

## Review Article

**A Review on Mushroom Intoxications**

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**Abstract:** Wild mushrooms that grow in forests and field, are of different types, and it is common for the native inhabitants to consume them. Nevertheless, mushrooms are one of the most common toxic exposures, with over 12000 mushroom exposures reported at a global report by WHO. Mushrooms have been used as constituents of human diet and many primal documents written in oriental countries have already described the medicinal properties of fungal species. Some mushrooms are known because of their nutritional and therapeutically properties and that causes fatal accidents every year mainly due to misidentification.

**Keywords:** WHO, Mushroom poisoning, Mycetismus, Muscarinic.

**INTRODUCTION**

Approximately 140,000 species of mushrooms have already been itemised all over the world, nearly 2,000 being measured safe for human consumption and about 700 have therapeutic properties. Mushrooms are considered to be natural nutraceuticals and are cultivated for both comestible and medicinal purposes. The habit of eating naturally grown mushrooms is quite common in our country especially among the people living in rural areas. Hundreds of people are admitted to hospitals with mushroom poisoning every year and many lose their lives because of the complications. The clinical picture caused by poisonous compounds in mushrooms is called mushroom poisoning or 'mycetismus'. Mushroom poisoning is most commonly seen in spring and autumn seasons with cool, damp evenings which promote mushroom growth.

Toxicity may also vary established on the amount ingested, the age of the mushroom, the season, the geographic location, and the way in which the mushroom has been cooked prior to ingestion. Consuming poisonous mushrooms can produce various types of reactions, such as allergic gastroenteritis, psychological relaxation and fatal liver intoxication.

Mushroom poisoning is usually the result of ingestion of wild mushrooms due to misidentification of a toxic mushroom as an edible species bearing close resemblance. It is also found as a result of small children, especially toddlers in the 'grazing' stage ingesting mushrooms found in the lawn. "Magic"

mushrooms are intentionally taken by adolescents for their hallucinogenic effects[2]. The clinical manifestations of mushroom poisoning depend mainly on the type of mushroom involved (the degree of toxic species), amount ingested (obvious), age (symptoms in children are more fatal compared to an adult due to their having low body weight), time of onset of symptoms (very toxic mushroom poisoning cases usually have delayed onset of symptoms which are very severe with hepatic, renal, hemolytic and CNS involvement), geographic distribution (some of the dangerous species of mushrooms could be more abundant in some locations; also some specimen that look edible at one geographic location may be deadly in another region) as well as premorbid hepatic and renal condition

**Poisonous Mushroom species****Genus Amanita**

The family Amanitaceae (genus Amanita) is well known as having many toxic species. Amatoxins are present in species of Amanita genus such as: Amanita phalloides, A. virosa, A. verna, A. ocreata, A. bisporigera, A. suballiaea, A. tenuifolia and A. hygroskopica. The family of amatoxin comprises a neutral component designated as alpha-amanitin, an acid one called betaamanitin, gamma and delta-amanitin and the non-poisonous component amanullin from A. phalloides and amaninamine from A. virosa

**Genus Clitocybe and Inocybe**

Species of genus Clitocybe also cause muscarinic syndrome. The species C. dealbata, C.

*rivulosa*, *C. candicans*, *C. cerussata*, and *C. phyllophila* are described in literature as poisonous mushrooms due to the presence of muscarine in their chemical composition.

Approximately 15 minutes to 2 hours after ingestion patient can present gastrointestinal problems, miosis, hyper-secretion and in severe cases bradycardia.

#### Genus Cortinarius

The genus *Cortinarius* comprises between 2,000- 3,000 species of mushrooms that were considered as non-toxic until 1950. In several case reports it was demonstrated that the mushrooms *C. speciosissimus* and *C. orellanus* are nephrotoxic due to the presence of the cyclopeptide orellanine whose metabolites are supposed to be most active.

#### Genus Gyromitra

Species of genus *Gyromitra*, family *Helvellaceae* are really attractive to hunters and gourmets because of their taste. However, some species of *Gyromitra* contain a well-known toxin named gyromitrin, whereas other species are non-toxic. This is one of the reasons why intoxications occur, toxic and non-toxic species are sometimes difficult to distinguish because they are mixed-up.

#### Genus Psilocybe

The use of psychoactive substances of fungal origin for recreational purposes has become an increasing problem in many countries all over the world. Species of genus *Psilocybe* are known due to their psychedelic effects caused by psilocybin. Common psilocybin containing mushrooms are: *P. semilanceata*, *P. Mexicana*, *P. bohémica*, *P. cubensis* and *P. baeocistis*.

The symptoms of intoxication occur 30 minutes after ingestion of fresh or dried mushroom and start with anxiety, nausea, vertigo and asthenia, neurosensorial symptoms consists of visual problems, disorientation, motor incoordination and sympathomimetic symptoms consist of mydriasis, tachycardia and hypertension.

#### Intoxications

##### Amatoxin

- Its nitrogenous bicyclic octapeptide insoluble in water. It irreversibly binds to and inhibits RNA polymerase II, blocking the production of DNA, the basis of cell reproduction; this leads to the death of many cells especially frequently reproducing cells like those found liver, intestine, kidneys and ultimately the CNS. It also coerces into the muscle protein actin -essential for muscle contraction, resulting in weakness.
- Symptoms; they start with a latent period of 12hrs which is followed by Gastrointestinal track disturbances characterised by nausea, vomiting and

abdominal pain. This will be followed by dehydration, loss of consciousness death in 72hrs. The damage of liver cells is evident by elevated enzymes like SGOT and ALP with double folds. Elevated prothrombin time >50 sec and Serum Bilirubin level: >300 µmol/L.

- Diagnosis of Amatoxin is done through history taking; the history of ingesting mushrooms, family intoxicated after having mushroom dish. On physical examination: yellowing of eyes. Laboratory work can be done by help of Maximer test. If a specimen of the ingested mushroom is found, analysis for amatoxins done by expressing a drop of liquid from the specimen on a paper, containing wood pulp allowed to dry and placing a drop of one molar HCL on this spot, after several minutes, appearance of blue colour to confirm amatoxin poisoning.
- Toxicology is done by analysing the urine and vomitus via High Performance Liquid Chromatography to confirm the diagnosis.
- Management is purely supportive under the critical care. Give intravenous fluids and activated charcoal. Amatoxin appear to undergo entero-hepatic circulation, repeat dose activated charcoal and laxatives may interrupt this cycle and reduce toxicity.
- Give empirical antibiotics namely penicillin. Cimetidine – it is a cytochrome P 450 inhibitor hence reduces the metabolism of amatoxin by the hepatocytes. Vit.K – if coagulopathy is present. N-Acetylcysteine. It improves cerebral blood flow and oxygenation in patients with fulminant hepatitis due to any cause.

#### Muscarinic

Ingestion of any number of *Inocybe* or *Clitocybe* species (e.g., *Inocybe geophylla*, *Clitocybe dealbata*) results in an illness characterized primarily by profuse sweating. This effect is caused by the presence in these mushrooms of high levels (3- 4%) of muscarine. Muscarine poisoning is characterized by increased salivation, perspiration, and lacrimation within 15 to 30 minutes after ingestion of the mushroom. With large doses, these symptoms may be followed by abdominal pain, severe nausea, diarrhea, blurred vision, and labored breathing. Intoxication generally subsides within 2 hours. Deaths are rare, but may result from cardiac or respiratory failure in severe cases.

- Tetrahydro-4-hydroxy-N,N,N-5-tetramethyl-2-furanmethanaminium is found in small amounts in *Amanita muscaria* and in larger amounts in *Clitocybe serussata*, *C. dealbata*, *C. phyllophilla* and *C. rivulosa*. Muscarine structure is very similar to acetylcholine and bind to the same receptors. It is not hydrolysed by cholinesterase causing a parasymphomimetic symptomatology.

- Management is supportive, give intravenous fluids. Give anticholinergic.

**Psilocybin**

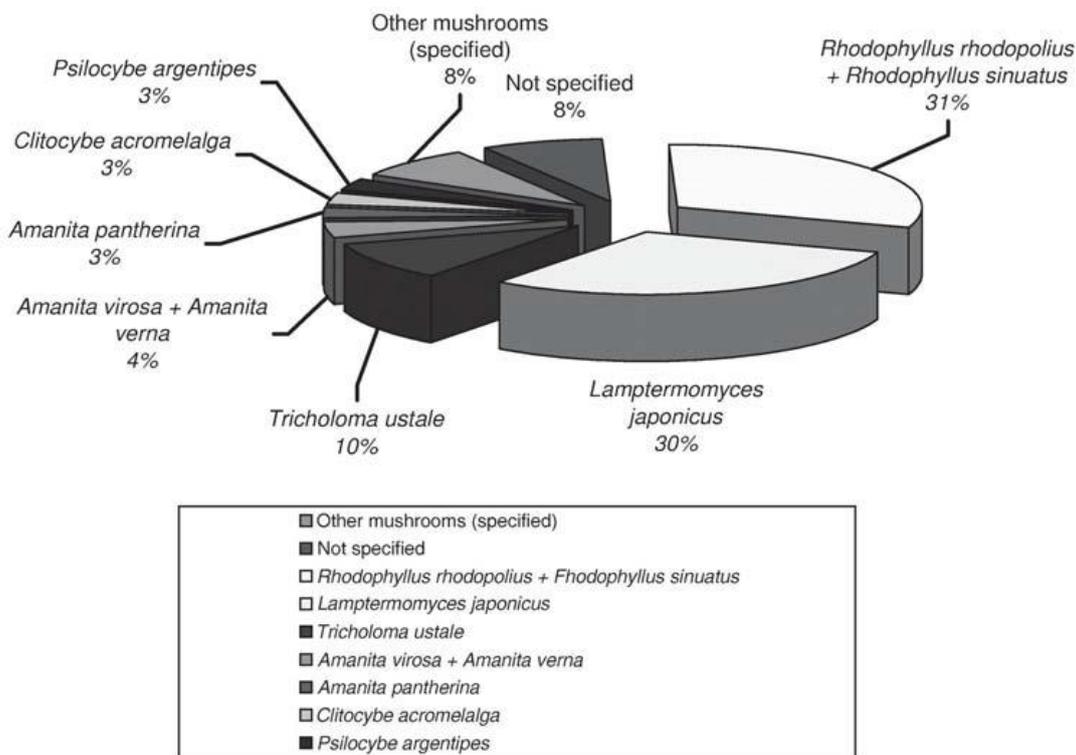
- Component of the Tyramine type, 4-phosphoryloxy-N,N-dimethyltryptamine. Cleavage of the phosphoric ester group by alkaline phosphatase and unspecific esterase indicates that psilocybin acts as a prodrug and that its hydroxyl metabolite psilocin the active agent.
- Activity of psilocybin is due to the activation of serotonin 2-A receptor.
- Give the serotonin re-uptake inhibitor and monitor vitals.

**Clinical Cases**

- 17 years-old Caucasian male had picked and ingested raw and wild mushrooms hoping that they were hallucinogenic. He presented to the hospital with a one week nausea and diarrhoea, for previous 3 days he was anuria and on examination he had no abnormalities. Serum biochemistry showed abnormal creatine and urea consistent with renal failure. After 4 weeks he had no recovery of renal function and required on-going haemodialysis [1].
- A 24-years-old female was admitted in a hospital with abdominal pain, nausea, emesis and weakness. She had consumed a mushroom 6 hours before admission. A nasogastric tube was placed for aspiration and administration of charcoal. Simultaneously fluid and electrolyte resuscitation to treat the emesis was given in the course of

intoxication. Patient developed multiple organ failure in spite of supportive treatment such as intravenous inotropic therapy and dialysis. An intra-aortic balloon counter pulsation catheter was placed because of gradual deterioration of her clinical status. After this procedure she improved gradually until complete recovery [2].

- Two patients a man and his wife, both were 67 years old, ingested the specie *Clitocybe rivulosa* wrongly identified as *Marasmius oreades*. The wife presented abdominal pain, diarrhoea and intense sweating followed by and unconsciousness state. Artificial ventilation was needed because of bronchial hyper secretion. High blood pressure and alterations in cardiac rate were also noticed such as convulsions. Patient died one week after hospital admission, her husband presented moderated muscarinic syndrome 15 hours after mushrooms ingestion. He presented nausea, diarrhea, intense sweating, myosis and bronchial hyper secretion. Symptomatic treatment was instituted and administration of atropine. Recovery was completely. Patient was discharged from hospital the day after admission [3].
- A fatal case of magic mushroom poisoning happened with a 27 years old man that was found in an irrigation canal. Two cultivation pots of mushrooms were found in his room, which was identified as *Psilocybe subcubensis*. The victim might have been influenced by these hallucinogenic substances. As a result he died of winter cold temperature [4].



**Fig-1: distribution of mushroom toxins**

### Analysis of the toxins

#### Extraction from mushrooms

- After a mushroom is minced into small pieces with a knife or scissors, they are extracted with 3 mL of methanol/ water/0.01 M HCl (5:4:1) by shaking the mixture at 4 °C for 24 h

#### Extraction from body fluid

- A 5-mL volume of serum is mixed with 10 mL acetonitrile, shaken for 10 min and centrifuged at 1,000 g for 10 min.
- The supernatant solution is mixed with 30 mL dichloromethane, shaken for 20 min and centrifuged at 1,000 g for 5 min.
- The supernatant solution is condensed under a stream of nitrogen and injected into HPLC for analysis

### DISCUSSIONS



Fig-2: HPTLC of methanolic extract Before Derivitization

- There are some toxic mushrooms, the toxins of which are not clarified; for such types of mushrooms, chemical analysis is useless.
- Raw mushrooms should not be frozen, because their forms are destroyed upon thawing; they should be stored in a refrigerator at 4 °C.
- In countries where mushrooms are highly consumed, a number of intoxications are reported every year mainly due to misidentification of species. Amanita phalloides toxin was detected by high pressure liquid chromatography method in blood.

- Poisoning with mushroom having long incubation period is very dangerous and has significantly higher mortality rate.
- Common toxins are amanitin, muscarinic and psilocybin.
- Many cases occurs in paediatrics than in adults
- Many treatment modalities aiming detoxification are suggested by many different studies from all over the world.
- Aiming at primary prevention, the government should establish regional toxicology centres which would impart public education on recognition of toxic mushroom along with first aid management.

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