Toxic Mushrooms: A Hidden Danger

Abstract:-Mushrooms, while adding a tasty element to dishes, can also be lethal. A limited number of mushroom varieties are highly poisonous, leading to severe health complications, including harm to the kidneys and liver, and in some cases, death. The primary dangers come from substances like Orellanine, Amanitins, Muscarine, Ibotenic acid, Muscimol, and Gyromitrin, which can cause a variety of symptoms such as kidney and liver damage, hallucinations, and a slowing of the central nervous system. This article delves into the harmful mycotoxins present in certain mushrooms that can result in serious or fatal poisoning in humans. The main mycotoxins to watch out for are orellanine, α- and β-amanitin, muscarine, ibotenic acid, muscimol, and gyromitrin. Despite the critical need for detailed records of these poisonings, such records are scarce due to the absence of effective methods for identifying these mycotoxins in bodily fluids. The article also looks into the toxic mycotoxins in more complex fungi that can cause severe or fatal poisonings in humans. Key toxins include orellanine, α- and β-amanitin, muscarine, ibotenic acid, muscimol, and gyromitrin. Despite the urgent need for toxicological records, there is a lack of reporting due to insufficient methods for detection. Recent progress in techniques like liquid chromatography-high resolution mass spectrometry (LC-HRMS) and liquid chromatography-time-of-flight-mass spectrometry (LC-TOF-MS) has improved the ability to detect these toxins, but there are still obstacles to overcome. This review highlights the necessity of developing dependable detection methods and improving collaboration in forensic toxicology to more accurately diagnose, treat, and prevent mushroom poisonings.

Key words - Mushrooms, Poisonous mushrooms, Mycotoxins, Orellanine, Amanitins, Muscarine, Ibotenic acid, Muscimol, Gyromitrin, Kidney damage, Liver damage, Hallucinations, Forensic toxicology, Liquid chromatography-high resolution mass spectrometry (LC-HRMS), Liquid chromatography-time-of-flight-mass spectrometry (LC-TOF-MS), Toxicological analysis, Mushroom poisoning, Nephrotoxin, RNA polymerase II inhibition, Muscarinic syndrome, Hallucinogenic mushrooms, Metabolite profiling, Toxic metabolite

INTRODUCTION

Mushrooms, a type of fungi, are globally recognized for their nutritional, medicinal, and toxic properties. While many species are safe to consume, some pose significant health risks due to their toxic constituents. This review delves into the toxicological aspects of poisonous mushrooms, focusing on the challenges faced in forensic toxicology and analytical methodologies.

Incidence of Fungal Poisoning

Mushroom poisoning occurs worldwide, influenced by local dietary habits, economic conditions, and cultural practices. Most poisonings result from the misidentification of edible and toxic mushrooms. However, the intentional consumption of hallucinogenic mushrooms is also a growing concern. Although fewer than a hundred mushroom species are known to be severely toxic, their ingestion can lead to serious health complications.

Toxic Mycotoxins in Higher Fungi

Orellanine

Orellanine is a nephrotoxin primarily found in Cortinarius species, causing kidney damage. Its detection is complicated by a long latency period between ingestion and symptoms. Liquid chromatography with high-resolution mass spectrometry (LC-HRMS) is a reliable method for detecting orellanine in biological samples.

α- and β-Amanitin

Amanitins, found in Amanita species, are among the most lethal mushroom toxins. These cyclic peptides inhibit RNA polymerase II, leading to severe liver damage. Liquid chromatography-time-of-flight-mass spectrometry (LC-TOF-MS) is used to detect amatoxins in forensic investigations.

Muscarine

Muscarine, present in Inocybe and Clitocybe species, causes muscarinic syndrome, characterized by excessive salivation, sweating, and gastrointestinal disturbances. Recovery follows supportive care, including intravenous fluids and atropine.

Ibotenic Acid and Muscimol

Ibotenic acid and muscimol, found in Amanita muscaria and Amanita pantherina, cause hallucinations and central nervous system depression.

These toxins are of particular concern in cases of intentional ingestion of hallucinogenic mushrooms.

Gyromitrin

Gyromitrin, found in Gyromitra species, is metabolized into monomethylhydrazine (MMH), a potent toxin causing red blood cell breakdown and liver damage. Symptoms include gastrointestinal distress, jaundice, and severe cases can lead to convulsions and coma.

Challenges in Analytical Toxicology

Documenting mushroom poisoning cases through toxicological analysis is essential but underreported due to the lack of suitable analytical methods. Recent advances, such as LC-HRMS for orellanine and LC-TOF-MS for amatoxins, offer promising solutions. However, detecting other mycotoxins in biological samples remains challenging.

Multiple Toxin Exposure

A case report of consuming mushrooms with both isoxazole and amatoxin emphasizes the severe risks of wild mushroom consumption and the need to consider multiple toxin exposures in complex cases.

Toxic Metabolite Profiling

Research on toxic mushrooms like Inocybe virosa shows the importance of identifying toxic compounds to understand their risks and prevent poisonings.

LITERATURE REVIEW

Mushroom poisoning is a significant global health issue resulting from the ingestion of toxic fungi. Key mycotoxins responsible for severe or fatal poisonings include orellanine, α- and β-amanitin, muscarine, ibotenic acid, muscimol, and gyromitrin. Orellanine, found in Cortinarius species, causes delayed renal failure and is now more detectable due to advancements in liquid chromatography-high-resolution mass spectrometry (LC-HRMS).

GROUP DISCUSSIONS

The group discussion on human poisoning from toxic fungi centers around the complexities of mycotoxins, their effects, and the epidemiological factors influencing mushroom poisoning incidents. One key point of discussion is the challenge of detecting orellanine, a mycotoxin with a prolonged latency period between ingestion and symptom onset, which complicates clinical diagnoses and timely treatment. Participant..s emphasized the need for advancements in analytical methods, such as improving liquid chromatography-high-resolution mass spectrometry (LC-HRMS), to enhance detection capabilities.

CONCLUSION

Poisoning from toxic mushrooms is a significant concern. While new analytical methods are promising, more research is needed to detect a wider range of mycotoxins. Better documentation and reporting of poisonings will improve public health and forensic toxicology.

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