

# Adverse Health Effects Associated With Aflatoxin Hazard.

Aflatoxin is a type of mycotoxin produced by a group of fungi known as *Aspergillus*, which is a genus of fungi that are mainly found in tropical and subtropical climates. Aflatoxin contamination can occur in food and feed products, particularly in nuts, grains, spices, and dried fruits. It is a major public health concern in many countries across the world and may cause severe health problems to humans and animals.

I will discuss the adverse health effects associated with aflatoxin hazards, and outline what can be done to reduce the risk of aflatoxins in food that is to be consumed.

## Adverse Health Effects Associated With Aflatoxin Exposure.

Exposure to aflatoxins has been linked to a number of serious health conditions in humans and animals. In humans, long-term exposure to aflatoxins can increase the risk of certain types of cancers, including liver and stomach cancer. Other potential health effects of aflatoxin exposure include:

- Impaired immune system functioning.

1. Cellular immunity: Aflatoxins can directly affect T-cells and associated components of the adaptive immune system, leading to decreased ability to combat infections.

2. Innate immunity: A normal functioning innate immune system is critical for the initial response to pathogens. Aflatoxins can impair various aspects of this system, such as macrophage and neutrophil function.

3. Cytokine production: Aflatoxins may alter the production of cytokines, which are critical signaling molecules in the immune system. Disrupted cytokine signals can lead to an inadequate immune response.

4. Antibody response: Exposure to aflatoxins has been linked to a weakened antibody response, which could result in a reduced ability to fight off infections that the body has previously encountered or for which it has been vaccinated against.

5. Detoxification pathways: Aflatoxins are metabolized by the liver, and their metabolites can be even more toxic than the parent compounds. The liver's detoxification pathways can be overwhelmed by aflatoxins, leading to liver damage, which in turn can compromise overall immune function.

6. Cell and organ function: Chronic exposure to aflatoxins can lead to liver cancer and cirrhosis, which further deteriorates the immune system.

- Birth defects.

Studies have shown that aflatoxin can cross the placenta and reach the developing fetus. It is believed that aflatoxin disrupts normal fetal development by interfering with DNA synthesis and causing genetic mutations. These mutations can affect the growth and development of organs and tissues, leading to birth defects.

Furthermore, aflatoxin exposure during pregnancy has been associated with adverse pregnancy outcomes, such as miscarriage, stillbirth, and low birth weight. This highlights the importance of avoiding exposure to aflatoxin-contaminated foods during pregnancy.

- Liver cirrhosis

When aflatoxin is ingested, it is processed by liver enzymes to form highly reactive intermediates known as epoxides. These epoxides can bind to DNA and form DNA adducts, which are chemically altered DNA molecules. The DNA adducts can disrupt the normal functioning of the genes involved in cell growth and division, potentially leading to mutations.

Repeated exposure to aflatoxin and the resulting formation of DNA adducts can lead to chronic inflammation and progressive damage to liver cells, ultimately contributing to the development of liver cirrhosis. Liver cirrhosis is a condition characterized by the irreversible scarring and fibrosis of the liver, which impairs its ability to function properly.

Moreover, aflatoxin exposure can also promote the development of liver cancer, especially hepatocellular carcinoma (HCC). Aflatoxin-induced DNA damage and mutations increase the risk of malignant transformation and the formation of cancerous tumors within the liver.

- Neurotoxic effects

Aflatoxin ingestion causes oxidative stress. Aflatoxin exposure has been shown to generate reactive oxygen species (ROS), which can lead to an imbalance between antioxidant defense mechanisms and the production of damaging free radicals. This oxidative stress can induce damage to neuronal cells and disrupt their normal function.

Additionally, aflatoxin has been found to have immunotoxic effects, affecting the immune system's response within the central nervous system. Disruption of the immune response can lead to inflammation and the release of pro-inflammatory molecules, which may negatively impact neuronal health.

Furthermore, studies also suggest that aflatoxin can impair neurotransmitter balance. Neurotransmitters are chemical messengers that facilitate communication between neurons in the brain. Aflatoxin exposure may disturb the levels or functioning of neurotransmitters, potentially affecting brain function and contributing to neurotoxic effects.

- Reduced cognitive development.

Aflatoxin interferes with the normal functioning of the central nervous system. Aflatoxin can disrupt the balance of neurotransmitters in the brain, which are chemicals responsible for transmitting signals between nerve cells. This disruption can lead to inflammation and oxidative stress, causing damage to brain cells and affecting their ability to communicate effectively.

Furthermore, aflatoxin can also impair the production and release of certain hormones and growth factors in the brain, which are crucial for brain development and plasticity. This can have long-term consequences on cognitive abilities, as the brain may not develop and function optimally.

It is worth mentioning that the extent of the impact on cognitive development may depend on various factors, such as the amount and duration of exposure to aflatoxin, individual susceptibility, and overall nutritional status.

- Respiratory illnesses.

*Aspergillus flavus*, the mold that produces aflatoxins, can colonize the respiratory tract and cause respiratory illnesses. In this context, *Aspergillus flavus* can cause fungal rhinosinusitis or bronchopulmonary aspergillosis. These conditions occur when the mold spores are inhaled and establish an infection in the respiratory system. This can lead to symptoms such as nasal congestion, sinus inflammation, coughing, and difficulty breathing.

It's crucial to handle and store food properly to prevent aflatoxin contamination, as ingestion is the primary route of exposure. Additionally, individuals with compromised immune systems or underlying respiratory conditions may be more susceptible to respiratory infections caused by molds like *Aspergillus flavus*.

- Elevated serum markers of inflammation.

Inflammation is the body's natural response to injury or infection, and it is characterized by the release of certain substances called inflammatory markers. Aflatoxin can trigger inflammation in the body by activating the immune system and causing the release of pro-inflammatory cytokines, which are signaling molecules involved in the inflammatory response.

The elevated serum markers of inflammation seen in individuals exposed to aflatoxin can include C-reactive protein (CRP), interleukin-6 (IL-6), and tumor necrosis factor-alpha (TNF-alpha). These markers are commonly measured in blood tests and can indicate the presence and severity of inflammation.

It's important to note that aflatoxin exposure and its effects on inflammation can vary depending on factors such as the level and duration of exposure, individual susceptibility, and overall health status. Regular monitoring and appropriate interventions are crucial in managing aflatoxin hazards.

## Reducing Aflatoxin Risk.

The most effective way to reduce the risk of aflatoxin exposure is to prevent aflatoxin contamination in food and feed products. This can be done by implementing good agricultural, post-harvest, and processing practices. These include:

- Planting tolerant varieties of crops.

Planting tolerant varieties of crops can help reduce the aflatoxin hazard in several ways. Tolerant varieties are specifically bred or genetically modified to be less susceptible to fungal infection and aflatoxin contamination. Here's how they can help:

1. Resistance to fungal infection: Tolerant varieties of crops have built-in resistance mechanisms that make them less prone to fungal infection by the aflatoxin-producing fungi. This reduces the likelihood of aflatoxin contamination in the first place.
2. Reduced fungal growth: Even if fungal spores manage to infect the crops, tolerant varieties can limit the growth and spread of the fungi. They may have natural defenses or produce compounds that inhibit fungal growth, thereby reducing aflatoxin production.
3. Enhanced crop quality: Tolerant varieties are often bred to have improved overall crop quality, including traits such as better yield, improved nutritional content, and longer shelf life. By promoting healthy crop growth, these varieties can help minimize stress factors that can make crops more susceptible to aflatoxin contamination.
4. Economic benefits: Planting tolerant varieties can also have economic advantages for farmers. Crops with reduced aflatoxin contamination are more likely to meet food safety regulations and quality standards, allowing farmers to access better markets and command higher prices for their produce.

By planting tolerant varieties of crops, farmers can significantly reduce the risk of aflatoxin contamination and its associated hazards.

- Improving soil fertility

Improving soil fertility can play a crucial role in reducing the aflatoxin hazard. Here's how it works:

1. Enhanced plant vigor: When soil fertility is improved, crops tend to have better overall health and vigor. Healthy plants are better able to resist and recover from stress, including stress caused by fungal infections. This can reduce the susceptibility of crops to aflatoxin-producing fungi.
2. Nutrient availability: Adequate soil fertility ensures that crops have access to essential nutrients needed for proper growth and development. When crops are nutrient-deficient, their immune system weakens, making them more susceptible to fungal infections and aflatoxin contamination. By improving soil fertility, crops can have the necessary nutrients to maintain a strong defense against fungal attacks.
3. Balanced soil pH: Soil pH plays a crucial role in the availability of nutrients to plants. A well-balanced pH level allows for optimal nutrient uptake, which can enhance plant health and reduce the risk of fungal infections. By maintaining the appropriate soil pH through soil fertility management practices, the chances of aflatoxin contamination can be minimized.
4. Crop rotation and diversification: Improving soil fertility often involves practices such as crop rotation and diversification. These practices help break the lifecycle of aflatoxin-producing fungi by interrupting their host crop cycles. By rotating crops and introducing different plant species, the population of aflatoxin-producing fungi can be reduced, thereby lowering the aflatoxin hazard.

- Using fungicides and other disease-control strategies

Using fungicides and other disease control strategies can be effective in reducing the aflatoxin hazard. Here's how they can help:

1. Fungal growth inhibition: Fungicides are chemical substances specifically designed to control fungal growth. By applying fungicides to crops, the growth and development of aflatoxin-producing fungi can be inhibited. This reduces the chances of aflatoxin contamination in the first place.
2. Preventive measures: Fungicides can be used as a preventive measure to protect crops from fungal infections. By applying fungicides before the onset of favorable conditions for fungal growth, such as high humidity or temperature, the risk of aflatoxin contamination can be minimized.
3. Integrated Pest Management (IPM): IPM is an approach that combines various strategies to control pests and diseases, including aflatoxin-producing fungi. It involves a combination of cultural, biological, and chemical control methods. By implementing IPM practices, such as crop rotation, use of resistant varieties, and targeted fungicide application, the aflatoxin hazard can be effectively managed.

4. Post-harvest treatments: Aflatoxin contamination can occur during storage and transportation of crops. Applying post-harvest treatments, such as fungicide application or proper drying methods, can help prevent fungal growth and aflatoxin production during storage, reducing the overall aflatoxin hazard.

It's important to note that the use of fungicides should be done following recommended guidelines and regulations to ensure safety and minimize environmental impact.

- Using clean seeds.

Using clean seeds is an important practice that can help reduce the aflatoxin hazard. Here's why:

1. Minimizing initial contamination: Clean seeds refer to seeds that are free from fungal spores or other sources of contamination. By using clean seeds, the initial contamination of crops with aflatoxin-producing fungi can be minimized. This reduces the risk of aflatoxin contamination right from the start.

2. Preventing fungal spread: Aflatoxin-producing fungi can be present on the surface of seeds or within seed tissues. Planting infected seeds can lead to the spread of the fungi to the entire crop. Using clean seeds helps prevent the introduction and spread of aflatoxin-producing fungi in the field, reducing the chances of aflatoxin contamination.

3. Optimal seedling establishment: Clean seeds usually have higher germination rates and seedling vigor compared to contaminated seeds. When clean seeds are used, the resulting seedlings have a better chance of establishing themselves in the field, growing healthier, and being less susceptible to fungal infections that can lead to aflatoxin contamination.

4. Seed treatment options: Before planting, seeds can undergo various treatments to further reduce the aflatoxin hazard. These treatments may include seed disinfection, seed coating with fungicides, or biological control agents. Using clean seeds allows for more effective seed treatment options, which can provide an additional layer of protection against aflatoxin-producing fungi.

By using clean seeds, farmers can significantly reduce the risk of aflatoxin contamination and promote healthier crop growth.

Other methods of controlling aflatoxin hazard are as follows:

- Improving post-harvest practices (e.g. drying, storage) to reduce the growth of aflatoxigenic fungi
- Conducting routine aflatoxin testing on food and feed products
- Improving processing techniques (such as using aflatoxin-binding agents)

In addition, public health interventions such as education programs, awareness campaigns, and targeted inspection and monitoring of food and feed products can be effective in reducing the risk of aflatoxin exposure.

## **In conclusion.**

Aflatoxins are a serious public health concern, and exposure to aflatoxins can lead to a number of adverse health effects in humans and animals, including increased risk of certain types of cancers. The best way to reduce the risk of aflatoxin exposure is to prevent aflatoxin contamination in food and feed products, by implementing sound agricultural, post-harvest, and processing practices. In addition, public health interventions such as education programs, awareness campaigns, and targeted inspection and monitoring of food and feed products can be effective in reducing the risk of aflatoxin exposure.

