calves	Loosmore and Harding, 1961
2.	Aflatoxins B1, B2, M1 and M2	Cause liver and kidney cancer and immune suppression in foetus	Turner <i>et al.</i> , 2005
3.	Aflatoxins B1	Inhibit the nucleic acid and protein formation in animals	Sumit <i>et al.</i> , 2010
4.	Aflatoxins B1 and B2	Acute necrosis in liver, Acute lesions encephalopathy in children and eventually their kidney and liver damaged, Hepatic carcinoma in males and females	Wogan and Newberne, 1968
5.	Aflatoxins B1 and B2	Mice which are exposed to aflatoxins prone towards hepatocellular carcinoma	Leslie <i>et al.</i> , 2011
6.	Aflatoxins B1	strong relation between hepatomegaly and aflatoxins, as the liver toxicants which cause harmful effects in humans	Gong, 2005
7.	Aflatoxins B1	Corn grits and polished rice i.e, grain by products showed presence of aflatoxin which pose adverse effect on children health	Arim 2000
8.	Aflatoxins B1, B2, G1, and G2	Aflatoxin contaminated cereal crops such as wheat, walnut, corn, cotton, peanuts and tree nuts, pose threats to human and animal health and responsible for hepatotoxicity, teratogenicity and immunotoxicity.	Roze <i>et al.</i> , 2013
9.	Aflatoxins B1, B2, G1, and G2	Studies showed detrimental effect of aflatoxin on testis, kidney and heart. Report showed that aflatoxin presences in post- mortem brain tissue, suggested that its ability to cross the blood brain barrier.	Qureshi <i>et al.</i> , 2015
10.	Aflatoxins B1	Aflatoxin responsible for mitochondrial DNA and brain cells abnormalities. Aflatoxin adversely affects human brain chemistry	Verma, 2004
11.	Aflatoxins B1	Studies showed that rodent central nervous system adversely affected by aflatoxin	Laag and Abdel Aziz, 2013
12.	Aflatoxins B1	In 1974, a major outbreak of hepatitis due to consumption of aflatoxin contaminated maize grain was reported in the states of Gujrat and Rajasthan	Krishnamachari <i>et al.</i> , 1975
13.	Aflatoxins B1	In 1974, another outbreak of aflatoxin adversely affecting both humans and dogs noticed in northwest Indian region	Reddy and Raghavender, 2007
14.	Aflatoxins B1 and B2	Studies revealed that aflatoxin molecule easily cross the placental barrier and react with cellular macromolecules and leading to foetus abnormalities	Wild <i>et al.</i> , 1991

Table 2 Permissible limit of aflatoxin in different commodities

Sl. No.	Commodities	Aflatoxin limit	Authorities	Reference
1.	Different nuts, grains, dried figs and milk	0.5 to 15 µg/kg limit	Codex standards	Food Safety Digest, 2018
2.	Total aflatoxins in food	Total aflatoxins in food had maximum 15-20 µg /kg limit applied by 25 countries, with half of them in Latin America and few in Africa. Majorly contain aflatoxins B2, G1 and G2	European Union	Yabe and Nakajima, 2004
3.	Total aflatoxins in all food stuffs material	20µg/Kg is maximum aflatoxin limit	Food and Drug Administration	Liu et al., 2012
4.	Maize grain	Maximum aflatoxin limit is 20ng/g	Food and Drug Administration & World Health Organization	Grybauskas et al., 2000

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