

Aflatoxins Poisoning

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Abstract

Aflatoxins are released from *Aspergillus* species and enter in living organisms from various routes and results in toxicity. Humans are exposed to aflatoxins poisoning due to consumptions of infected crops, meat, poultry and dairy produce. The physiological effects due to aflatoxins may be mild to fatal, according to their exposed concentration to humans and bioabsorption duration. These side effects are usually categorized as acute toxicity, genotoxicity and immunotoxicity. So further, efficient genomic and proteomic strategies are required to develop resistant livestock breeds and dietary significance having cultivars along with general public awareness campaigns related to aflatoxins contamination free edible items selection.

Keywords: *Aspergillus*, aflatoxins poisoning, acute toxicity, genotoxicity, immunotoxicity, public awareness.**Copyright © 2022 The Author(s):** This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY-NC 4.0) which permits unrestricted use, distribution, and reproduction in any medium for non-commercial use provided the original author and source are credited.

1. INTRODUCTION

Mycotoxins are the important toxins including Aflatoxins, which is formed from *Aspergillus* species including (*Aspergillus flavus* and *Aspergillus parasiticus*) which is spread in the whole world. In 1960, during the toxic epidemic named Turkey-X disease in UK, aflatoxins were discovered. In this epidemic the peanut pie which is originated from Brazil is consumed by the thousands of birds and they died. The optimum growth temperature is 30°C with high humidity about 85% [1]. According to Food and Agriculture Organization, aflatoxins are mainly grouped as group 1 carcinogens as they cause hepatic cancer. They are released by *A. flavus*, *A. parasiticus* and *A. nomius*. Some other aflatoxins which are categorized as the most toxic ones and are naturally produced named as AFB1, AFB2, AFG1 and AFG2 [2]. It is estimated that almost 25 percent crop of the world is overwhelmed by mycotoxins. Among them, one of the broad groups of mycotoxins is Aflatoxins which mainly invade cassava plant, chill pepper, maize, millet, peanut, wheat, sesame, rice and seeds of sunflower [3]. They require the 30 - 37°C and humidity 85% [2].

1.1 Routes of food chain invasion

Following are the possible routes of entry of aflatoxins in food chain:

- During the time period of growth and development, *Aspergillus* species attack the crops.
- During extreme weathers like humidity or drought seasons, there is more chances of aflatoxins addition from *Aspergillus flavus*.
- Humans come in contact aflatoxins via contaminated food like meat, dairy and poultry produce provided by already infected animals through their dietary routes [3]. Secondly, it may directly enter in human body by the intake of contaminated agricultural cultivations and usually AFB1, AFB2, AFG1 and AFG2 are ingested through this route whereas AFM1 and AFM2 enter in human body through infected dairy products [4]. In addition to this, AFM1 is entered into infants by the milk they consumed by nursing mother and also by the intake of milk obtained from animals that are already exposed to AFB1 [2].

2. Physiological Risks

2.1 For Animals

Animals infected with aflatoxicosis are meant to produce less milk and eggs. It causes dysfunction of gastrointestinal tract, reproduction is reduced, jaundice and anemia etc. Even exposure to AFB1, AFM1 and

AFG1 may result in cancer in different animal species [5].

2.2 In Humans

Mycotoxins derived from *Aspergillus* species are known to induce a broad spectrum negative impact on human health [6] and over view it, is as follows (Table 1).

Table-1: Aflatoxins poisoning in humans

Major Physiological Disturbances	Effects	References
Genotoxicity	<ul style="list-style-type: none"> • The oral intake AFB1 absorbs into the duodenum, transferred to the liver where further results in activation of CYP450 enzyme and Interferes in gene expression • Formation of DNA adducts; Various mutations; Mutation in p53 (tumor suppressor gene), • Affects cell cycle progress • Disturbs nucleotide twinning • Mutations in tumor suppressor genes and stimulates oncogenes (an antagonistic effect) • Interrupts GIT repair and its regeneration 	[6, 8, 9, 10, 11, 15, 16, 17]
Acute toxicity	<ul style="list-style-type: none"> • Intakes a heavy dosage of aflatoxins for short duration may cause the acute toxicity: • Rapid aging • Nausea • Yellowing of skin and sclera (icterus), dermal cancer and Itching • Vomiting • Bleeding • Abdominal pain • Lethargy • Edema • Convulsions • Coma leading to Death (with high children death rate) • Renal dysfunction • Bladder infections • Bones disorders • Pancreatic malfunction • CNS based complications like psychosis • Hepatic carcinoma & bile duct hyperplasia • Reduced growth and diminished development (exclusively in children) • Lungs cancer 	[2, 3, 5, 7, 12, 13, 14]
Immunotoxicity	<ul style="list-style-type: none"> • Diminished Innate and acquired immunities • Enhanced infections susceptibility • Suppression of cell mediated responses like of B and T lymphocytes along with their reduced proliferation; • Less number of production and function of macrophages 	[18, 19, 20]

3. Control & Management

To avoid aflaxotins poisoning exposure following points should be considered:

3.1 General Public Awareness

General public awareness is required that what they should eat and how to select contamination free food? Similarly, People connected to agriculture should be aware of aflatoxins' toxicity based malnutrition, their symptoms during seasons of growth, harvest, storage and transportation of the crops [21].

3.2 Molecular breeding

This technique is used to develop resistance against contamination of aflatoxins in crops by the addition of suitable foreign antifungal genes either naturally or synthetically in selective seeds to obtain resistance against fungi and their toxins [22-25].

3.3 Treatment & Cure

There is no proper remedy against the aflatoxicosis so far but possible treatments may include:

- Excessive intake of fluids
- Additional use of vitamin B and K supplements

- Intake of low protein diet
- Balanced intake appropriate carbohydrates.
- Symptoms such as fever, nausea, vomiting, etc. must be monitored carefully. If the symptoms are leading towards the acute liver failure, it is considered as critical situation which must be handled with adequate precautions and measurements should be taken [26-29].

Conclusion and future perspective

Aflatoxins cause various health issues in living organisms and level of toxicity varies from mild to acute e.g., malignancy. Thus, further research investigations should be designed to provide better strategies for the treatment of aspergillosis and other types of aflatoxins poisoning [33].

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