



Silent Poison on Our Plates: Curbing Aflatoxins from Farm to Fork

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Highlight

Aflatoxins are toxic compounds produced by *Aspergillus* moulds that quietly contaminate staple foods such as maize, rice, peanuts, tree nuts and even milk. This article explains what aflatoxins are, where and when they enter the food chain, and why they matter for human health, farm incomes and international trade. The problem is greatest in hot, humid regions, including South Asia, where crops are exposed to moisture and heat during harvest, drying and storage. Drawing on recent reviews published between 2023 and 2026, the article shows how laboratory detection, adherence to regulatory limits and practical measures, from Good Agricultural Practices to proper drying and storage, can keep contaminated produce out of our kitchens and protect the livelihoods of farmers.

Every grain of rice, handful of peanuts or glass of milk reaches our table after a long journey through fields, stores, markets and kitchens, and at each step it can pick up an invisible hazard. Aflatoxins are among the most dangerous of

these hazards. They are toxic secondary metabolites produced by certain fungi, primarily *Aspergillus flavus* and *A. parasiticus*, which grow on food crops and agricultural commodities under favourable conditions, most often during storage and the post-harvest stage. Regarded as potent carcinogens, aflatoxins pose serious risks to human and animal health and contaminate a wide range of food products (Yohannis *et al.*, 2025). With warm, humid conditions widespread across the tropics and subtropics, and with trade demanding ever stricter food safety standards, understanding how aflatoxins arise and how to keep them out of the food supply chain matters to farmers, traders, processors and consumers alike.

Aflatoxin Types: Know the Family

Aflatoxins are not a single substance but a family of related compounds. The four main members found in crops are aflatoxins B1, B2, G1 and G2, named for the blue(B) and green(G) fluorescence they show under ultraviolet light, while aflatoxin M1 is a milk-borne product of B1 metabolism (Table 1).

Table 1: Major types of Aflatoxins

Type	Key features
Aflatoxin B1	The most toxic and most common type; a potent carcinogen
Aflatoxin B2	Less toxic than B1 but still hazardous
Aflatoxins G1 and G2	Characterized by green fluorescence under UV light
Aflatoxin M1	A metabolite of aflatoxin B1 found in milk and dairy products from animals that consume contaminated feed

Aflatoxin B1 deserves the most attention because it is both the most common and the most toxic, and it is the form on which many regulations focus.

Health Risks of Aflatoxin Exposure

Cancer risk

Aflatoxin B1 is classified as a Group 1 carcinogen by the International Agency for Research on Cancer (IARC), meaning it is known to cause cancer in humans. Prolonged exposure is linked to liver cancer, particularly in regions with high dietary exposure (Yohannis *et al.*, 2025). In the liver, aflatoxin B1 is converted into a reactive form that can damage DNA, and the risk of liver cancer rises further in people who are also infected with hepatitis B virus.

Acute and chronic toxicity

Acute poisoning.

At high doses, aflatoxins can cause liver damage, liver failure and even death. Symptoms include nausea, vomiting, abdominal pain, jaundice and swelling of the liver.

Chronic exposure.

Long-term exposure to low levels can lead to immune suppression, growth retardation and

liver cirrhosis, and may damage the kidneys and other organs. Because aflatoxins largely survive normal cooking and processing, prevention on the farm and in storage is far more effective than any attempt to remove them later.

Children at greater risk

Aflatoxins can stunt growth and impair cognitive development in children, making them especially vulnerable. Children also eat more food relative to their body weight, so the same contaminated meal delivers a proportionally larger dose.

Sources and Contamination Pathways of Aflatoxins

How contamination occurs

Aflatoxin-producing moulds live naturally in soil and decaying plant matter, and their spores can reach crops through the air, insects and contaminated irrigation water. Contamination usually happens in two steps: first, *Aspergillus* moulds colonise the crop; second, aflatoxins are released as secondary metabolites, especially when the fungus or crop is under stress. It can occur during growth, harvesting or storage, and the conditions that favour it are:

High humidity, since hot, humid environments are ideal for mould growth; High temperatures; Physical damage to crops; and Inadequate drying

and improper storage practices. Once aflatoxin-producing moulds infest a crop, contamination is difficult to eliminate.

Main sources

Aflatoxins can enter the food supply from several directions:

Crops and commodities: peanuts, corn, cotton seed, tree nuts, rice and spices.

Animal feed and by-products: livestock feed and dairy products (aflatoxin M1).

Processed foods: improperly stored grain products, beverages and oils.

Environmental reservoirs: soil and decomposing organic matter.

Water and irrigation: irrigation water carrying fungal spores.

Wild and imported foods: wild-harvested and imported products.

Aflatoxins in grains

Aflatoxins are among the most significant mycotoxins contaminating food crops, and grains are particularly susceptible. Produced primarily by fungi of the genus *Aspergillus*, they represent a significant public health risk as well as serious economic consequences (Ali *et al.*, 2023). The crops most affected include corn, peanuts, rice, wheat, barley, millet and sorghum (Safdar *et al.*, 2026).

Aflatoxins in nuts

Peanuts. One of the most aflatoxin-prone nuts, peanuts are commonly contaminated by *A. flavus*, especially when grown and harvested in

hot, humid conditions where aflatoxin-producing fungi are prevalent.

Tree nuts. Almonds, pistachios, walnuts and Brazil nuts are also susceptible, both in the field and during post-harvest storage.

Contamination in nuts therefore occurs at two stages: before harvest, through fungal growth in the field under stress conditions, and after harvest, through storage conditions, handling and transportation.

Aflatoxins in the Food Chain and Food Production

From field to fork

Contaminated grains such as corn and peanuts end up in flour, snacks, oils, corn-based beverages and animal feed. Human exposure can therefore lead to liver cancer, immune suppression and growth impairment. Aflatoxins are also frequently found in feed made from contaminated grains; animals that eat it may suffer toxicity, and the toxins can enter the human food chain through milk, meat and eggs (Mfashwanayo *et al.*, 2026). Figure1 shows how risk builds up along the chain and where it can be controlled.

Economic and trade consequences

In food production, aflatoxins are a major concern because of their toxicity and carcinogenic properties, which affect human health and food safety (Safdar *et al.*, 2026). Their presence in food can result in:

Economic losses for producers and exporters (Goda *et al.*, 2025); regulatory challenges and trade restrictions; and public health risks, including liver cancer and immune suppression.

For a farmer or trader, a rejected lot means lost income; for a country, it can mean lost access to export markets.

Global Prevalence of Aflatoxins

Aflatoxin contamination is a global problem, but its burden falls disproportionately on tropical and subtropical regions. Sub-Saharan Africa, South Asia and parts of Latin America face the highest contamination rates because of hot, humid climates, inadequate storage infrastructure and limited access to food safety regulation. Risk can be pictured as a traffic-light map:

Green zones (low prevalence): North America, Europe and Australia.

Yellow zones (moderate risk): parts of China and South America.

Red zones (high risk, above 65%): much of sub-Saharan Africa, parts of the Middle East, and South and Southeast Asia.

South Asia falls in the high-risk category, which makes vigilance especially important for Indian farmers, traders and food processors. The picture is not static. Warmer temperatures and erratic rainfall may widen the areas in which aflatoxin-producing fungi thrive, so regions that are now moderate or low risk could face growing pressure in the years ahead. This is why aflatoxin management is increasingly seen as a climate-resilience issue as well as a food safety issue.

Detection of Aflatoxins

Because aflatoxins cannot be reliably spotted by eye, detection depends on laboratory methods and careful sampling.

Chemical analysis. High-performance liquid chromatography (HPLC), enzyme-linked immunosorbent assay (ELISA) and other analytical methods are the mainstay of detection. ELISA is widely used for quick screening, while HPLC gives precise measurement of individual aflatoxins.

Visual inspection. Mould growth may sometimes be visible on crops, but aflatoxin contamination often cannot be seen with the naked eye, so a clean-looking lot is not necessarily a safe one.

Representative sampling. Because toxins are often concentrated in a few heavily contaminated grains or kernels, samples must be drawn carefully to represent the whole lot.

Regulatory Limits for Aflatoxins and Food Safety

Most countries have established limits for aflatoxins in food and feed to protect public health (Table 2). The same figures are quoted for nuts, one of the most susceptible commodity groups.

Because limits differ between markets, exporters must meet the standard of the importing country; a consignment that passes in one market can be rejected in another.

Prevention and Post-Harvest Management of Aflatoxins

Reducing aflatoxin contamination needs action at every stage, from the field to the storage bin (Table 3).

Table 2. Regulatory limits for aflatoxins in food.

Authority	Limit	Scope
European Union	About 4 ppb for aflatoxin B1 and 10 ppb for total aflatoxins	Strict limits in food stuffs, particularly peanuts, corn, other nuts and susceptible crops
United States (FDA)	20 ppb for aflatoxin B1 and total aflatoxins	Food products intended for human consumption, including peanuts and tree nuts
Codex Alimentarius	International guidelines	Reference standards; limits vary by country

Table3. Practical measures to prevent and control aflatoxins.

Stage	Practical measures
Before harvest (Good Agricultural Practices)	Crop rotation; resistant varieties or cultivars; optimized, proper irrigation; insect control
Harvest and drying	Dry crops adequately; sort and clean produce, physically removing contaminated material
Storage	Store in cool, dry conditions to prevent mould growth
Post-harvest treatment	Fungicides and other chemical treatments; physical treatments; biological control (Alaniz-Zanon <i>et al.</i> , 2025)

Biological control deserves special mention. It uses competitive, non-toxic fungi that crowd out toxin-producing moulds and so reduce contamination. In nuts, pre-harvest management, post-harvest management and post-harvest treatment work best together (Alaniz-Zanon *et al.*, 2025). For farmers and traders, the simplest rule is: keep it dry, keep it clean and keep it cool.

Practical Steps for Farmers and Storage Managers

- Choose resistant or locally adapted varieties and avoid drought and heat stress through timely irrigation.

- Control insects, whose feeding damage opens the way for mould.
- Harvest at maturity and handle crops gently to avoid cracks and bruises.
- Dry produce promptly and thoroughly before storage, and re-check moisture during storage.
- Use clean, dry, well-ventilated stores, and keep bags off the floor and away from damp walls.
- Separate and discard mouldy, shrivelled or discoloured produce, and never feed it to livestock.

- Test lots before sale or processing, particularly for export.

Simple Steps for Households

At home, buy grains, nuts and spices from reliable sources, store them in clean, dry, airtight containers and use older stock first. Discard any nuts or grains that look mouldy, shrivelled or discoloured, and never taste suspect food to check it, since cooking does not reliably destroy aflatoxins.

Milestones in Aflatoxin Control, 2004 to Present

Progress against aflatoxins has been steady but uneven:

2004: WHO, FAO and the UN began joint efforts to reduce aflatoxin contamination globally through education, training and better agricultural practices.

2010s: Technological advances brought rapid testing methods and biological control using competitive non-toxic fungi.

2015: The Global Food Safety Initiative (GFSI) recognised aflatoxin as a top food safety priority worldwide.

2018: The European Food Safety Authority issued a statement on the human health effects of increased permitted levels of aflatoxins in peanuts.

2019: Twenty-five aflatoxin-producing *Aspergillus* species were confirmed across sections *Flavi*, *Nidulantes* and *Ochraceorosei*.

2020: New producers were identified: *A. texensis*, *A. agricola* and *A. toxicus* (section *Flavi*).

2021: Promising novel and innovative technologies for aflatoxin mitigation emerged. Taken together, these milestones show a shift from awareness and education towards rapid testing, biological control and new technologies. Yet the high prevalence that persists in tropical regions shows that putting these tools to work at farm level remains the main challenge.

Summary

Aflatoxins, produced mainly by *Aspergillus flavus* and *A. parasiticus*, are potent mycotoxins with serious health and economic consequences. Aflatoxin B1 is the most dangerous and is classed as a Group 1 human carcinogen. Peanuts, corn, tree nuts, other grains and dairy products are the main sources, and contamination is favoured by high humidity, high temperature and improper storage.

Because visual inspection is not enough, chemical analysis such as HPLC and ELISA is essential. In practice, farmers and handlers should follow Good Agricultural Practices, dry crops adequately, store them in cool, dry conditions and apply post-harvest treatments. Children and communities in tropical developing regions face the greatest risk, and regulatory limits differ between the EU, the USA and Codex guidelines. Continued cooperation among WHO, FAO and GFSI remains vital for global food safety.

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