

1. WHAT ARE MYCOTOXINS AND HOW DO THEY FORM?

When people hear about mycotoxins in food, they often picture food that is visibly mouldy. This association is understandable but incomplete. Mycotoxins are chemical substances naturally produced by certain species of microscopic fungi. They may occur in foods showing no visible deterioration, and not all moulds can produce them. To understand the issue, we need to distinguish the fungus, the substance it produces and the actual exposure of the person eating the food.

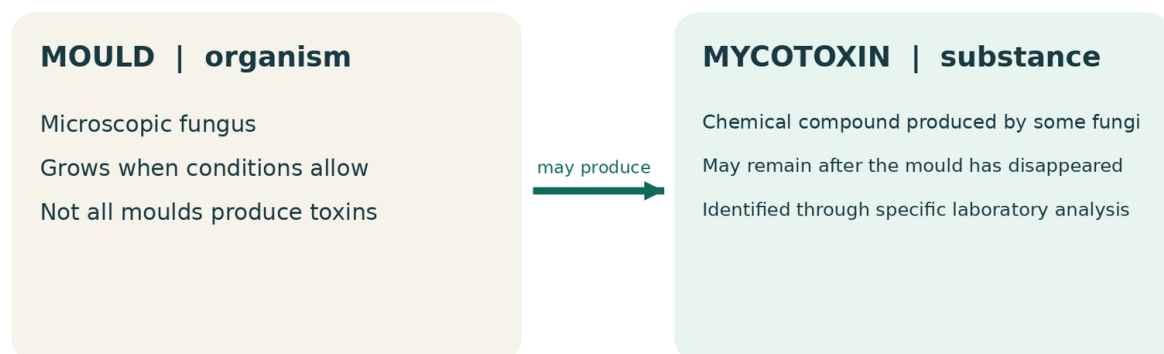
MOULDS AND MYCOTOXINS: TWO DIFFERENT THINGS

Moulds are fungi that can grow on plant materials, foods and other surfaces, particularly when water availability and temperature are suitable. Under certain circumstances, some species synthesise mycotoxins as secondary metabolites. A mycotoxin is therefore not the fungus itself: it is a chemical compound that the fungus may produce and leave behind in the contaminated material.

This distinction has practical consequences. Visible mould does not, in itself, prove that a particular mycotoxin is present or exceeds the applicable limits. Conversely, the absence of visible mould does not prove the absence of a mycotoxin: fungal growth may have occurred earlier or in a part of the product that is not readily visible. Targeted analyses are needed to determine which substances are present and at what concentrations.

MOULD AND MYCOTOXIN ARE NOT THE SAME THING

The toxic substance may persist even after fungal growth has stopped

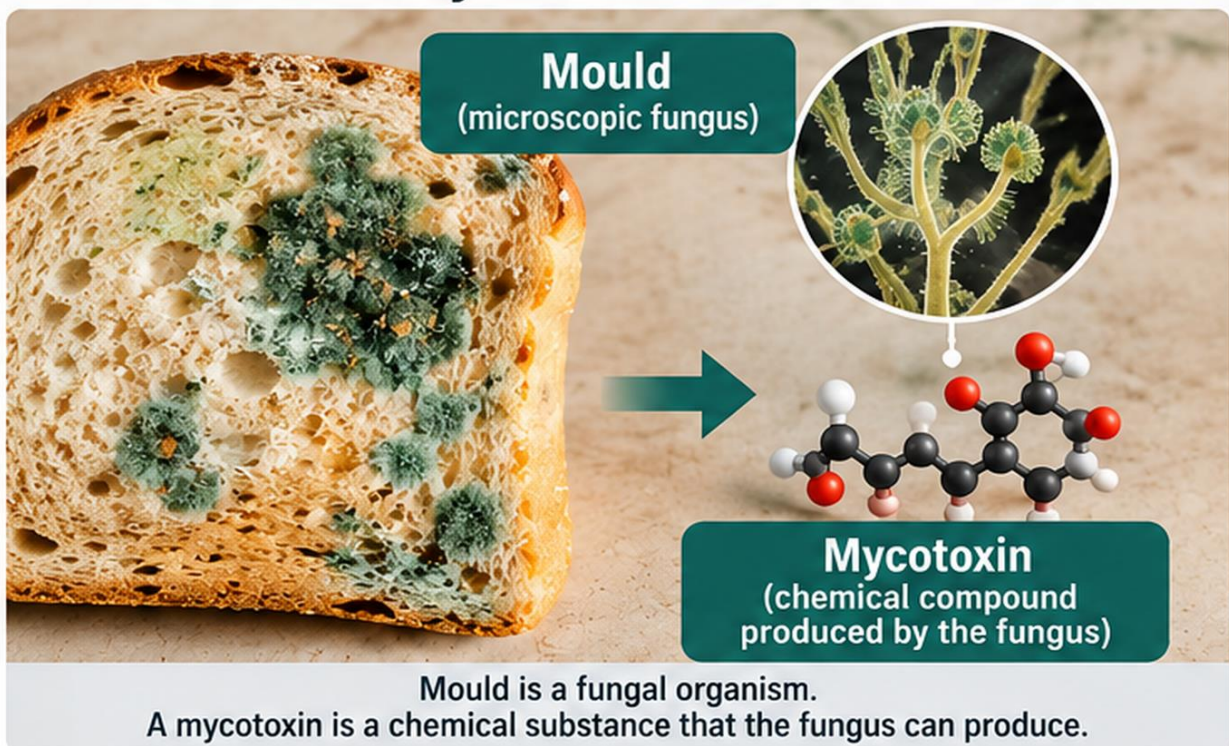


WHICH FUNGI CAN PRODUCE THEM?

Three genera frequently feature in studies of mycotoxins in food: *Aspergillus*, *Penicillium* and *Fusarium*. Not every species within these genera produces the same substances, nor does it necessarily produce them under all environmental conditions. The mycotoxin content of a food cannot therefore be inferred simply from the broad identification of a mould.

Aflatoxins are associated with certain *Aspergillus* species; ochratoxin A may be produced by particular *Aspergillus* and *Penicillium* species; and various *Fusarium* species may produce deoxynivalenol, zearalenone, fumonisins and other toxins. These substances do not form a homogeneous group: their chemical structures, behaviour and toxicological effects differ considerably. The following chapters examine the main groups separately.

1. Moulds and mycotoxins: the difference



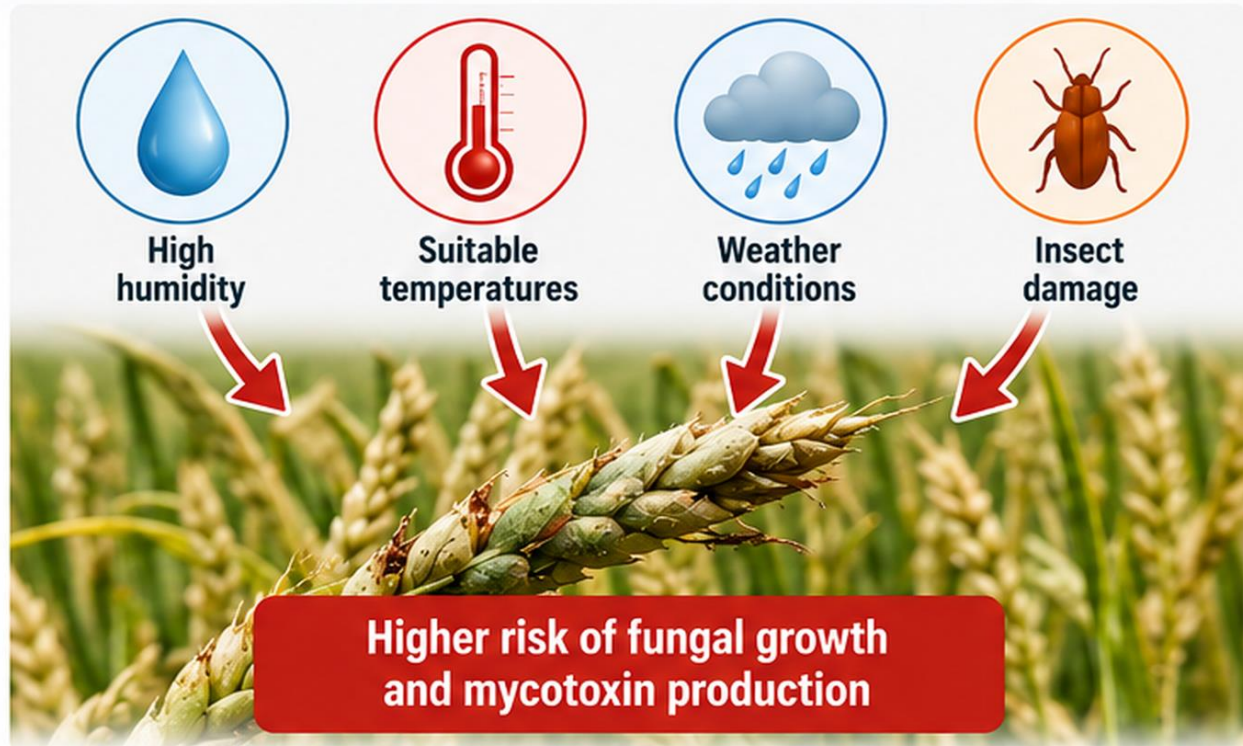
WHEN AND WHY DO THEY FORM?

Fungal contamination may begin before harvest, while the crop is still growing, or arise or continue during harvesting, transport, drying and storage. Moisture, temperature, weather conditions, insect damage, crop characteristics and storage practices can influence fungal growth and toxin production. The conditions favouring growth are not identical for all fungal species or all mycotoxins.

For example, *Fusarium* infections in cereals may occur in the field. Other problems may intensify when products are not dried adequately or are stored in conditions that favour

fungal growth. Safety therefore depends on more than the geographical area of production: the same raw material may encounter very different conditions throughout the supply chain.

2. Conditions that favour the formation of mycotoxins



CAN MYCOTOXINS REMAIN AFTER THE MOULD HAS GONE?

Yes, in some cases. Many mycotoxins are relatively stable and may persist after treatments that reduce or stop fungal viability. Milling, cooking and other processes may alter the distribution or concentration of particular substances, but they do not provide a general guarantee of removal. The outcome depends on the mycotoxin, the product and the actual processing conditions.

Consequently, food that looks normal may still require analytical testing, particularly where certain raw materials or supply chains are known to be susceptible to contamination. Equally, it would be wrong to claim that every food that has come into contact with mould is necessarily dangerous: specific evidence is needed rather than automatic assumptions.

WHERE CAN THEY OCCUR IN THE FOOD CHAIN?

Commonly studied categories include cereals and cereal products, maize, tree nuts, peanuts, spices, dried fruit, coffee and some fruit products. Their distribution varies by mycotoxin group, and there is no universal ranking of the 'most contaminated' foods. Frequency of consumption matters as well as the measured level: even a comparatively low concentration in a frequently eaten food can contribute to overall exposure.

There is also an indirect route: some toxins ingested through animal feed may be transformed in the animal's body and subsequently occur in food products. A classic example is aflatoxin M1, which may appear in milk from animals fed feed contaminated with aflatoxin B1. This does not mean that every mycotoxin behaves in this way or that the same conclusion applies to all foods of animal origin.

3. The food chain: where mycotoxins can be found



**Cereals
and flours**



**Tree nuts
and oilseeds**



Dried fruit



Spices



**Coffee
and cocoa**



**Fruit-based
products**



**Milk and dairy products
(indirect route)**



**Other products
of animal origin
(indirect route)**

PRESENCE, EXPOSURE AND RISK ARE NOT SYNONYMOUS

Presence is established by measuring a mycotoxin's concentration in food, normally expressed in micrograms per kilogram ($\mu\text{g/kg}$). Exposure also depends on how much of the food is consumed, how often and for how long. Risk assessment additionally considers the hazards posed by the particular substance and the characteristics of the exposed population, including age and physiological circumstances.

Mycotoxins do not all produce the same effects: some can cause acute harm at high doses, while others are mainly investigated for the effects of prolonged exposure. Aflatoxins require particular attention because of their genotoxicity and carcinogenicity. Nonetheless, it would be incorrect to treat every analytical detection as evidence of definite harm to health: results must be interpreted in their toxicological context.

OFFICIAL CONTROLS AND THEIR LIMITATIONS

The European Union sets maximum levels for certain mycotoxins in specified food categories under Regulation (EU) 2023/915, as amended. These values are tools for protecting health and managing risk; they do not demonstrate that a substance is chemically absent below the limit. Other mycotoxins may be the subject of scientific assessments or monitoring programmes without an equivalent system of limits for every food.

Preventive measures throughout the supply chain remain crucial: good agricultural practice, prompt drying, appropriate storage, raw-material selection and analytical testing. Tests provide information about particular samples, but their value also depends on how the samples are taken: mycotoxins may be unevenly distributed, especially in large quantities of cereals and tree nuts.

KEY POINTS TO REMEMBER

Mycotoxins are naturally occurring contaminants that are not necessarily visible and cannot always be removed by ordinary food processing. They form when particular fungi encounter favourable conditions, either in the field or after harvest. Not all moulds produce mycotoxins, and not all mycotoxins pose the same risks. Understanding food safety therefore requires information about the supply chain, prevention, representative sampling and correctly interpreted analytical results.

SCIENTIFIC AND REGULATORY REFERENCES

- [1. EFSA – Mycotoxins \(topic page\).](#)
- [2. World Health Organization \(WHO\) – Mycotoxins, fact sheet \(2023\).](#)
- [3. EFSA – Aflatoxins in food.](#)
- [4. European Commission – Legislation on contaminants in food.](#)
- [5. European Commission – Regulation \(EU\) 2023/915; consult the current consolidated text.](#)