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Edible and Poisonous Mushrooms: Nature's Treasure and Hidden Danger

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Mushrooms constitute a taxonomically and biologically diverse group of fungi with considerable nutritional, nutraceutical, ecological and economic significance. Edible mushrooms are valued for their proteins, dietary fibre, vitamins, minerals and diverse bioactive constituents such as phenolic compounds, polysaccharides, β-glucans and ergothioneine. These constituents contribute to their reported antioxidant, antimicrobial, anti-inflammatory and immunomodulatory potential. Conversely, several wild mushroom species produce potent toxic metabolites, including amatoxins, gyromitrin, orellanine, muscimol and ibotenic acid which cause gastrointestinal, neurological, hepatic or renal toxicity. A critical food safety concern is the morphological resemblance between certain edible and poisonous species which makes identification based solely on colour, odour, taste or external appearance unreliable.

Introduction

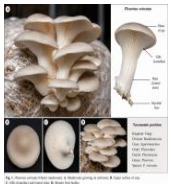
Mushrooms represent the macroscopic reproductive structures of diverse fungi and are taxonomically classified within the kingdom Fungi (Liu 2024). Unlike plants, fungi lack chlorophyll and obtain nutrients through absorptive heterotrophic nutrition (Kariman et al 2026). Mushrooms exhibit considerable diversity in morphology, habitat, nutritional composition and biochemical properties, ranging from commercially cultivated species such as the white button mushroom (*Agaricus bisporus*) to numerous wild species occurring in forest and agricultural ecosystems (Pallavi et al 2026). Edible mushrooms are recognized as nutritionally valuable foods owing to their content of high-quality proteins, dietary fibre, essential minerals, vitamins and biologically active compounds including phenolic compounds, polysaccharides and other secondary metabolites (Singh et al 2025). In contrast, certain mushroom species synthesize toxic metabolites and mycotoxin like **compounds** that produce gastrointestinal toxicity (Wijesekara T and Xu 2025).

Edible Mushrooms: Nutritional and Functional Importance

Edible mushrooms constitute an important group of macrofungi that are consumed worldwide because of their nutritional, functional and culinary attributes Ramady et al 2020. Their cultivation and utilization have increased considerably due to their relatively high nutritional value, short production cycle and ability to grow on a variety of lignocellulosic agricultural residues (Balasi et al 2023). Among the major commercially cultivated species button mushroom (*Agaricus bisporus*), oyster mushroom (*Pleurotus spp.*), shiitake (*Lentinula edodes*) and paddy straw mushroom (*Volvariella volvacea*) are of considerable economic importance (Thakur et al 2025). From a nutritional perspective, mushrooms are characterized by low fat content, moderate-to-high protein content, dietary fibre, essential minerals and several vitamins (Kisana et al 2026). Mushroom proteins contain a relatively favourable amino acid profile, while minerals such as potassium, phosphorus, iron, zinc and selenium

may contribute to their nutritional significance (Trindade et al 2025). They also contain biologically active compounds, including phenolic compounds, flavonoids, polysaccharides, terpenoids, ergothioneine and other secondary metabolites. The presence of these bioactive constituents contributes to the functional food and nutraceutical potential of edible mushrooms. Several mushroom-derived compounds have demonstrated antioxidant, antimicrobial, anti-inflammatory, immunomodulatory and other biological activities (Zade et al 2025). Consequently, edible mushrooms are increasingly regarded not merely as a source of nutrients but also as functional foods with potential health promoting properties. In addition to their nutritional importance, mushroom cultivation has significant environmental relevance. Many cultivated species can efficiently utilize agricultural and agro industrial residues as substrates, thereby facilitating the bioconversion of low-value biomass into nutritious food. This characteristic makes mushroom cultivation an important component of sustainable agriculture and circular bioeconomy approaches (Martin et al 2023).

List of Several Edible mushroom

Edible mushroom	Key distinguishing character	Bioactive compound	Neutraceutical potential	Images
Button mushroom (*Agaricus bisporus*)	White to brown pileus, short stout stipe, free gills that change from pink to dark brown with maturity	• Ergothioneine • Glutathione • Phenolic compounds, • Polysaccharides • β-glucans	• Antioxidant immunomodulatory • Potential cardiometabolic benefits	
Oyster mushroom (*Pleurotus* spp.)	Fan or oyster shaped pileus, short or lateral stipe, decurrent gills grows in clusters	• β-glucans • Lovastatin • Ergothioneine • Phenolics • Terpenoids	• Antioxidant, hypocholesterolemic • Antimicrobial and immunomodulatory potential	
Shiitake (*Lentinula edodes*)	Umbrella shaped brown pileus with characteristic scales, white gills, centrally positioned stipe	• Lentinan • Eritadenine • β-glucans • Ergothioneine • phenolics	• Immunomodulatory • Antioxidant and potential cholesterol-lowering effects	
Paddy straw mushroom (*Volvariella volvacea*)	Grey to brown pileus, free gills, characteristic **volva** at the base of the stipe	• β-glucans • Polysaccharids, • Phenolics • Flavonoids • Ergothioneine	• Antioxidant • Immunomodulatory and nutritional potential	
Milky mushroom (*Calocybe indica*)	Large, white, fleshy fruiting body, convex to broadly expanded pileus, thick, robust stipe	• β-glucans • Polysaccharids • Phenolic compounds • Flavonoids • Ergothioneine	• Antioxidant • Antimicrobial and immunomodulatory potential	
Enoki (*Flammulina filiformis*)	Small white pileus with long, slender stipes, clustered fruiting bodies, distinctive elongated morphology under cultivation	• β-glucans • Polysaccharids • Ergothioneine • Phenolics • Flavonoids	• Antioxidant • Immunomodulatory and potential metabolic health benefits	

Poisonous Mushrooms: Nature's Hidden Danger

Poisonous mushrooms comprise fungal species that synthesize toxic secondary metabolites capable of producing adverse physiological effects following ingestion (Lee et al 2022). These toxins may exert their effects on multiple organ systems, including the gastrointestinal tract, central and peripheral nervous systems, liver, kidneys and cardiovascular system (Buczma et al 2026). The severity of mushroom poisoning depends on the fungal species, type and concentration of toxin, quantity consumed and individual susceptibility (Nieminen P and Mustonen 2020). A major challenge in the safe identification of wild mushrooms is the considerable morphological similarity between certain poisonous and edible species (Laksmana et al 2026). Characteristics such as pileus colour, shape, odour, texture and taste are not reliable criteria for determining toxicity (Sahu et al 2025). Some poisonous species may closely resemble edible mushrooms at different developmental stages, leading to accidental ingestion and potentially severe poisoning. Mushroom toxins belong to several chemical groups, including amatoxins, phallotoxins, gyromitrin, orellanine, muscimol and ibotenic acid, among others. These compounds differ considerably in their mechanisms of action and clinical manifestations. For example amatoxins primarily target the liver and may cause severe hepatotoxicity whereas orellanine is associated predominantly with delayed renal injury (Wijesekara and Xu 2025). Therefore, accurate taxonomic identification is fundamental to mushroom safety. Reliable identification may require assessment of macroscopic and microscopic morphological characteristics, ecological distribution and where necessary, molecular methods such as DNA based identification. Wild mushrooms should not be consumed solely on the basis of appearance or traditional identification methods, particularly when species identity is uncertain.

Poisonous mushroom	Key morphological character	Major Toxic compound	Primary toxicological effects	Image
Death cap (*Amanita phalloides*)	Greenish to olive-brown pileus, white gills, membranous ring, distinct basal volva	• **Amatoxins**, particularly α-amanitin and β-amanitin	• **Hepatotoxicity** inhibition of RNA polymerase II • Hepatic failure and potentially death	
Destroying angels (*Amanita* spp.)	Generally white fruiting bodies, free white gills, ring and basal volva may be present	• **Amatoxins** and related toxic peptides in certain species	• Gastrointestinal symptoms	
Fly agaricus (*Amanita muscaria*)	Bright red to orange-red pileus, often with white veil remnants, white gills, ring and volva	• Ibotenic acid • Muscimol	• Primarily **neurotoxic effects** • Including altered consciousness, hallucinations, agitation	
False morels (*Gyromitra* spp.)	Irregular, folded or brain-like pileus, stout stipe, morphology may resemble edible morels	• **Gyromitrin**	• **Gastrointestinal** • **Neurological toxicity**	

Deadly webcaps (*Cortinarius* spp.)	Brown to reddish-brown pileus; rusty-brown spore print; often difficult to distinguish from edible brown mushrooms	• Orellanine	• **Delayed nephrotoxicity**	

Mushroom Poisoning: What Happens?

Mushroom poisoning also known as mycetism occurs when a person consumes a mushroom containing toxic compounds. The symptoms and severity depend on the mushroom species, type of toxin, amount consumed and individual sensitivity (Wijesekara and Xu 2025). Some toxins produce symptoms within a few hours, whereas others may cause delayed symptoms, making poisoning particularly difficult to recognize. Common symptoms include nausea, vomiting, abdominal pain, diarrhoea, dizziness, confusion, excessive sweating and changes in heart rate or blood pressure (Deng 2026) .

Why Correct Identification Matters

Correct identification of mushrooms is essential for preventing accidental poisoning. Important identification characteristics include the shape and colour of the cap, gill or pore structure, stem, presence of a ring or volva, spore print characteristics and growing habitat. In difficult cases, microscopic examination or molecular identification be required. It is important to remember that colour, smell, taste or appearance alone cannot reliably distinguish edible mushrooms from poisonous species. Some toxic mushrooms closely resemble edible species. Therefore, unidentified wild mushrooms should never be consumed (Gibson 2021).

Cultivated Mushrooms: A Safer Choice

Mushrooms species can grow on agricultural residues such as wheat straw, paddy straw and maize residues, converting low value biomass into nutritious food. Thus, mushroom cultivation contributes to food production, waste recycling, sustainable agriculture and income generation.

Conclusion

Mushrooms represent an important source of nutrition, bioactive compounds and economic opportunities, but their diversity also includes species containing potent toxins. Edible mushrooms can be safely enjoyed when they are correctly identified and obtained from reliable sources. In contrast, wild mushrooms with uncertain identity should never be consumed. Scientific identification and responsible consumption are the keys to enjoying the nutritional benefits of mushrooms while avoiding the risks associated with poisonous species.

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