AMANITA MUSCARIA (*FLY AGARIC*)

INTRODUCTION

Amanita muscaria is a mushroom with a bright red cap covered in white spots or warts that is native to the temperate and boreal forests of the northern hemisphere. *A. muscaria* mushrooms are also called "fly agaric" mushrooms due to their traditional use as an insecticide. The unique look of *A. muscaria* has made it a staple in pop culture, with it being featured in everything from artwork and emojis to "Alice in Wonderland" and Nintendo's "Super Mario" franchise. *A. muscaria* produces psychoactive effects in humans when consumed and for thousands of years has been used by shamans across Europe, Asia, and Siberia as part of various rituals. Though *A. muscaria* is a psychoactive mushroom, it is not a classic psychedelic like the mushrooms of the *Psilocybe* genus, which are commonly referred to as "magic mushrooms." *A. muscaria* mushrooms do not contain psilocybin, and their consumption results in different pharmacological effects than psilocybin-containing mushrooms. Importantly, in the United States, *A. muscaria* is not subject to the same legal barriers and criminalization as psilocybin-containing mushrooms, as the U.S. Drug Enforcement Administration (DEA) does not currently categorize *A. muscaria* or its constituents as federal controlled substances.[1]

The renewed interest in psilocybin-containing mushrooms in the 21st century due to their potential use in treating various mental and physical health conditions has sparked consumers' interest in other types of mushrooms, including *A. muscaria*, that are more legally accessible. According to research conducted by the RAND Corporation, approximately 3.5 million U.S. adults used *A. muscaria* in 2025 making it the third most used psychedelic substance in 2025 behind psilocybin and MDMA.[2] Additionally, public health researchers from the University of California, San Diego measured the increasing demand of *A. muscaria* by consumers through an analysis of Google searches and found that Google searches related to *A. muscaria* rose by 114 percent from 2022 to 2023.[3] As *A. muscaria* use increases, there have been public health concerns regarding unregulated sales of *A. muscaria* products and the lack of consumer knowledge about how *A. muscaria* differs from psilocybin-containing mushrooms. This factsheet addresses those issues.

CHEMICAL CONSTITUENTS OF *A. MUSCARIA*

Muscimol is the chemical compound in *A. muscaria* that is responsible for its psychoactive effects. Muscimol is a central nervous system depressant that resembles the neurotransmitter gamma-aminobutyric acid (GABA) and can react with the $GABA_A$ receptors in the brain. Other substances that bind to $GABA_A$ receptors include benzodiazepines, barbiturates, Z-drugs (sleep medications), and alcohol; in comparison, psilocybin binds to

[1] 21 U.S.C. § 812.

[2] Michelle Priest, et al. "U.S. Psychedelic Use and Microdosing in 2025," *RAND*, January 21, 2026, https://www.rand.org/pubs/research_reports/RRA4334-1.html#citation. The RAND Corporation report uses a broad definition of "psychedelic substances" that includes classic psychedelics (such as LSD and psilocybin), non-classical psychedelics (such as MDMA and *A. muscaria*), the dissociative anesthetic ketamine, and other emerging substances, such as the synthetic phenethylamine 2C-B.

[3] Eric C. Leas, et al., "Need for a Public Health Response to the Unregulated Sales of *Amanita muscaria* Mushrooms," *American Journal of Preventative Medicine* 67, no. 3 (Sept. 2024): 459, https://doi.org/10.1016/j.amepre.2024.05.006.

serotonin receptors in the brain. When muscimol binds to $GABA_A$ receptors, it produces sedative-hypnotic and dissociative, dream-like states. Because of the difference in the targeted brain receptor, muscimol's psychoactive effects manifest differently in the human body than psilocybin, and users have anecdotally described muscimol's effects as similar to alcohol intoxication. Individuals who use muscimol report experiencing physical relaxation and sedation, along with feelings of euphoria, blurred vision, and loss of motor skills. Users will often fall into a deep sleep and experience vivid dreams. While some users report that muscimol can produce hallucinatory effects, they report that muscimol does not produce the same mystical, mind-manifestation hallucinations that psilocybin does.

In addition to muscimol, *A. muscaria* also contains the compound ibotenic acid. Ibotenic acid is considered a neurotoxin, and for this reason, *A. muscaria* is considered a non-edible, poisonous mushroom. While ibotenic acid is considered toxic to humans, it rarely results in fatal intoxication unless it is consumed at very high levels. However, it will cause nausea, vomiting, abdominal pain, diarrhea, agitation, and headaches when consumed. To avoid the toxic effects from ibotenic acid, individuals consuming *A. muscaria* are advised not to ingest the mushroom in its raw form. Drying or boiling *A. muscaria* before ingesting it converts some of the ibotenic acid in the mushroom to muscimol through a chemical process called decarboxylation and reduces the possibility of experiencing strong effects from the ibotenic acid.

EXPERIENCE OF INDIVIDUALS WHO USE *A. MUSCARIA*

According to a 2025 study published in the journal "Substance Use & Misuse," the most commonly reported reasons individuals use *A. muscaria* are to improve sleep, reduce substance use and withdrawal symptoms, with alcohol and benzodiazepines being the substances mentioned most often, and alleviate anxiety.[4] Other reported reasons for the use of *A. muscaria* included inducing mental stimulation, relieving pain, and decreasing depression.[5] Despite the anecdotally reported benefits of consuming *A. muscaria* and muscimol, there is scarce clinical research on its possible therapeutic effects in humans, and there is currently no clinical evidence supporting its medical use.

Individuals wishing to consume *A. muscaria* can ingest the dried or boiled mushroom or they can purchase products containing extracted and concentrated muscimol. These muscimol products are available in a variety of forms, including gummies, tinctures, and edibles, such as chocolate, and are sold in gas stations, convenience stores, and smoke shops. Users of muscimol products have reported that they are often mislabeled, under-dosed, or adulterated with other substances. Additionally, some of these products are labeled as "mushroom gummies" and the like and fail to clearly disclose which mushroom they contain or make clear that *A. muscaria* is different from psilocybin-containing mushrooms and does not produce the same effects.

PUBLIC HEALTH CONCERNS REGARDING *A. MUSCARIA*

A 2024 report published in the Morbidity and Mortality Weekly Report of the U.S. Centers for Disease Control and Prevention (CDC) provided commentary on the testing of six packages of mushroom gummies from five different brands available for purchase at gas stations and smoke shops in Charlottesville, Virginia following four cases of adults who became ill after they intentionally ingested gummies labeled to contain *A. muscaria* between September 1 – November 20, 2023.[6] Three of the brands that the investigators purchased claimed to contain *A. muscaria*, while the two other brands were labeled to contain unspecified mushroom nootropics, which are substances taken to enhance cognitive function.[7] Chemical analysis of the mushroom gummies found that four of

[4] Jadyn Hartwig, et al., "Exploring User Experiences with Amanita muscaria: A Thematic Analysis of Reddit Online Forum Discussions," *Substance Use & Misuse* 60, no. 7 (March 2025): 952-961, https://doi.org/10.1080/10826084.2025.2476141.
[5] *Id.*
[6] Avery Michienzi, et al. "Notes from the Field: Schedule I Substances Identified in Nootropic Gummies Containing Amanita muscaria or Other Mushrooms — Charlottesville, Virginia, 2023–2024," *MMWR* 73, no. 28 (July 18, 2024): 628-630, https://www.cdc.gov/mmwr/volumes/73/wr/mm7328a3.htm.
[7] *Id.*

the six bags tested contained unlabeled psilocybin or its metabolite psilocin.[8] The investigation also revealed additional unlabeled substances in some of the products, including caffeine, ephedrine, and mitragynine, which is the main psychoactive compound found in the kratom leaf.[9] Based on their findings, the investigators advised individuals who believe that they are purchasing gummies containing *A. muscaria* or other mushroom-containing gummies sold as psychedelics or nootropics to be aware that these products might contain undisclosed and potentially harmful substances and that the package labels may not accurately represent the product's contents. The investigators also recommended that healthcare providers counsel patients and caregivers that mushroom-containing edible products marketed with claims of health benefits may contain undisclosed ingredients and have been linked to illness requiring hospitalization.

In June 2024, the CDC and the U.S. Food and Drug Administration (FDA), in collaboration with America's Poison Centers and state and local partners, initiated an investigation into a series of illnesses that occurred in individuals that had consumed "Diamond Shruumz" brand microdosing chocolate bars.[10] On June 27, 2024, Prophet Premium Blends, LLC (Prophet) initiated a recall of all flavors of its Diamond Shruumz branded chocolate bars, cones, and gummies.[11] The company claimed that the products contained muscimol and that the substance could be the potential cause of the symptoms observed in the individuals who became ill after consuming their products.[12] By October 31, 2024, the CDC's investigation identified a total of 180 illnesses reported from 34 states beginning in January 2024.[13] Of the illnesses reported, 73 individuals had to be hospitalized, and there were three potentially associated deaths.[14] In November 2024, the FDA published the results of the chemical analysis it performed on a sampling of Diamond Shruumz branded products; specifically, the FDA tested 22 samples of chocolate bars, 10 infused cones, 22 gummies, and one raw ingredient that was reportedly used in the manufacturing of some of the products.[15] The testing indicated that only nine of the 22 chocolate bars, five of the 10 infused cones, and the raw ingredient contained muscimol.[16] Prophet had claimed in its recall that its Diamond Shruumz products contained muscimol and that the substance was a potential cause of the symptoms some individuals had experienced, but FDA testing revealed that muscimol does not appear in all Diamond Shruumz products and thus, could not be the explanation for the symptoms reported.[17] In addition to muscimol, FDA analysis of the sampled Diamond Shruumz branded products identified the presence of additional compounds in a number of the samples tested, including: (1) acetylpsilocin, which is a psychedelic drug related to psilocybin and psilocin; (2) psilocin; (3) pregabalin, which is a prescription drug sold under the brand name "Lyrica" and is used to treat nerve pain, epilepsy, fibromyalgia, and generalized anxiety disorder; and (4) three different kavalactones, which are the compounds found in the kava plant.[18] The FDA's test results revealed that there was a wide variation in what compounds that were present in Diamond Shruumz branded products which presented a risk to consumers.[19] The FDA also noted that although the compounds identified in the products individually have known effects when ingested, there is less research on the interactions between these compounds when ingested together.[20]

In December 2024, after the issue with the Diamond Shruumz branded products, the FDA issued a letter to food manufacturers stating that *A. muscaria*, its extracts, and its certain constituents, including muscimol and ibotenic acid, are not authorized for use as ingredients in conventional food, do not meet the "generally recognized as

[8] *Id.*
[9] *Id.*
[10] "Investigation of Illnesses: Diamond Shruumz Brand Chocolate Bars, Cones & Gummies," *U.S. Food and Drug Administration*, last updated November 15, 2024, https://www.fda.gov/food/outbreaks-foodborne-illness/investigation-illnesses-diamond-shruumz-brand-chocolate-bars-cones-gummies-june-2024.
[11] *Id.*
[12] *Id.*
[13] *Id.*
[14] *Id.*
[15] *Id.*
[16] *Id.*
[17] *Id.*
[18] *Id.*
[19] *Id.*
[20] *Id.*

safe"[21] standard, and are unapproved food additives.[22] The FDA mentioned at the time that it was also evaluating the use of *A. muscaria* and its constituents as ingredients in dietary supplements, but as of this writing, it has not made a determination that dietary supplements containing such ingredients are unsafe or adulterated.[23]

LEGALITY OF *A. MUSCARIA*

Other than the FDA determination that *A. muscaria* and its constituents are unapproved food additives, no federal regulation of *A. muscaria*, muscimol, or ibotenic acid exists. Because *A. muscaria*, muscimol, and ibotenic acid are not classified by the DEA as controlled substances, the mushrooms themselves and any non-food products containing muscimol and/or ibotenic acid are legal to grow, purchase, distribute, or sell under federal law. Additionally, as of February 2026, *A. muscaria*, muscimol, and ibotenic acid are not regulated or banned in any U.S. state or the District of Columbia with the exception of Louisiana. Under Louisiana law, *A. muscaria* is included in the definition of a "hallucinogenic plant," and it is unlawful for any individual to knowingly or intentionally "produce, manufacture, distribute, or possess with intent to produce, manufacture, or distribute a material, compound, mixture, or preparation intended for human consumption which contains a hallucinogenic plant."[24] Furthermore, Louisiana law establishes that it is unlawful for any individual to knowingly or intentionally produce, manufacture, distribute, or possess products intended for human consumption that contain muscimol or ibotenic acid.[25] In 2025, Utah introduced a bill that would have scheduled *A. muscaria* as a Schedule III controlled substance, but the bill died upon adjournment of the legislature.[26] Additionally, in 2025, Texas introduced multiple bills that would have added muscimol and ibotenic acid to penalty group 2 under the Texas Controlled Substances Act, but they all failed to pass.[27]

CONCLUSION

The growing consumer interest in *A. muscaria* brings forth a need for increased education and regulatory guidance. Unstandardized commercial products, inconsistent labeling practices, and documented cases of adulteration demonstrate that there are meaningful risks to individuals who wish to consume *A. muscaria* or muscimol and who may not fully understand how these substances differ from psilocybin. Additionally, there is limited clinical research on *A. muscaria* or muscimol's therapeutic benefits which makes the marketed health claims associated with these products unfounded. Ensuring public safety when it comes to *A. muscaria* will require continued surveillance, transparent product information, including labeling and packaging requirements, and greater awareness among consumers, health care providers, and policymakers.

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[21] Under 21 C.F.R. § 170.30, any substance that is intentionally added to food is a food additive, that is subject to premarket review and approval by FDA, unless the substance is generally recognized, among qualified experts, as having been adequately shown to be safe under the conditions of its intended use, or unless the use of the substance is otherwise excepted from the definition of a food additive. "Generally Recognized as Safe (GRAS)," *U.S. Food and Drug Administration*, last updated October 17, 2023, https://www.fda.gov/food/food-ingredients-packaging/generally-recognized-safe-gras.

[22] "FDA Alerts Industry and Consumers about the Use of Amanita Muscaria or its Constituents in Food," U*.S. Food and Drug Administration*, last updated December 18, 2024, https://www.fda.gov/food/hfp-constituent-updates/fda-alerts-industry-and-consumers-about-use-amanita-muscaria-or-its-constituents-food.

[23] Id.

[24] LA. STAT. ANN. § 40:989.1 (West 2025).

[25] LA. STAT. ANN. § 40:989.5 (West 2025).

[26] H.B. 500, 2025 Leg., Gen. Sess. (Utah 2025).

[27] S.B. 1868, 89th Leg., Reg. Sess. (Tex. 2025); H.B. 291, 89th Leg., 1st Called Sess. (Tex. 2025); and H.B. 227, 89th Leg., 2nd Called Sess. (Tex. 2025). Penalty group 2 includes hallucinogens, stimulants, and specific forms of THC.

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