

Mycotoxin (Toxin from fungus)	Fungus	Agricultural raw materials and food products	TDI/TWI (µg/kg body weight)	Effects	Regulation	Comments
Aflatoxins (B1, B2, G1, G2; M1 is metabolite of B1 in milk, M2 is metabolite of B2 in milk)	Aspergillus flavus, Aspergillus parasiticus, Aspergillus nomius	Cereals (maize, rice, sorghum, wheat), oilseeds (groundnuts, cottonseed, sunflower), nuts (pistachios, almonds, walnuts, Brazil nuts), spices (e.g., chilli, pepper, paprika, ginger, turmeric), dried figs, milk (for M1).	Margin of Exposure (MOE) approach. (EFSA 2020;18(3):6040 for dietary exposure assessment.	Hepatotoxic, potent carcinogens (especially B1 for liver cancer), immunotoxic, teratogenic. Aflatoxin M1 is also considered a genotoxic carcinogen.	· Reg. (EU) 2023/915: Sets maximum levels for Aflatoxin B1 and sum of Aflatoxins B1, B2, G1 & G2 in various foodstuffs. Sets maximum levels for Aflatoxin M1 in milk and dairy products, infant formulae and follow-on formulae.	Aflatoxin B1 is the most potent natural carcinogen known. Growth of Aspergillus species is favored by high temperatures and humidity. Aflatoxin M1 is a concern in milk from animals fed contaminated feed.
Ochratoxin A (OTA)	Aspergillus species (e.g., A. ochraceus, A. carbonarius, A. niger), Penicillium species (e.g., P. verrucosum, P. nordicum)	Cereals (wheat, barley, rye, maize, oats), coffee beans, cocoa beans, dried vine fruit (raisins, sultanas, currants), wine, grape juice, beer, spices, liquorice, pork products (from animal feed).	TDI: 0.1 µg/kg bw (EFSA 2020;18(9):62 Ochratoxin A in food – Re-evaluation of TDI) Note: This TWI is provisional pending further data on genotoxicity.	Nephrotoxic (kidney damage), carcinogenic in animal studies (kidney tumours), immunotoxic, teratogenic. Suspected human carcinogen.	· Reg. (EU) 2023/915: Sets maximum levels for Ochratoxin A in cereals and derived products, dried vine fruit, roasted coffee, soluble coffee, wine, grape juice, fruit juices, spices, liquorice, baby foods, dietetic foods.	OTA is heat-stable to some extent. P. verrucosum is common in temperate climates on stored cereals, while A. carbonarius is a major source in grapes, coffee and cocoa in warmer climates. Primarily associated with mouldy apples. P. expansum is a common blue mould rot. Levels can be reduced by removing mouldy parts of fruit before processing, but the toxin can diffuse into healthy tissue. Pasteurisation does not significantly destroy patulin.
Patulin	Penicillium expansum, Aspergillus clavatus, Byssochlamys nivea	Apples and apple products (juice, cider, compote, puree), pears, other fruits showing mould (e.g., grapes, peaches, apricots) if damaged or rotten.	TDI: 0.4 µg/kg bw (EFSA 2005;2(11):301)	Gastrointestinal disturbances (nausea, vomiting, ulcers), neurotoxic effects, and immunotoxic effects. Suspected mutagen and carcinogen, but the evidence is inconclusive.	· Reg. (EU) 2023/915: Sets maximum levels for Patulin in fruit juices (especially apple juice), fruit nectars, spirit drinks, cider, solid apple products (including apple compote and puree), and for apple products intended for infants and young children.	
Deoxynivalenol (DON - also known as Vomitoxin)	Fusarium species (e.g., F. graminearum, F. culmorum)	Cereals (wheat, maize, barley, oats, rye), processed cereal products (flour, bread, breakfast cereals, pasta), beer.	Group TDI for DON and its acetylated derivatives (3-Ac-DON and 15-Ac-DON) and DON-3-glucoside: 1.0 µg/kg bw per day (EFSA 2017;15(9):4718)	Acute effects: nausea, vomiting, diarrhoea, abdominal pain, headache, dizziness. Chronic effects: reduced weight gain, anorexia, immunomodulatory effects.	· Reg. (EU) 2023/915: Sets maximum levels for Deoxynivalenol in unprocessed cereals (wheat, maize, barley, oats, rye), flours, bran, germ, pasta, bread, bakery wares, breakfast cereals, and cereal-based foods for infants and young children.	Common contaminant in cereals grown in temperate regions of Europe, North America and Asia. Produced by fungi that cause Fusarium head blight in wheat and Gibberella ear rot in maize. Relatively heat stable.
Zearalenone (ZEN)	Fusarium species (e.g., F. graminearum, F. culmorum, F. equiseti)	Cereals (maize, wheat, barley, oats, rye, sorghum), processed cereal products, soybean.	TDI: 0.25 µg/kg bw per day (EFSA 2011;9(12):2197)	Oestrogenic effects (acts like oestrogen), leading to reproductive and fertility problems (hyperestrogenism, infertility, effects on foetal development) in animals. Potential endocrine disruptor in humans.	· Reg. (EU) 2023/915: Sets maximum levels for Zearalenone in unprocessed cereals (maize, wheat, barley, oats, rye), refined maize oil, flours, bran, germ, bread, bakery wares, breakfast cereals, pasta, and cereal-based foods for infants and young children, and maize-based snacks. · Reg. (EU) 2023/915: Sets maximum levels for the sum of Fumonisin B1 and B2 in unprocessed maize, maize intended for direct human consumption, maize-based foods for direct human and maize-based foods for infants and young children.	Often co-occurs with DON. Can be found in cereals affected by Fusarium head blight. Relatively heat stable.
Fumonisin (FB1, FB2, FB3)	Fusarium verticillioides, F. proliferatum	Maize and maize-based products (corn meal, grits, flour, breakfast cereals, snacks), sorghum.	Group TDI for Fumonisin B1 (FB1) and Fumonisin B2 (FB2), alone or in combination: 1.0 µg/kg bw per day (EFSA 2018;16(2):5172)	Carcinogenic in rodents (liver and kidney tumours for FB1), suspected human oesophageal carcinogen. Neurotoxic (equine leukoencephalomalacia), pulmonary oedema in swine.	· Reg. (EU) 2023/915: Sets maximum levels for the sum of T-2 and HT-2 toxins in unprocessed cereals and cereal products for human consumption, including cereal flours, bran, breakfast cereals, and cereal-based foods for infants and young children.	Primarily a contaminant of maize grown in warmer climates. Can be present at high levels. Processing (e.g., nixtamalization) can reduce levels.
T-2 and HT-2 toxins	Fusarium species (e.g., F. sporotrichioides, F. langsethiae, F. poae)	Cereals (oats, barley, wheat, maize, rye), cereal products.	Group TDI for the sum of T-2 and HT-2 toxins: 0.02 µg/kg bw per day (EFSA 2017;15(1):4655)	Highly toxic: causes alimentary toxic aleukia (ATA) in humans (nausea, vomiting, diarrhoea, skin inflammation, bone marrow suppression, immune suppression). Dermal irritant.	· Reg. (EU) 2023/915: Sets maximum levels for the sum of ergot sclerotia in unprocessed cereals and for the sum of ergot alkaloids in cereal milling products. and wheat gluten, and in processed cereal-based foods for infants and young children.	Commonly found in oats and barley in Northern Europe. Considered among the most potent trichothecenes.
Ergot alkaloids (e.g., ergometrine, ergotamine, ergosine, ergocristine, ergocryptine (alpha- and beta-forms), ergocornine and their respective -inine epimers)	Claviceps species (e.g., C. purpurea, C. fusiformis, C. paspali)	Cereals (rye, wheat, triticale, barley, millet, oats), flour, bread, cereal-based products, pasture grasses.	Group TDI for ergot alkaloids: 0.6 µg/kg bw per day (sum of parent alkaloids) (EFSA 2012;10(7):2798). Acute Reference Dose (ARfD): 1 µg/kg bw (EFSA 2012;10(7):2798)	Ergotism (St. Anthony's Fire): vasoconstrictive effects (gangrenous ergotism - dry gangrene of extremities) and/or neurological disturbances (convulsive ergotism - hallucinations, convulsions).		The alkaloids are found in ergot sclerotia (dark, horny structures of the fungus) that replace kernels in infected cereal heads. Sclerotia can be removed by cleaning, but alkaloids can also be present in dust.
Citrinin	Penicillium citrinum, Aspergillus species, Monascus species	Cereals (rice, wheat, barley, oats, maize), red yeast rice (food supplement), cheese, possibly other fermented foods.	Margin of Exposure (MOE) approach - current exposure levels could be a concern. (EFSA 2012;10(3):2605)	Nephrotoxic (kidney damage). Genotoxic and carcinogenic in some studies but data are conflicting.	· Reg. (EU) 2023/915: Sets maximum levels for Citrinin in food supplements based on rice fermented with red yeast Monascus purpureus.	Can co-occur with Ochratoxin A. Found in red yeast rice, which is used as a food colouring and in food supplements for cholesterol reduction. Heat stability is variable. Less potent than aflatoxin B1 but considered a significant potential hazard due to its carcinogenicity and wider occurrence than previously thought.
Sterigmatocystin	Aspergillus versicolor, A. nidulans, Bipolaris sorokiniana	Cereals (maize, wheat, barley, rice), cheese, coffee beans, spices.	Margin of Exposure (MOE) approach (EFSA 2013;11(6):3254)	Hepatotoxic, carcinogenic (liver tumours), nephrotoxic. Structurally similar to aflatoxins and a precursor in their biosynthesis.	· Reg. (EU) 2023/915: Does not currently set specific maximum levels for sterigmatocystin in most foodstuffs, but general food safety provisions apply.	