

Mycotoxins in Food



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What are mycotoxins?

Mycotoxins are toxic metabolites produced by certain species of fungi* on several agricultural commodities under specific environmental conditions. It has been estimated that at least 25% of the grain produced each year worldwide is contaminated with mycotoxins. Thus, mycotoxins may pose a potential threat to human and animal health if food products prepared from these commodities are ingested. To date, hundreds of mycotoxins have been identified. However, only about 20 of them are known to be contaminants of human and animal foods.

* Some facts about fungi :

- ◆ a large and diverse group of organisms
- ◆ most living on dead organic matters
- ◆ some living on plants and animals, causing diseases in these organisms

Beneficial effects :

- ◆ some are edible (e.g. straw mushrooms)
- ◆ some are used for the production of bread, wine, soy sauce, etc.
- ◆ some are used as traditional Chinese medicines (e.g. ling-chi)
- ◆ some produce antibiotics

Undesirable effects :

- ◆ some produce mycotoxins
- ◆ some are poisonous (e.g. poisonous mushrooms)
- ◆ some cause food spoilage (e.g. moulds on bread, apples, etc.)

How are mycotoxins produced?

A variety of fungal species can produce mycotoxins and their production is affected by many factors such as temperature, oxygen levels, humidity, nutrients, etc.

It should be pointed out that the presence of a recognised toxin-producing fungus does not in itself imply the presence of mycotoxins because many factors are involved in its formation. Conversely, the absence of any visible fungus does not guarantee a toxin-free nature as the fungus may have already died while leaving the toxin intact.

What are the significant mycotoxins?

Although a number of fungal species are able to produce mycotoxins, there are three genera that are of major concern in foods: *Aspergillus*, *Penicillium* and *Fusarium*. They are listed in Table 1.

Table 1 Important mycotoxins that have been found in some agricultural food commodities

Mycotoxin	Major fungal species	Major foods involved
Aflatoxins B ₁ , B ₂ , G ₁ , G ₂	<i>A. flavus</i> <i>A. parasiticus</i> <i>A. nomius</i>	Peanuts, maize, cottonseeds
Aflatoxins M ₁ , M ₂	Metabolites of aflatoxins B ₁ and B ₂	Milk and dairy products
Patulin	<i>P. expansum</i>	Apple juice and apple related products
Ochratoxin A	<i>P. verrucosum</i> <i>A. ochraceus</i>	Cereals, pulses, coffee beans
Fumonisin B ₁	<i>F. moniliforme</i> <i>F. proliferatum</i>	Maize
Trichothecenes	<i>F. sporotrichioides</i> <i>F. poae</i> <i>F. graminearum</i> <i>F. culmorum</i>	Cereals, wheat, maize
Zearalenone	<i>F. graminearum</i> <i>F. culmorum</i> <i>F. crookwellense</i>	Maize

What are their effects on health?

Human exposure to mycotoxins can occur by several ways, including ingestion, contact and inhalation but most studies on the effects of health deal with ingestion of contaminated foods.

Mycotoxins have a diverse range of chemical and physical properties and hence exhibit a wide range of acute and chronic health effects on man and animals. The mycotoxins in Table 1 are all relatively heat-stable and would not be significantly destroyed by normal cooking procedures. Their effects on health include:

- cancers
- birth defects
- genetic material damage
- liver damage
- kidney damage
- nerve tissue damage
- reduced immune function, etc.



How to prevent and reduce mycotoxins contamination?

Fungi and mycotoxins are closely associated with growing crops and stored foods and are therefore almost impossible to eliminate, especially when they develop prior to harvest. In the production and storage of food crops and consumer food products, the aim should be to reduce mycotoxin levels to the lowest that can be technologically achievable. Observing relevant code of practices, good agricultural practices and good manufacturing practices during handling, storage, processing and distribution stages is one of the keys to safeguard food safety.

Responsibilities of Food Trade

To minimise mycotoxins in foods, the trade should

- ◆ develop Hazard Analysis and Critical Control Point (HACCP)-based food safety systems in their productions.
- ◆ obtain raw materials only from reliable and reputable suppliers.
- ◆ verify the specifications for quality products.
- ◆ maintain good storage conditions :
 - store food in cool and dry environment.
 - keep stock according to a first-in-first-out basis.
- ◆ keep records of control points.

Responsibilities of Consumers

Purchase

- ◆ purchase from reliable and reputable retailers.
- ◆ ensure foods are stored in dry and cool conditions.
- ◆ avoid any unclean, open or damaged packages.

Storage

- ◆ store according to storage statements and instructions on the label.
- ◆ avoid stocking up excessive foods.
- ◆ watch out the durability of foods.

Consumption

- ◆ consume before the "best before" date.
- ◆ discard foods that look mouldy, damaged or shrivelled.