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Mushroom Poisoning

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There is no known test for identification of edible or poisonous mushroom. A mushroom should never be eaten unless it has been accurately identified and the edibility of the species is known. Many traditional methods are known for testing of these fungi but they are unreliable. Amongst different mushroom poisoning, Amanita type poisoning is the most dangerous type. When anyone after eating mushrooms develops symptoms, no time should be lost in summoning a doctor, who should be informed of the nature of the case which he is required to attend so that he should bring necessary appliances. In the meantime, preliminary treatment may be given.

Mushroom poisoning, also known as mycetism or mycetismus, refers to harmful effects from ingestion of toxic substances present in a mushroom. The symptoms can vary from slight gastrointestinal discomfort to death. Mushroom poisoning is usually the result of ingestion of wild mushrooms after misidentification of a toxic mushroom as an edible species. The most common reason for this misidentification is close resemblance in terms of colour and general morphology of the toxic mushrooms species with edible species. One cannot safely enjoy wild edible mushrooms without knowing poisonous mushrooms. There are many different types of mycotoxins. Of 14 distinctive types of mushroom poisoning found worldwide, about eight distinctive patterns of reactions to mycotoxins have been addressed below:

1) Amanitin (amatoxins)
2) Gastrointestinal irritants
3) Muscarine
4) Isoxazole derivatives (Muscimol, Ibotenic acid and relatives)
5) Gyromitrin
6) Orellanine
7) Psilocybin, psilocin, and other indole derivatives
8) Coprine and other alcohol induced syndromes

1. Amanitin (amatoxins): This is far and away the worst type of mushroom poisoning, causing more deaths than all other poisonous wild mushroom exposures combined. Poisonous mushrooms such as the Death Cap (*Amanita phalloides*), the Destroying Angel (*A. virosa / A. bisporigera), A. ocreata, A. verna*, and several "little brown mushrooms" such as the deadly Galerina (*Galerina autumnalis*, *G. marginatus* and *G. venenata*), *Lepiota josserandii, L. helveola, L. castanea*, *L. subincarnata*, *Conocybe filaris* have been shown to contain these dangerous toxins. Amanitins are a group of complex cyclic polypeptides which damage tissues by inhibiting RNA synthesis within each individual cell.

Symptoms: Symptoms are typically delayed anywhere from six to 24 hours after the poisonous mushrooms are consumed, which unfortunately gives the body time to completely absorb the toxins and can also make diagnosis more problematic because of the lack of uneaten specimens for proper identification. The initial symptoms mimic those of influenza or a stomach virus, nausea, vomiting, abdominal cramps and diarrhea. These symptoms can be severe, e.g. violent vomiting, acute cramping and bloody diarrhea. After a period of apparent improvement that lasts approximately 24 hours, the liver and kidneys begin to fail. Coma, permanent debilitating liver/kidney damage and death are common outcomes.

Onset of symptoms manifests itself in four stages

i. First stage is a latency period of 6 to 24 hours after ingestion, in which the toxins are actively destroying the victim's kidneys and liver but the victim experiences no discomfort.

ii. Second stage is a period of about 24 hours characterized by violent vomiting, bloody diarrhea, and severe abdominal cramps.

iii. Third stage is a period of 24 hours during which the victim appears to recover (if hospitalized, the patient is sometimes released!)

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iv. Fourth stage is a relapse, during which kidney and liver failure often occurs, leading to death. Patients may also "bleed out" and die due to the destruction of clotting factors in the blood. There may be more than one relapse.

If someone has ingested an amanitin-containing mushroom, DON'T WAIT for symptoms to appear. There is no antidote for amanitin poisoning and the best hope is to rush the person to the hospital where the toxins can be removed before being fully absorbed into the body. Treatment is largely supportive and symptomatic. Penicillin, kutkin and silibinin/silymarin show promise as treatments along with oral activated charcoal and electrolytes. Active measures to treat liver disease are typically followed.

2. Gastrointestinal irritants: This is the most common type of mushroom poisoning but generally, the least troublesome. Mushrooms in general contain a variety of proteins and amino acids, some of which are peculiar to certain species or certain genera of mushrooms and which cause mild to severe gastrointestinal irritation. Mushrooms that contain these toxins are numerous and include: several species of gilled mushrooms in genus *Agaricus*, the green-spored *Lepiota*, several blue-staining, orange to red-pored boletes in genus *Boletus* e.g. *B. satanas*, *B. subvelutipes* and *B. sensibilis*, the sulphur tuft mushroom (*Hypholoma fasciculare*), several species of genus *Russula* e.g. *R. emetica, Paxillus involutus*, *Scleroderma citrinum* and other species of that genus; *Verpa bohemica* and *Gomphus floccopus*.

Symptoms: Symptoms usually appear within an hour and are rarely delayed more than four hours at most. They include nausea, vomiting, diarrhea and abdominal cramps. These symptoms may range from mild to acute. In most cases the symptoms subside after the body has eliminated the meal and the troublesome amino acids but in severe cases medical treatment and hospitalization are needed to maintain fluids and electrolyte balance. In rare cases, death can occur from heart failure secondary to dehydration and electrolyte depletion. If mushroom poisoning is suspected, seek medical attention immediately and if possible take uncooked specimens with you.

3. Muscarine: A handful of mushroom species contain this toxin which can elicit visual disturbances, glandular hyper-secretion (excessive secretion of tears, perspiration and salivation), difficulty in breathing, a drop in blood pressure and an irregular heartbeat. In acute cases, fatalities have been reported due to respiratory failure. Nausea, vomiting and diarrhea are also typical. Mushrooms which contain muscarine include: *Omphalotus illudens, O. olivascens*, *Clitocybe dealbata*, *Mycena pura* and several species of genus *Inocybe,*

Symptoms: The symptoms usually occur within 15-30 minutes of ingestion and are focused on the involuntary nervous system. They include excessive salivation, sweating, tears, lactation (in pregnant women), severe vomiting and diarrhea. These symptoms may be accompanied by visual disturbances, irregular pulse, decreased blood pressure and difficulty in breathing. Victims normally recover within 24 hours but severe cases may result in death due to respiratory failure. Atropine is a specific antidote but must be administered by a physician. Dogs are particularly susceptible to the toxin muscarine.

4. Isoxazole derivatives (Muscimol, Ibotenic acid and relatives)

Several poisonous wild mushrooms of genus *Amanita,* most notably the Fly Agaric (*A. muscaria*), *A. gemmata, A. cothurnata*, *A. frostiana*, *A. crenulata*, *A. strobiliformus*, *A. pantherina* and *Tricholoma muscarium* contain these chemical compounds.

Symptoms: Symptoms appear within 30 minute to 2 hours after ingestion and last for several hours. Nausea and vomiting are quite common but the principle effects are on the central nervous system: confusion, visual distortion, a feeling of greater strength, delusions and convulsions. Drowsiness is a common symptom, and many who ingest these mushrooms fall asleep and can not be roused. In rare cases the coma-like state can last for more than 24 hours.

This facet of the syndrome can be particularly frightening for the attending physician as most cases involve patients who arrive in this apparently comatose state. The resulting panicked reaction and over treatment, generally produces no benefit to the patient. In humans, there are no reliably documented cases of death from toxins in these mushrooms in the past 100 years. Dogs and especially cats can die from these isoxazole toxins.

5. Gyromitrin: Monomethylhydrazine (MMH) is a substance used as a propellant for rockets. MMH is highly carcinogenic. It is produced when gyromitrin is gently heated. MMH interferes with normal utilization and function of vitamin B_6, thus affecting amino acid metabolism. Mushrooms like *Gyromitra esculenta*, *G. ambigua*, *G. infula*, *G. montanum*, G. gigas, *G. fastigiata*, *G. californica*, *G. sphaerospora* and many related ascomycetes such as some species of *Helvella*, *Verpa* and *Cudonia*, even morels can cause upset if consumed raw or not thoroughly cooked though the toxins are not clearly known in most cases.

Symptoms: Following ingestion of the poisonous mushrooms, seven to ten hours pass before onset of nausea and vomiting. Victims typically feel bloated and experience abdominal pain and diarrhea. Deaths due to liver damage have been reported in severe cases. There is no specific antidote for this type of poisoning; medical treatment is largely supportive and a physician should be consulted.

6. Orellanine: Mushrooms viz. *Cortinarius orellanus* and *C. rubellus C. splendens*, *C. atrovirens*, *C. venenosus*, *C. gentilis* may possibly cause orellanine like poisoning. The compounds involved in this syndrome show a very strong turquoise or blue fluorescence under UV light. Both the mushrooms and tissues of the poisoned individual will exhibit this fluorescence.

Symptoms: Symptoms occur within 36 hours to three weeks of ingestion (average is about 8 days), and include nausea, vomiting, lethargy, anorexia, frequent urination, burning thirst, headache, sensations of coldness and shivering (fever generally absent), evidence or progressive kidney failure. Onset of symptoms from orellanine poisoning can be very greatly delayed (as much as three weeks). Beyond the standard management of kidney failure, there is little but supportive treatment of use in cases of orellanine poisoning. Patients with severe, but not irreversible damage may begin to recover kidney function between two and four weeks after the onset of symptoms.

7. Psilocybin / psilocin: Psilocybin and psilocin are alkaloids that interact with the brain, affecting nerve transmission and causing hallucinations. Both psilocybin and psilocin are found naturally in mushrooms, though their ecological purpose is unknown. In the human body, they affect the serotonergic systems in the brain and show some cross-tolerance with substances such as LSD. Mushrooms reported to cause psilocybin-psilocin poisoning include *Gymnopilus spectabilis*, *G. luteus*, *Panaeolus subbalteatus*, *Pluteus salicinus* and many species of *Psilocybe*.

Symptoms: Following ingestion, fifteen to sixty minutes pass before the onset of anxiety, giddiness, hallucinations, perceived motion of stationary objects, impaired time and distance perception, and marked euphoria. Later effects include uncontrolled laughter, color images stimulated by sounds, and tingling sensations of the skin. After several hours, victims typically fall asleep, experience intense colorful dreams, and then awaken with general muscle weakness and fatigue.

8. Coprine: Several mushrooms are known to contain the amino acid coprine, which interacts negatively with alcohol in the human body. Coprine poisoning occurs when mushrooms containing coprine are consumed before, with, or after alcohol. Mushrooms reported to cause coprine poisoning include *Coprinus atramentarius*, *C. variegatus* and *Clitocybe clavipes*.

Symptoms: Following ingestion, there is a delay of thirty minutes to two hours before the onset of symptoms including an increased pulse rate, flushing over the upper half of the body, headache and rapid

breathing. After fifteen to thirty minutes of these symptoms, the victim feels weak and dizzy and typically experiences nausea and vomiting.

Folk traditions to identify wild mushroom for poison

The best way to identify mushrooms for poison is through positive identification. Learn to identify the distinctive characteristics of poisonous mushrooms. Any time you collect and eat wild mushrooms, you take a risk. Even the best mushroom collectors can make a mistake, so never eat anything that you are uncertain about and do not attempt to collect and eat mushrooms without professional training. Many folk traditions concern the defining features of poisonous mushrooms. However, there are no general identifiers for poisonous mushrooms, so such traditions are unreliable. Guidelines to identify particular mushrooms exist, and will serve if one knows which mushrooms are toxic. There are very few ways to identify wild mushrooms for poison without placing yourself at risk. Instead, consider identification the safest way to test your mushrooms and avoid poisoning yourself or someone else.

· Poisonous mushrooms are brightly colored. Fly Agaric, usually bright-red to orange or yellow, is narcotic and hallucinogenic, although no human deaths have been reported. The deadly destroying angel, in contrast, is an unremarkable white. The deadly Galerinas are brown. Some choice edible species (chanterelles, Amanita caesarea, Laetiporus sulphureus etc.) are brightly colored, whereas most poisonous species are brown or white. Make sure you are not dealing with an Amanita--the most deadly mushroom. This variety may be bright orange or pure silken white. However, there are many variations. With your knife, dig up the mushroom below the surface. Where the mushroom meets the soil, there will be a noticeable ball shaped swelling (volva).

· Break open the stem. Any mushroom that has a hollow stem should be considered deadly poisonous. If the stem looks like a hollow straw inside, it most likely contains lethal toxins.

· If a mushroom is small and brown, leave it in the ground. Little brown mushrooms are all considered poisonous and should be avoided.

· Look for stem rings and avoid all mushrooms with these rings. The rings of mushroom tissue are about three quarters up the stem and should be easy to spot.

· Morel mushrooms are popular edibles that look like tall conical caps that are very wrinkly. If you find a morel after the first of summer, it is a false morel and should not be eaten. Morels only blossom in the spring, but false morels--which look like the edible kind--blossom during the summer or fall.

· Poisonous mushrooms blacken silver. None of the known mushroom toxins have a reaction with silver.

· All mushrooms are safe if cooked/parboiled/dried/pickled/etc. While it is true that some otherwise, inedible species can be rendered safe by special preparation many toxic species cannot be made toxin free. Many fungal toxins are not particularly sensitive to heat and so are not broken down during cooking; in particular, α-amanitin, the poison produced by the death cap (Amanita phalloides) and others of the genus, is not denatured by heat.

· Poisonous mushrooms will turn rice red when boiled. A number of Laotian refugees were hospitalized after eating mushrooms (probably toxic Russula species) deemed safe by this folklore rule.

· Poisonous mushrooms have a pointed cap. Edible ones have a flat, rounded cap. The shape of the mushroom cap does not correlate with presence or absence of mushroom toxins, so this is not a reliable method to distinguish between edible and poisonous species. Death cap, for instance, has a rounded cap when mature.

Boletes

· are, in general, safe to eat. It is true that, unlike a number of Amanita species in particular, in most parts of the world, there are no known deadly varieties of the Boletus genus, which reduces the risks associated with misidentification. However, mushrooms like the Devil's bolete are poisonous both raw and cooked and can lead to strong gastrointestinal symptoms and other species like the lurid bolete require thoroughcooking to break down toxins.

How to avoid mushroom poisoning?

1. Unfamiliar species: check and re-check your identification, especially looking out for a similar poisonous species. If still in doubt, ask an expert or throw it away.

2. Examine each specimen: Always check each specimen in case a different species has got in amongst your collection of edible ones.

3. Keep your collections separate: Do not mix edible and non-edible species in a collecting tray if you are collecting for the pot. It is a good idea if collecting for the pot to only collect edible species and not other species for identification purposes.

4. Check the spore print: A simple operation, leaving a cap on some paper and covering for an hour or so. This will help check your identification.

5. Do not eat raw wild fungi. Some wild fungi are poisonous if eaten raw, e.g. Wood Blewit, *Lepista nuda*, the Blusher, *Amanita rubescens* or species of *Helvella*. Always cook your collections.

6. Retain an uncooked specimen: This is a very sensible idea. Keep one example of what you have eaten in the fridge. In case, you do poison yourself, this will help others identify what you have eaten and therefore know how to treat you. Different species contain different toxins, therefore treatments will vary.

7. Only eat good specimens: Many poisoning cases occur when edible species are eaten in poor condition. Only eat good specimens!

8. Experimenting: If experimenting and eating a type for the first time, only eat a small amount. Different people react to fungi in different ways and it is safer to test your own body out gently.

9. Alcohol: Avoid drinking alcohol with species you haven't eaten before and with certain species, e.g. the Common Ink Cap, *Coprinus atramentarius*.

10. Fear: Do not feed wild mushrooms to people who don't want to eat them. Fear can make people sick.

11. Susceptible people: Do not serve wild fungi to young children, old or sick people. Their resistance may be lower.

12. Greed: Do not eat large quantities of wild mushrooms in one sitting. This alone can make you sick.

How to treat mushroom poisoning?

The incidence of mushroom poisoning has steadily increased with the popularity of "natural" diets. There is no definite way of determining whether a wild mushroom is edible or poisonous without knowing its species. If you suspect your child has eaten a mushroom and you are not positive it was edible, treat it as if it were poisonous. Some mushrooms cause only mild stomach upset, some are fatal.

1) Gather any remaining mushrooms to bring to the doctor's office or emergency room. If the child has only eaten a bit, bring the rest of the mushroom. If he has eaten a number of them, gather mushrooms from the same area for inspection.
2) Call your doctor as soon as you suspect mushroom ingestion.
3) Take the child to the emergency room if directed by your doctor. In addition, if you cannot contact a professional medical specialist by phone, take your child to the emergency room. It's better to be safe than sorry.
4) Induce vomiting if directed by a specialist.
5) Monitor a child's vital signs. Medical personnel will do this; however, you must take your child's pulse and respiration count if you are without medical help. Count the beats of his heart per hour and record them along with the time. Do the same for the number of breaths he takes.

Conclusion

Mushroom poisoning is the result of ingestion of wild mushrooms after misidentification of a toxic mushroom as an edible species. The most common reason for misidentification is close resemblance of the toxic mushrooms species with edible species in terms of general morphology and colour. To prevent mushroom poisoning, mushroom gatherers familiarize themselves with the mushrooms they intend to collect, as well as with any similar-looking toxic species. The safety of eating wild mushrooms may depend on methods of preparation for cooking.

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