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NLM Citation: LiverTox: Clinical and Research Information on Drug-Induced Liver Injury [Internet]. Bethesda (MD): National Institute of Diabetes and Digestive and Kidney Diseases; 2012-. Lion's Mane. [Updated 2024 Jan 5].
Bookshelf URL: https://www.ncbi.nlm.nih.gov/books/

Lion's Mane

Updated: January 5, 2024.

OVERVIEW

Introduction

Lion's mane, Hericium erinaceus, is an edible mushroom found most abundantly in East Asia that has been used widely as a food and as an herbal medication in traditional Chinese medicine. Recently, lion's mane has been purported to improve cognition and relieve anxiety and depression. Lion's mane is generally recognized as safe and has not been linked to serum enzyme elevations during therapy nor to episodes of clinically apparent liver injury.

Background

Lion's mane (Hericium erinaceus) is saprophytic mushroom found throughout the Northern hemisphere and used for centuries in traditional Chinese medicine generally as a tonic to relief stress, anxiety and depression. Lion's mane mushroom typically grows on the trunks of dead hardwood trees and has distinctive long, white dangling spines that resemble as lion's mane. As a traditional medicine, lion's mane was purported to have multiple potentially beneficial activities including antioxidant, antidiabetic, antilipidemic, antihypertensive, antineoplastic, an immunomodulatory activities as well as hepatoprotective, neuroprotective and cardiovascular protective properties. Most of these effects have been demonstrated in cell culture or in animal models but have not been found in humans. Chemical analyses demonstrate multiple constituents in Hericium erinaceus including unique hericenones, erinacine terpenoids, beta-polysaccharides, and phenolic acids as well as lectins, proteins, fatty acids, sterols, and multiple minerals and vitamins as are found in multiple mushroom species. Which ingredient is responsible for the purported effects of lion's mane are unknown. Erinacines have been found to cross the blood-brain barrier in rats and to stimulate synthesis of nerve growth factor, to speed recovery from ischemic injury, and improve alertness and learning in mice. These neuroprotective and mental cognitive enhancing activities have not been shown to any great extent in humans. At present, lion's mane is not approved for treatment of symptoms or any diseases in humans in the United States. Nevertheless, it is widely available in nutrition centers and on the internet and purported to improve memory and cognitive function. The typical dose in 1 to 3 mg daily. The few studies of short term therapy with lion's mane in humans reported few adverse events and scant evidence of any toxicity. In clinical trials of prolonged therapy, mild gastrointestinal complains of abdominal discomfort, nausea, or diarrhea have been reported usually in less than 10% of treated subjects and generally not requiring discontinuation of the herbal product. At least one example of an acute hypersensitivity reaction to oral lion's mane has been described.

Hepatotoxicity

Lion's mane has not been subjected to prospective trials of its safety but is widely described as being well tolerated and without side effects. In small clinical trials, there have been no case reports of clinically apparent liver injury attributed to lion's mane, and it is not mentioned or listed in large case series or systematic reviews of the literature on herbal and dietary supplement induced liver injury. Thus, there is little evidence that lion's mane in typical oral doses or as a component of herbal products or teas causes clinically apparent liver injury in humans.

Likelihood score: E (unlikely cause of clinically apparent liver injury).

Mechanism of Injury

Lion's mane has not been linked to serum enzyme elevations during therapy or clinically apparent liver injury. The mechanism by which lion's mane might cause liver injury is not known but more than a thousand components have been identified in Hericium erinaceus extracts, some of which are unique to this species of mushroom. The major components responsible for its purported effects include β glucan polysaccharides, hericenones, and erinacine terpenoids.

Drug Class: Herbal and Dietary Supplements

Other names: Hericium erinaceus, hedgehog fungus, monkey head, bearded tooth, satyr's beard, Yamabushitake, and pom pom.

PRODUCT INFORMATION

REPRESENTATIVE TRADE NAMES

Lion's Mane – Generic

DRUG CLASS

Herbal and Dietary Supplements

CHEMICAL FORMULA AND STRUCTURE

DRUG	CAS REGISTRY NUMBER	MOLECULAR FORMULA	STRUCTURE
Erinacine A	156101-08-5	C25-H36-O6	SID: 85374575
L-Ergothioneine	497-30-3	C9-H15-N3-O2-S	SID: 134977585

ANNOTATED BIBLIOGRAPHY

References updated: 05 January 2024

Abbreviations: HDS, herbal and dietary supplements; DILI, drug-induced liver injury; ALS, amyotrophic lateral sclerosis.

Zimmerman HJ. Unconventional drugs. Miscellaneous drugs and diagnostic chemicals. In, Zimmerman, HJ. Hepatotoxicity: the adverse effects of drugs and other chemicals on the liver. 2nd ed. Philadelphia: Lippincott,1999: pp. 731-4.

(Expert review of hepatotoxicity published in 1999; several herbal medications are discussed, but not lion's mane).

Mori K, Inatomi S, Ouchi K, Azumi Y, Tuchida T. Improving effects of the mushroom Yamabushitake (Hericium erinaceus) on mild cognitive impairment: a double-blind placebo-controlled clinical trial. Phytother Res. 2009;23:367-72. PubMed PMID: 18844328.

(Among 30 Japanese adults [ages 50 to 80 years] with mild cognitive impairment treated with powdered Yamabushitake [Hericium erinaceus: 3 grams daily] or placebo for 16 weeks, dementia symptom scales improved with the H. erinaceus preparation but not with placebo, and side effects were limited to mild abdominal discomfort and diarrhea, while serum ALT, AST, Alk P, and bilirubin levels remained in the normal range).

Jacobsson I, Jönsson AK, Gerdén B, Hägg S. Spontaneously reported adverse reactions in association with complementary and alternative medicine substances in Sweden. Pharmacoepidemiol Drug Saf 2009; 18: 1039-47. PubMed PMID: 19650152.

(Among 778 spontaneous reports of adverse reactions to herbal and alterative medicines to a national Swedish Registry, no cases were attributed to lion's mane).

Nagano M, Shimizu K, Kondo R, Hayashi C, Sato D, Kitagawa K, Ohnuki K. Reduction of depression and anxiety by 4 weeks Hericium erinaceus intake. Biomed Res. 2010;31:231-7. PubMed PMID: 20834180.

(Among 30 adult Japanese women with "a variety of indefinite complaints and no specified diseases" who received H. erinaceus cookies [2 gm] or similar placebo cookies daily for 4 weeks, there were no differences in changes from baseline between the two groups in menopausal, depression, and sleep scales, but indefinite complaints index scores for "irritating", "anxious" and "pulpitation" improved with the herbal therapy but not with placebo; no mention of ALT levels or adverse events).

Teschke R, Wolff A, Frenzel C, Schulze J, Eickhoff A. Herbal hepatotoxicity: a tabular compilation of reported cases. Liver Int 2012; 32: 1543-56. PubMed PMID: 22928722.

(A systematic compilation of all publications on the hepatotoxicity of specific herbal products identified 185 publications on 60 different herbs, herbal drugs and supplements but does not list or mention lion's mane).

Khan MA, Tania M, Liu R, Rahman MM. Hericium erinaceus: an edible mushroom with medicinal values. J Complement Integr Med. 2013; 10 (1): 253-258. PubMed PMID: 23735479.

(Review of the purported biologic effects of lion's mane mushrooms as shown in animal models or in vitro, including antioxidant, antineoplastic, antihypertensive, antidiabetic, hepatoprotective, neuroprotective, cardioprotective, immunomodulatory, wound healing, and lipid lowering properties).

Bunchorntavakul C, Reddy KR. Review article: herbal and dietary supplement hepatotoxicity. Aliment Pharmacol Ther 2013; 37: 3-17. PubMed PMID: 23121117.

(Systematic review of literature on HDS associated liver injury does not mention lion's mane).

Navarro VJ, Seeff LB. Liver injury induced by herbal complementary and alternative medicine. Clin Liver Dis 2013; 17: 715-35. PubMed PMID: 24099027.

(Review of the epidemiology, regulatory status, diagnosis, pathogenesis and causes of liver injury from herbal products with specific discussion of conjugated linoleic acid, ephedra, germander, green tea, usnic acid, flavocoxid, aloe vera, chaparral, greater celandine, black cohosh, comfrey, kava, skullcap, valerian, noni juice, pennyroyal and traditional herbal remedies; no mention of lion's mane).

Navarro VJ, Barnhart H, Bonkovsky HL, Davern T, Fontana RJ, Grant L, Rleddy KR, et al. Liver injury from herbals and dietary supplements in the U.S. Drug-Induced Liver Injury Network. Hepatology 2014; 60: 1399-408. PubMed PMID: 25043597.

(Among 839 cases of liver injury from drugs collected in the US between 2004 and 2013, 130 were due to HDS products, including 45 from body building agents [probably anabolic steroids] and 85 from diverse HDS products but no case was attributed specifically to lion's mane).

Brown AC. Liver toxicity related to herbs and dietary supplements: Online table of case reports. Part 2 of 5 series. Food Chem Toxicol 2017; 107: 472-501. PubMed PMID: 27402097.

(Description of an online compendium of cases of liver toxicity attributed to HDS products, does not list or discuss lion's mane).

Medina-Caliz I, Garcia-Cortes M, Gonzalez-Jimenez A, Cabello MR, Robles-Diaz M, Sanabria-Cabrera J, Sanjuan-Jimenez R, et al.; Spanish DILI Registry. Herbal and dietary supplement-induced liver injuries in the Spanish DILI Registry. Clin Gastroenterol Hepatol. 2018;16:1495-1502. PubMed PMID: 29307848.

(Among 856 cases of hepatotoxicity enrolled in the Spanish Drug-Induced Liver Injury Registry between 1994 and 2016, 32 were attributed to herbal products, the most frequent cause being green tea [n=8] and Herbalife products [n=6], no mention of lion's mane).

Saitsu Y, Nishide A, Kikushima K, Shimizu K, Ohnuki K. Improvement of cognitive functions by oral intake of Hericium erinaceus. Biomed Res. 2019;40:125-131. PubMed PMID: 31413233.

(Among 31 adults above the age of 50 with mild cognitive difficulties who were treated with Hericium erinaceus for 12 weeks, there were no significant differences in changes from baseline in scores of three standard cognitive tests between the two groups; no mention of adverse events or ALT levels).

Li IC, Chang HH, Lin CH, Chen WP, Lu TH, Lee LY, Chen YW, et al. Prevention of early Alzheimer's disease by erinacine A-enriched *Hericium erinaceus* mycelia pilot double-blind placebo-controlled study. Front Aging Neurosci. 2020;12:155. PubMed PMID: 32581767.

(Among 49 Chinese adults with mild Alzheimer's disease treated with erinacine A enriched Hericium erinaceus [350 mg three times daily] or placebo for 48 weeks, lion's mane treated subjects had more improvement in cognitive tests than placebo recipients and the only adverse events were abdominal discomfort, nausea, and diarrhea affecting 8% of patients; no mention of ALT levels of hepatotoxicity).

Ballotin VR, Bigarella LG, Brandão ABM, Balbinot RA, Balbinot SS, Soldera J. Herb-induced liver injury: systematic review and meta-analysis. World J Clin Cases. 2021;9:5490-5513. PubMed PMID: 34307603.

(Systematic review of the literature on HDS induced liver injury identified 446 references describing 936 cases due to 79 different herbal products, the most common being He Shou Wu [91], green tea [90] Herbalife products [64], kava kava [62] and greater celandine [48]; lion's mane is not listed or discussed).

Bessone F, García-Cortés M, Medina-Caliz I, Hernandez N, Parana R, Mendizabal M, Schinoni MI, et al. Herbal and dietary supplements-induced liver injury in Latin America: experience from the LATINDILI Network. Clin Gastroenterol Hepatol. 2022;20:e548-e563. PubMed PMID: 33434654.

(Among 367 cases of hepatotoxicity enrolled in the Latin American Drug-Induced Liver Injury Network between 2011 and 2019, 29 [8%] were attributed to herbal products, the most frequent being green tea [n=7], Herbalife products [n=5] and garcinia [n=3]; lion's mane is not mentioned).

Grozier CD, Alves VA, Killen LG, Simpson JD, O'Neal EK, Waldman HS. Four weeks of *Hericium erinaceus* supplementation does not impact markers of metabolic flexibility or cognition. Int J Exerc Sci. 2022;15:1366-1380. PubMed PMID: 36582308.

(Among 24 college age healthy adults treated with Hericium erinaceus [10 grams daily] or placebo for 4 weeks there were no differences in degree of changes in metabolic flexibility including fat and carbohydrate metabolism nor in cognitive function in the two arms).

Uffelman CN, Doenges KA, Armstrong ML, Quinn K, Reisdorph RM, Tang M, Krebs NF, et al. Metabolomics profiling of white button, crimini, portabella, lion's mane, maitake, oyster, and shiitake mushrooms using untargeted metabolomics and targeted amino acid analysis. Foods. 2023;12:2985. PubMed PMID: 37627983.

(Chemical analysis of 7 mushroom species used in traditional medicine found 1344 compounds shared by all 7, but all also had unique ingredients which were more than 800 for lion's mane which had the highest levels of the amino acid L-ergothioneine among the seven, but concentrations varied considerably among different preparations perhaps reflecting harvesting time and region of cultivation).

Nieman KM, Zhu Y, Tucker M, Koecher K. The role of dietary ingredients in mental energy - a scoping review of randomized controlled trials. J Am Nutr Assoc. 2023:1-16. PubMed PMID: 37561965.

(Review of literature on 18 dietary ingredients purported to increase mental energy identified 101 studies [on 16 ingredients] among which lion's mane, ashwagandha, chamomile, dark chocolate, ginseng, lavender tea, maca, turmeric and valerian were said to be "promising").

Hersant H, He S, Maliha P, Grossberg G. Over the counter supplements for memory: a review of available evidence. CNS Drugs. 2023;37:797-817. PubMed PMID: 37603263.

(Analysis of 103 supplements sold as improving memory identified 18 common ingredients, and a review of controlled trials of these compounds found some evidence for effects of ashwagandha, choline, curami, ginger, lion's mane, polyphenol, phosphatidylserine, and turmeric, but no compelling evidence for use of coenzyme Q, theanine, omega 3 fatty acids, or vitamins B6, B9 and B12; mentions that more than a billion US dollars are spent on supplements for improving cognition yearly).

Docherty S, Doughty FL, Smith EF. The acute and chronic effects of lion's mane mushroom supplementation on cognitive function, stress and mood in young adults: a double-blind, parallel groups, pilot study. Nutrients. 2023;15:4842. PubMed PMID: 38004235.

(Among 41 healthy adults ages 18 to 45 years who were treated with Hericium erinaceus [1.8 grams] or placebo daily for 28 days, speed of performance was improved with an initial dose while chronic therapy led to a reduction in stress, but multiple cognitive function tests were performed and most did not change significantly and some improved with placebo therapy; adverse events were not discussed).

La Monica MB, Raub B, Ziegenfuss EJ, Hartshorn S, Grdic J, Gustat A, Sandrock J, et al. Acute effects of naturally occurring guayusa tea and Nordic lion's mane extracts on cognitive performance. Nutrients. 2023;15:5018. PubMed PMID: 38140277.

(Among 40 healthy adults treated with a single dose of H. erinaceus (1 gram), guayusa (650 mg), or placebo, there were minor improvements in cognitive performance within a hour of ingestion of lion's mane, while no adverse events were reported except for a slight increase in blood pressure with guayusa, which was attributed to its caffeine content which also may have accounted for its effects on cognition).

Muhanna M, Lund I, Bromberg M, Wicks P, Benatar M, Barnes B, Pierce K, et al. ALS Untangled #73: Lion's mane. Amyotroph Lateral Scler Frontotemporal Degener. 2023 Dec 23:1-4. PubMed PMID: 38141002.

(Systematic review of the literature of the possible beneficial effects of lion's mane in amyotrophic lateral sclerosis [ALS] found no studies in ALS relevant cell or animal models and no clinical trials in humans with ALS).