



## RESEARCH ARTICLE

### MUSHROOM: MEDICINAL VS POISONOUS

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#### ABSTRACT

Mushrooms have medicinal properties and have great demand in pharmaceutical industries. Mushrooms have been collected for eating throughout the world and people become ill or died when they consumed poisonous mushrooms. Poisonous mushrooms have different types of toxic substances that should not be consumed without proper identification.

#### Key words:

Mushroom, Medicinal properties,  
Poisonous mushroom, Toxic metabolites,  
Precautions.

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## INTRODUCTION

Mushrooms are the fleshy, spore-bearing fruiting bodies of higher (macro) fungi, typically produced above ground on soil or on their food source. There are about 1, 40,000 species of fungi in the world, out of which mushroom having 15,000 to 14,000 species. Two families and 2 taxa belonged to class-Ascomycetes viz., Family- *Helvellaceae* and *Morchellaceae* and nine families and 38 taxa to class-Basidiomycetes viz., Family-*Agaricaceae*, *Amanitaceae*, *Boletaceae*, *Cantharellaceae*, *Coprinaceae*, *Ganodermataceae*, *Hydnagiaceae*, *Lycoperdaceae* and *Russulaceae* are mushroom found in India.

#### Nutritional and medicinal value of mushroom

Mushrooms flourish under all climates, some are saprophytic, and some are highly specific such as the dung and ectomycorrhizal fungi. Mushroom can be found growing in tea, rubber, oil palm estates, open lawns, forests, upland as well as lowlands. Besides culinary, mushrooms have both nutritional and medicinal value. Mushrooms contain high amount of protein, low in simple carbohydrate but rich in complex carbohydrate (polysaccharides) and dietary fiber, high in antioxidants, low in fat. They are a good source of riboflavin (B2), Niacin (B3), Pantothenic acid (B5) as well as Ergo sterol and essential mineral such as Selenium, Copper and Potassium which are important for body immune system. Besides these

mushrooms also contain many medicinal compounds such as triterpenoides, glycoproteins and natural antibiotics. Several nutraceutical products have been isolated from mushroom. The major compounds are ganoderic acid, triterpenes and polysaccharides. Around 1800 species of mushrooms are thought to have medicinal properties. Many medicines have been developed to enhance immunity and stabilize convalescence based on bioactive compounds isolated from extracts of mushroom sporocarps or mycelium of inedible species belonging to the *Scutigeraceae*, *Polyporaceae*, *Xylariaceae*, *Thelephoraceae* and *Paxillaceae* families (Mizuno, 1999). Most of the Basidiomycetes mushroom contain polysaccharides with antitumor and immunomodulating properties in fruiting bodies, cultured mycelium, culture broth. Polysaccharide have been isolated and carcinostatic drugs like "Krestin"(PSK) from Kawaratake (*Trametes versicolor*), "Lentinan" from Shiitake (*Lentinus edodes*) and "*Schizophyllum*" (*Sonifilan*) from Suehirotake (*Schizophyllum commune*) are developed in Japan (Mizuno, 2000). Wild mushrooms contain different antioxidants such as phenolic compounds, tocopherol, ascorbic acid, and carotenoids which could be extracted for the purpose of being used against chronic diseases.

#### Poisonous mushroom

Mushrooms have been collected for eating throughout the world for thousands of years and during that time many people become ill or died when they inadvertently consumed poisonous mushrooms. Mushroom poisoning or mycetism refers to harmful effects from ingestion of toxic substances

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present in a mushroom. The toxins present are secondary metabolites produced by the fungus. The most common reason for the occurrence of mushroom poisoning is collecting and eating a species of mushroom that closely resembles (in terms of colour and general morphology) one that is poisonous. Out of 1, 00,000 known fungi species worldwide, and out of 15,000 species of mushroom, about 2000 are edible (Graeme, 2014). Ethnic Indian tribes are known to consume nearly 283 species of wild mushrooms out of 2000 species and around 100 species of mushrooms in India are known to be poisonous to humans (Diaz, 2005). Poisonous mushrooms have a variety of mycotoxins that can differ markedly in toxicity that may be divided into classes according to their chemical structures (Deshmukh *et al.*, 2006). The most common consequence of mushroom poisoning is gastrointestinal irritation that cause vomiting and diarrhea but usually no long-term damage. Serious symptoms do not always occur immediately after eating, often not until the toxin attacks the kidney or liver, sometimes days or weeks later. However, there are a number of recognized mushroom toxins with specific and sometimes deadly effects. The severity of mushroom poisoning may vary depending on the geographic location where the mushroom is grown, growth condition, the amount of mushroom consumed, and genetic characteristics of the mushroom. Boiling, cooking, freezing or processing may not alter the toxicity of mushroom. Mortality rate depends on the patient's age and general health.

#### Poisonous mushrooms are classified by the physiologic and clinical effects of their poisons

1. **Amanitoxins and Phallotoxins:** The toxins involved are complex polypeptides (Cyclopeptides). Cyclopeptides include amatoxins, phallotoxins and virotoxins. This group of toxins is responsible for most fatalities in mushroom poisoning. e.g. *Amanita phalloides*, *A. verna*, *A. virosa*, *A. bisporigera*, *A. ocreata*, *A. suballiacea*, *Galerina autumnalis*, *G. marginata*, *G. sulcipes*, *Lepiota helveola*, *L. chlorophyllum*, *L. josserandi*, *L. fulvella*, *L. subincarnata*, *L. brunneoincarnata* and *L. brunneolilacea*. This species forms mycorrhizae and is associated with trees belonging to the genus *Casuarina* (Iron Wood), *Eucalyptus* and *Melaleuca* (Paper Bark). The mushrooms are usually associated with the root tips of the trees. Thus, they may be some distance away from the tree. However, it is estimated that over 90% of mushroom fatalities is due to consumption of only one species, *Amanita phalloides*. The victims described the taste of *A. phalloides* as mild to quite good, so large amounts of it are normally consumed. The alpha-amanitin rapidly attacks the intestine, liver and kidney. However, any discomfort from this toxin is not immediate. It may be as long as 24 hours before any symptoms occur. The victim will experience diarrhea, profuse vomiting and abdominal pains, which usually last from four to six days. These symptoms will then subside and the victim will feel better and will often believe that whatever caused the illness has passed. However, this is misleading. Because by this time, the amatoxins will have caused collapse of kidney and liver function. The victim will then eventually go into a coma and death usually follows. Even when death does not occur, the illness lasts several weeks and permanent damage to the liver and kidney is likely. Thus, if an unknown mushroom has been consumed, it is best to
- arrive at a correct identification of that mushroom, immediately. If a species containing amatoxins is identified rapidly (within an hour or two after consumption), before it can cause any damage, vomiting is induced in the patient to empty the stomach followed by washing out the stomach.
2. **Norleucine:** *Amanita smithiana* and *Amanita proxima*, have also been associated with an acute oliguric renal failure. These mushrooms cause vomiting and diarrhea 1-12 hours after ingestion, followed by a transient elevation of transaminases, then oliguric renal failure in 3-6 days. Exposure to norleucine-containing mushrooms may require temporary hemodialysis.
3. Gyromitrin is a volatile hydrazine derivative synthesized by 'false morels' - *Gyromitra esculenta*, *G. infula*. In the stomach, gyromitrin is rapidly hydrolyzed into Monomethylhydrazine (MMH). Symptoms of this toxin usually appear approximately 2-12 hours after consumption. MMH causes initial bloated feelings, followed by nausea, and the usual vomiting, diarrhea and abdominal cramps and destruction of blood cells. Severe headaches and pain may also occur and linger for some time. If more severe poisoning has occurred, i.e., individuals who have eaten large amounts of mushrooms containing Gyromitrin, symptoms of liver toxicity will occur after between 36-48 hours. Jaundice and convulsion may occur, followed by coma and eventually death after 2-7 days. The actions of this toxin are somewhat similar to the cyclopeptides. In addition, it is hemolytic, and toxic to the central nervous system and irritates the gastrointestinal tract. Pyridoxine hydrochloride should be administered.
4. **Orellanine:** *Cortinarius orellanus*, *C. rubellus*, *C. orellanus*, *C. speciosissimus*, *C. splendens*, *C. gentilis* and *C. rainierensis*, belongs to the subgenus *Dermocybe*, contain this toxin. This toxin causes no symptoms for 3-20 days after ingestion. The mushrooms often contain other toxins in addition to orellanine; therefore people having eaten mushrooms containing orellanine may experience early symptoms as well. In mild poisoning cases, symptoms sometimes did not appear until 10-17 days after eating the mushroom. Typically around day 11, the process of kidney failure begins, and is usually symptomatic by day 20. These symptoms can include pain in the area of the kidneys, thirst, vomiting, headache and fatigue. There is a great deal of variation with respect to the recovery of the poisoned victim. In cases where renal damage has occurred, there may be a period of mild renal failure followed by complete recovery. However, in some cases, renal failure may occur and the victim will require lifelong hemodialysis or a kidney transplant, or in some instances coma, followed by death, will occur.
5. **Muscarine:** Mushrooms containing this toxin are very nondescript and are often referred to as little white or brown mushrooms, *Clitocybe dealbata*, *Inocybe*, *Omphalotus* species and some red-pored *Boletes*. Normally, they are found in grassy areas. The toxin stimulates the exocrine glands where sweat, saliva and tears are produced and causes what is referred to as PSL (Perspiration, Salivation, Lachrimation) syndrome within 15 to 30 minutes of consumption. Other symptoms include nausea, vomiting and diarrhea, urge to urinate, constriction of pupils, blurred vision, muscle spasms, slow heart-beat and a drop in blood pressure.

Although rare, death has been known to occur. However, when this has occurred, the victim usually has had a history of cardiovascular disease. The accepted treatment is intravenous injection of atropine.

6. **Ibotenic acid and muscimol:** The most well known species of mushroom, having toxins in this group is *Amanita muscaria*, *Amanita cokeri*, *A. gemmata*, *A. pantherina* and *Panaeolus campanulatus*. *Amanita muscaria* having its scarlet pileus that is covered with yellowish-white spots. This species forms mycorrhizae with pine trees and is common in temperate areas of the world. Onset of symptoms in this group may occur 30-120 minutes after consumptions. The toxins act on the central nervous system causing the victims to suffer from symptoms similar to alcohol intoxication. i.e., unable to walk or walk with drunken gait, confusion between 30 and 120 minutes of consumption. Alternation between lethargy and hyperactivity. Nausea and vomiting may also occur if large amounts of mushrooms have been consumed. This is followed by a deep sleep with dreams, lasting about two hours. The victim usually recovers.
7. **Coprine:** *Coprinus atramentarius* is the most common species known to contain this toxin. Also known from *C. insignis*, *C. quadrididus* and *C. variegatus*. Although unpleasant, consumption of mushroom is not fatal. A rather unique toxin in that symptoms occur only if mushroom is consumed with a drink containing alcohol. Symptoms begin approximately 30-60 minutes after consumption and will continue as long as there is alcohol in the system. Symptoms include hot flushes of the face and neck, a metallic taste in the mouth, tingling sensations in the limbs, numbness in the hands, palpitations, a throbbing headache, nausea and vomiting. The symptoms will continue as long as there is any alcohol in the victim's stomach. With the exception of treatment to control arrhythmia (irregular heartbeat), recovery is normally spontaneous once the body is rid of the alcohol.
8. **Psilocybin and Psilocin:** Hallucinogenic compounds are found in four agaric genera, *Psilocybe*, *Panaeolus*, *Conocybe* and *Gymnopilus*. Symptoms begin approximately 10-30 minutes after consumption. The toxins in this group have a strong effect on the central nervous system. Some of the common symptoms include uncontrollable laughter, hallucinations, optical distortions, euphoria and disembodied experience. The effects are normally about 4-5 hours, followed by sleep. Since as little as 5 mg. of *Psilocybe cubensis* can cause visual hallucinations in 15 minutes, it is obvious that the ingestion of large quantities of some mushrooms in this group can be fatal or cause severe toxic effects. Hallucinations may be suppressed by chlorpromazine and convulsions by diazepam.

9. **Gastrointestinal irritant:** This is a group of unrelated toxins. However, they all cause similar symptoms when consumed. e.g. *Agaricus*, *Amanita*, *Boletus*, *Chlorophyllum*, *Entoloma*, *Hebeloma*, *Lactarius*, *Marasmius*, *Naematoloma*, *Russula*, *Scleroderma*, *Tricholoma*. Symptoms from the mushroom begin 30-90 minutes following consumption. All cause varying degrees of digestive upset. Commonest symptoms are diarrhea, vomiting and abdominal cramps. Normally, symptoms clear up in 3-4 hours and complete recovery several days later. Some cases of fatality have been recorded, but these are usually cases in which large quantities of mushrooms have been consumed or if the victims were young children.

10. **Involutin:** Ingestion of *Paxillus involutus* may result in the acute onset of abdominal pain, nausea, vomiting, and diarrhea within 30 minutes to 3 hours of ingestion, followed by an immune complex-mediated hemolytic anemia with hemoglobinuria, oliguria, anuria, and acute renal failure.

#### Precautions for mushroom poisoning

- Awareness camp on 'Consumption of poisonous mushroom causes death' People should not consume wild mushroom easily found here and there, consume only those mushroom which are produced from spawn certified by the agriculture department or other recognized institutions .
- Educating people about scientific aspects of mushroom poisoning as well as health hygiene.
- Medical awareness: If there are symptoms of stomach pain, vomiting, loose motion, headache, fever etc. after consumption of mushroom, rush the patient to a nearby hospital. If it takes more than 20 to 25 minutes in reaching the hospital, make the patient vomit so that the poisonous foods are taken out of the stomach.

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