What are Mycotoxins: Mycotoxins are a chemically diverse range of secondary metabolites (i.e. have no role in formal metabolism) and are produced by various fungal species. Several hundred different mycotoxins have been identified, but the most commonly observed mycotoxins that present a concern to human health and livestock include aflatoxins, ochratoxin A, patulin, fumonisins and zearalenone.

They are toxic to humans and most are chemically stable and survive prolonged heat processing.

Occurrence in Foods: They commonly enter the food chain through contaminated food and feed crops, mainly cereals.

Other occurrence in foods include nuts, spices, dried fruits, apples and coffee beans, often under warm and humid conditions.

Outbreaks: In Kenya in 2004 there was an outbreak which resulted from aflatoxin contamination of maize. 317 cases were reported with 125 deaths.

Effects on Health: The toxic effects of mycotoxins can be significant and varied depending on the toxin, dose, host and food matrix involved.

These effects include: Carcinogenicity (cancer causing) especially in the liver, Hepatotoxicity (liver damage), Mutagenicity (changes to DNA), Other toxic effects include kidney disease, immuno-suppression and disturbance to the nervous and hormone systems.

Control and Preventive Measures:

Good Agricultural Practice:
- Proper preparation of the land, crop rotation, use of fungus and/or pest resistant cultivars, control of insect damage to the growing crop, control of fungal infection, prevention of stress to the growing crop, e.g. drought, weeds, harvesting at the appropriate time, and correct handling and storage after harvesting.

Monitoring Programs:
- Inspection and sampling of commodities intended for introduction into the food supply chain. Maximum levels are defined and often legally controlled in specific legislation. Rejection and removal of failed batches is a common control measure.

Pest Control Program:
- Pest damage may result in heating and moisture generation, leading to fungal growth and mycotoxin production in localised “hot spots”. Therefore, it is important to have adequate pest control programs in place.

Inactivation of Toxins:
- This can be achieved through roasting of peanuts, heat and moisture control, chemical control, e.g. acids, H2O2, NH3, hypochorites.

Testing
- Monitoring using analytical methods have been developed based on HPLC, TLC and ELISA. It is important to ensure an adequate sampling plan is used.
# Chemical Hazard :: Mycotoxins

## Examples of Mycotoxin

<table>
<thead>
<tr>
<th>Mycotoxin</th>
<th>Detail on the specific Mycotoxin</th>
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| Aflatoxin | Aflatoxins are produced by certain moulds of the genus *Aspergillus*. They are highly toxic compounds and can cause both acute and chronic toxicity and humans and animals. Liver damage is a common effect and it can also affect kidneys, intestine, blood, reproductive system and the immune system.  
They may be present in food commodities such as cereals, oilseeds spices and tree nuts.  
Control of aflatoxin is best achieved by measures designed to prevent contamination of crops in the field and during storage, or detection and removal of contaminated material from the food supply chain. |
| Ochratoxin | Ochratoxin A is produced by several species of *Aspergillus* and *Penicillium* and is a common food-contaminating mycotoxin. It is known to cause a number of health effects; the most notable effect is kidney damage and it may also have effects on fetal development and on the immune system.  
It has been found in a wide range of raw and processed food commodities including cereals coffee, dried fruit, wine, beer, cocoa, nuts, beans, peas, bread and rice.  
Control is best achieved by measures designed to prevent contamination of foods using HACCP-type techniques. Detection and removal of contaminated material from the food supply chain is important. |
| Fusarium fungi | Fusarium fungi are common to the soil and produce a range of different toxins, including trichotheccenes such as deoxynivalenol (DON), nivalenol (NIV) and T-2 and HT-2 toxins, as well as zearalenone (ZEN) and fumonisins. Fumonisins are known to cause adverse health effects in humans and animals. E.g. they can cause skin irritations and suppression of the immune system.  
They can be found in maize and maize products, rice and mung beans.  
Fumonisin production occurs almost entirely in the field so the most effective controls are applied at the pre-harvest stage e.g GAP measures. |
| Patulin | Patulin is a toxic fungal metabolite produced by certain moulds of the Penicillium, Aspergillus and Byssoclamys. Exposure to patulin can cause adverse health effects such as gastrointestinal problems in animals however little or no data has showed adverse health effects in humans.  
Patulin occurs most often in apples, or in products made from spoiled apples such as apple juice, pies and conserves. It has also been found in pears and grapes, in vegetables and in cereals grains and cheese.  
Controls such as GAP are required during Pre-harvest, Post-Harvest and during Processing. |

## SUMMARY TABLE

### Occurrences in food
- Cereals
- Nuts
- Apples

### Effects on health
- Carcinogenicity
- Hepatotoxicity
- Immuno-suppression

### Most concerning mycotoxins
- Aflatoxins
- Ochratoxin A
- Fusarium
- Patulin

### Control
- GAP
- Monitoring Programs
- Inactivation of toxin

### Published Risk Assessments
- EFSA :: PRINCIPLES OF RISK ASSESSMENT OF MYCOTOXINS IN FOOD AND FEED BY EUROPEAN FOOD SAFETY AUTHORITY  
- NCBI :: Risk assessment and risk management of mycotoxins  