

## **AFLATOXINS: THE MYCOTOXINS OF GREATEST CONCERN**

Aflatoxins are a family of mycotoxins mainly produced by certain *Aspergillus* fungi. Their importance lies not only in their possible occurrence in food, but especially in the ability of some to damage genetic material and increase the risk of liver cancer following prolonged exposure. Not every contaminated food causes harm: risk depends on the substance, its concentration and dietary exposure over time.

### **WHICH AFLATOXINS ARE TESTED FOR IN FOOD?**

The four principal aflatoxins in plant products are B1, B2, G1 and G2. The letters B and G historically refer to blue or green fluorescence observed under particular analytical conditions; the numbers distinguish different compounds. Aflatoxin B1 (AFB1) is of greatest toxicological concern and is classified as carcinogenic to humans. The other three should not be regarded as equivalent in all circumstances: both the available evidence and toxic potency differ. Risk assessments may adopt conservative assumptions as a precaution.

Aflatoxin M1 (AFM1) is another important form, particularly in milk. It is a metabolite that may form in animals consuming feed containing AFB1. Its appearance in milk does not mean mould has grown in the milk: contamination may originate earlier in the feed supply chain.

### **HOW DO AFLATOXINS FORM, AND WHICH FOODS ARE AFFECTED?**

Fungi such as *Aspergillus flavus* and *Aspergillus parasiticus* may contaminate crops and commodities under favourable environmental conditions. Heat, drought stress, damage to plant tissues, post-harvest moisture and inadequate storage can contribute to the risk, with different effects depending on the crop and fungal species. There is no simple rule whereby a particular climate always produces the same aflatoxin concentration.

Monitored matrices include maize, peanuts, pistachios, almonds, hazelnuts, some oilseeds, dried fruit and certain spices. These are categories requiring attention, not foods that are necessarily hazardous: origin, growing season, sorting, drying and batch management all affect results. Moreover, a batch may contain a few highly contaminated grains or nuts among many others with much lower concentrations.

### **MILK AND AFLATOXIN M1**

When a dairy cow ingests AFB1 through feed, some may be metabolised and appear in milk as AFM1. This process depends on several factors, including dietary exposure, physiological condition and milk production. Monitoring feed is therefore essential for

prevention. Ordinary heat treatment of milk must not be assumed to remove AFM1 completely.

EU legislation specifies maximum AFM1 levels for regulated milk categories, distinct from the limits for aflatoxins in plant products. Assessing a result thus requires accurate identification of the food matrix and relevant legal provision; a limit for one food must not automatically be applied to another.

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## FROM AFLATOXIN B1 TO AFLATOXIN M1

Milk contamination may originate in animal feed



**The presence of M1 does not imply mould growth in milk.**

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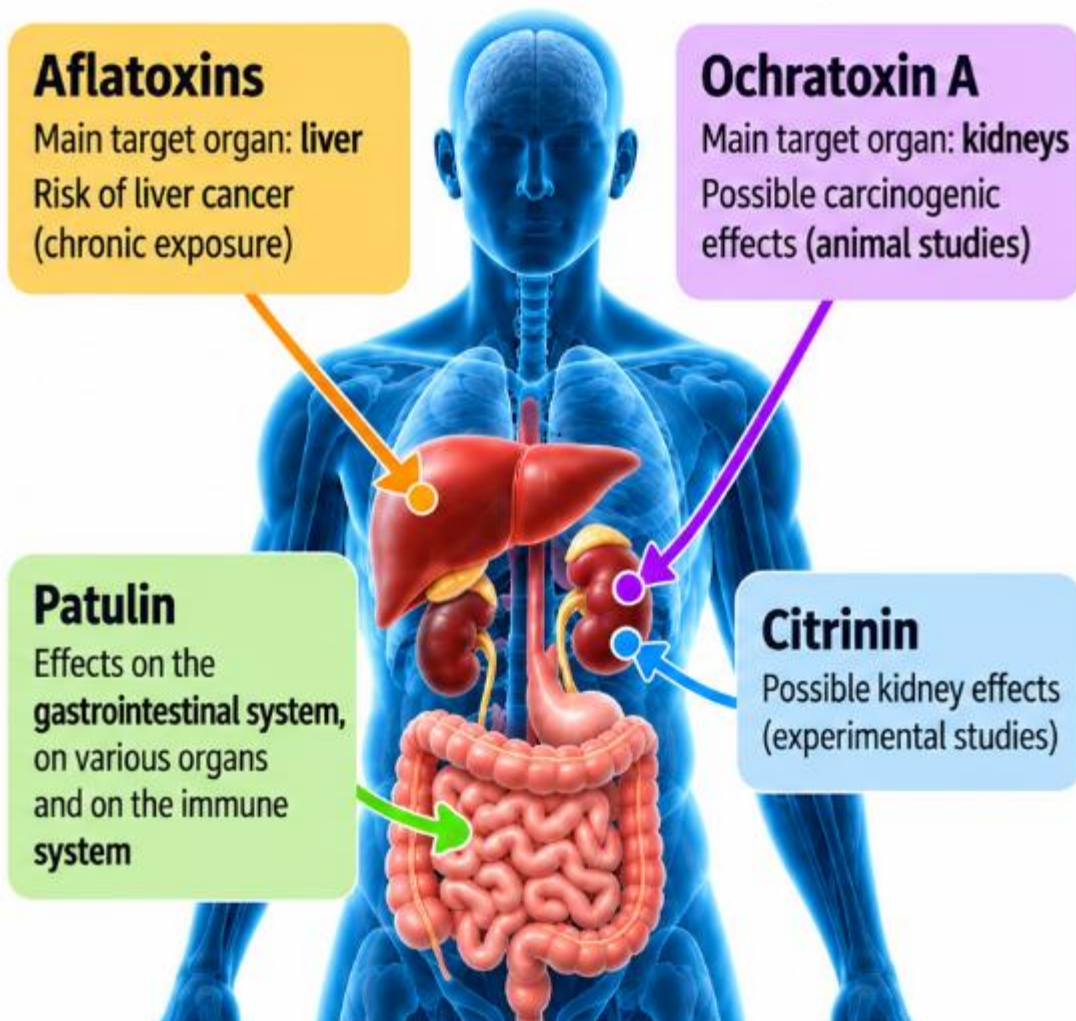
## WHY AFLATOXINS ARE A HEALTH CONCERN

The principal concern is chronic exposure, particularly to AFB1. After absorption, enzymes can convert AFB1 into reactive metabolites capable of binding to DNA. This genotoxicity contributes to the mechanism by which hepatocellular carcinoma risk increases. AFB1 exposure may be especially problematic in the presence of other liver cancer risk factors, including chronic hepatitis B virus infection.

In its 2020 assessment, EFSA considered AFB1, AFB2, AFG1, AFG2 and AFM1. One of the tools used to assess concern about genotoxic and carcinogenic substances was the margin of exposure (MOE), comparing a toxicological reference point with estimated exposure. An MOE is neither a legal limit for a particular food nor a prediction of an individual's clinical outcome. EFSA identified health concerns for some dietary exposures, particularly among younger age groups.

High short-term exposures can also cause adverse effects, but assessment of repeated exposure and cancer risk is a central issue in European routine food control. Detecting a trace analytically is not the same as quantifying an individual's health risk.

# Effects of the main mycotoxins on the human body



## HOW TO INTERPRET EUROPEAN LIMITS

Regulation (EU) 2023/915 lays down maximum levels for specified combinations of contaminants and foods. For numerous plant foods it distinguishes AFB1 from the sum of AFB1, AFB2, AFG1 and AFG2; for milk and some related products it addresses AFM1. Levels vary between foods and may differ according to whether a product will undergo further sorting or is intended for final consumers.

For example, the Regulation's Annex provides separate limits for AFB1 and total aflatoxins in cereals and cereal products, subject to expressly excluded categories. The same values cannot be applied to pistachios, peanuts, milk or infant foods. The

operational reference must always be the consolidated legislation applicable on the date of testing, including its notes.

Compliance with a maximum level establishes compliance with the relevant rules; it does not mean the substance is absent or that the food is the only dietary exposure source. Conversely, mere detection does not automatically mean that a legal limit has been exceeded.

## **SAMPLING: THE RISK OF HOT SPOTS**

Aflatoxin sampling is particularly challenging. Uneven distribution, especially in grain and tree nuts, may make a small or haphazardly collected sample unrepresentative. Collecting multiple incremental samples, preparing an aggregate sample and homogenising it correctly can be as important as laboratory sensitivity.

Implementing Regulation (EU) 2023/2782 sets out sampling methods and analytical criteria for official mycotoxin controls in food. Chromatographic techniques, often combined with selective detectors or mass spectrometry, allow individual aflatoxins to be quantified. Results must be interpreted alongside limits of quantification, measurement uncertainty and the applicable compliance assessment rules.

## **PREVENTION IS BETTER THAN TRYING TO REMOVE THEM LATER**

The most effective control starts throughout the supply chain: appropriate agronomic practice, timely harvesting, suitable drying, moisture management, monitored storage, batch sorting and risk-based self-monitoring systems. Removing visibly damaged pieces can help reduce contamination but does not automatically render a batch safe. Some aflatoxins can persist through processing and cooking; reductions depend on the treatment and food matrix.

The central message is straightforward: aflatoxins do not make an entire food category suspect, but they do require particularly careful prevention and testing. Good analysis means targeting the appropriate substances, using representative sampling and interpreting results in the context of legislation and actual exposure.

## **SCIENTIFIC AND REGULATORY REFERENCES**

[1. EFSA CONTAM Panel \(2020\). Risk assessment of aflatoxins in food. EFSA Journal, 18\(3\), 6040.](#)

[2. European Commission. Regulation \(EU\) 2023/915 on maximum levels for certain contaminants in food.](#)

3. European Commission. Implementing Regulation (EU) 2023/2782 on sampling and analysis methods for mycotoxins.

4. WHO. Mycotoxins – fact sheet.