



"*Hericium Erinaceus* As A Functional Food: A Review Of Its Nutritional And Therapeutic Potential"

Reema Rani¹ Shubhangi Sanjay Telavane¹ Dr. Rupali Tasgaonkar¹
Yadavrao Tasgaonkar Institute of Pharmacy, Bhivpuri Road, Karjat.

Abstract: Mushrooms represent a diverse source of nutritional and medicinal benefits, with the fungi kingdom playing a crucial role in human health. While some species are toxic, many have been recognized for their therapeutic properties, especially in East Asian cultures. Bioactive compounds derived from mushrooms, particularly from species such as *Hericium erinaceus* (Lion's Mane), are increasingly utilized to prevent and treat various diseases, including cancer, diabetes, and immune disorders. This review discusses the chemical constituents of *H. erinaceus*, emphasizing its rich content of polysaccharides, erinacines, and hericenones, which confer multiple health benefits. The mushroom exhibits significant anti-cancer, hypoglycemic, neuroprotective, antimicrobial, and antioxidant activities. Research highlights its potential in enhancing immune function and protecting against cardiovascular complications. Furthermore, findings from various studies indicate promising applications of *H. erinaceus* extracts in alternative medicine, warranting further investigation into its therapeutic efficacy and mechanisms of action. This review represents the importance of mushrooms as functional foods and highlights their potential in advancing health outcomes.

Keywords: Neuroprotective, Medicinal benefits, Mushroom.

Introduction:

Mushrooms are part of a wide range of natural food and medicinal sources. The fungi kingdom plays a key role in various biological processes, with some being toxic and others beneficial to human health. The therapeutic properties of mushrooms have been recognized for centuries, particularly in East Asian countries. Today, bioactive compounds derived from mushroom sporocarps or mycelium are used to prevent and treat numerous human diseases, including cancer, diabetes, immune system disorders, and infections. (1)

Eating dietary mushrooms can aid in treating various illnesses, some of which can be life-threatening. It is estimated that there are around 1.5 million different species of mushrooms globally. Mushrooms are valued not only for their nutritional benefits but also as a source of biologically active treatments. (2)

Investigational studies suggest that polysaccharides present in mushrooms offer health benefits without the harmful side effects commonly associated with many chemotherapeutic cancer treatments (Lee et al. 2010a). Edible mushrooms have been utilized to develop alternative medicines, including cancer treatments. Researchers have also explored the antibacterial properties of mushrooms. (4)

Hericium erinaceus is commonly known as the Hedgehog Mushroom or Lion's Mane Mushroom. (4) In Japanese, this mushroom is known as "yamabushi," a term that roughly means "mountain dwellers" or "those who rest in the mountains." (4). It is an edible and medicinal fungus, belongs to the *Hericiaceae* family within the Basidiomycota division. (2). *Hericium erinaceus* is thought to be a weak or saprotrophic parasite. This temperate species is commonly found in China and Japan (3). The fungus usually grows on decaying wood, but it can sometimes produce fruiting bodies from cracks or knotholes in living hardwood trees. (4). *H. erinaceus* is easily identifiable in its adult form by its distinctive basidiomes, which consist of multiple solitary, typically long, fleshy spines that start white and gradually change to yellowish and eventually brown as they age. (4).

Chemical constituents

The active compounds extracted from *H. erinaceus* and other mushrooms can be categorized into two groups based on their molecular weight: erinacines and hericenones. (7)

The *H. erinaceus* fungus has a high concentration of physiologically significant compounds, particularly β -glucan polysaccharides. These polysaccharides have been recognized as the active components responsible for this activity. (8)

The anti-cancer potential of fungi has often been addressed as an indirect method, such as through immune system activation. (1). This mushroom has several medicinal and health-promoting qualities, such as antihypertensive, anti-cancer, hypolipidemic, and neurological disease-protective capabilities. (1)

The fruiting bodies of *H. erinaceus* include significant components such as D-threitol, D-arabinitol, palmitic acid, and α -D-glucan, which have shown antihyperglycemic benefits in diabetic rats (4). *H. erinaceus* extracts included phenol-like and fatty acid-like substances that demonstrated antifungal and antibacterial action. Mycelial extracts contained antimicrobial compounds such as 4-chloro-3,5-dimethoxybenzyl alcohol, 4-chloro-3,5-dimethoxybenzaldehyde, and chlorinated orcinol. (4)

Phytochemical constituents (4)- Phytochemical constituents of *H. erinaceus* are given in table 1.1

Sr. No.	Phyto-chemical name	Bioactivity
1	Peptides (amyloid Beta)	Neuroprotective activity (Alzheimer's disease)
2	Phenols	Antioxidants
3	Terpenoids (dieterpenoids)	Antimicrobial activity
4	Tannins	Gastrointestinal protective activity

Table 1.1 Phytochemical constituents of *H. erinaceus*

Medicinal values of Hericium erinaceus:-

1) Anti-cancerous

Moharib et al. (2014) report that many polysaccharides extracted from mushrooms exhibit strong antitumor effects. One notable example is lentinan, a polysaccharide derived from *Lentinula edodes*, which has demonstrated significant anticancer activity and has been utilized clinically to treat various cancers, particularly stomach cancer. The hepatoprotective, immunomodulatory, and anticancer effects of *Hericium erinaceus* have attracted considerable interest from researchers. For instance, Kim and colleagues (2011) studied the anti-tumour effects of *H. erinaceus* extracts in Balb/c mice implanted with CT-26 colon cancer cells, revealing that a daily dose of the hot-water extract from the fruiting body, rich in β -glucan, reduced tumors weights by 38% over two weeks. (1)

2) Hypoglycemic effect -

Research has demonstrated that different types of mushrooms, such as *Hericium* spp., may have significant physiological effects in humans, including antioxidant activity, management of blood lipids, and reduction of blood glucose levels. The current study examined the impact of an extract from the fruiting bodies of *Hericium erinaceus* on blood glucose levels in a diabetic rat model. Residues from the fruiting bodies were separated using a gradient of chloroform, ethyl acetate, acetone, and methanol elution through a silica gel column, and

the components were further isolated and purified through additional silica gel chromatography to identify the structures of their active constituents using spectroscopy.

3) Neuroprotective activity-

Hericenones and erinacines extracted from *H. erinaceus* have demonstrated neuroprotective properties. In an animal model of global ischemic stroke, *Herichium erinaceus* mycelia (HEM) and its isolated diterpenoid derivative, erinacine A, reduced infarction by 22% at a dose of 50 mg/kg and 44% at 300 mg/kg. This effect is thought to be partially due to its ability to decrease cytokine levels. Additionally, a pure polysaccharide derived from the liquid culture broth of HEM was found to have neuroprotective effects in vitro, significantly delaying apoptosis by 20%-50% compared to the control group. The same research indicated that HEM was more effective than the control, nerve growth factor (NGF), or brain-derived neurotrophic factor (BDNF) alone in promoting the proliferation of rat adrenal nerve cells and neuroprotective extensions. (5)

4) Anti-microbial and antioxidant activity -

Kim et al. (2012) discovered that metabolites from the fruiting body of *H. erinaceus* exhibited significant antibacterial effects in an in vivo assay against *Salmonella* by enhancing immune system function. In patients with chronic gastritis and stomach ulcers, ethanol and ethyl acetate extracts from *H. erinaceus* fruiting bodies directly inhibited *Helicobacter pylori* (Shang et al. 2013). Various studies have demonstrated that extracts containing physiologically active compounds from *H. erinaceus* possess substantial antimicrobial activity, which could be further enhanced for pharmacological applications. Additionally, mycelial lipopolysaccharides (LPS) were found to have strong antioxidant properties. (1)

5) Cardio-vascular complications protecting activities-

H. erinaceus offers significant advantages in preventing cardiovascular issues through its protective properties. Mushrooms have traditionally been used as nutraceuticals to address lipid imbalances linked to cardiovascular diseases. Yang et al. investigated the hypolipidemic effects of an exo-biopolymer obtained from a submerged mycelial culture of *H. erinaceus* in rats with diet-induced hyperlipidemia. The study found that administering higher concentrations of the exo-biopolymer orally resulted in more pronounced hypolipidemic effects. (1)

6) Other therapeutic activities -

For nearly 30 years, animal models have been utilized to investigate the properties of extracts from the fruiting bodies of *H. erinaceus*. Studies have shown that freeze-dried fruiting bodies of *H. erinaceus* can effectively protect against ethanol-induced gastric mucosal damage in rats. In a case study involving a 63-year-old man admitted to intensive care with severe acute respiratory failure and widespread lung infiltration, an extract of *Herichium erinaceus* was tested for its effects on acute respiratory distress syndrome. Additionally, polysaccharides from *H. erinaceus* were employed to encapsulate curcumin nanoparticles for the delivery of anticancer medications using nano-precipitation techniques.

Conclusion -

Mushrooms are an excellent example of medical foods or food supplements. Mushrooms, particularly *Herichium erinaceus* (Lion's Mane), are a vital component of both nutrition and medicine, showcasing a wide array of therapeutic benefits. Research has highlighted their potential in treating serious health conditions, including cancer, diabetes, and neurodegenerative diseases, due to their rich content of bioactive compounds such as polysaccharides, erinacines, and hericenones. These compounds exhibit anti-cancer, hypoglycemic, neuroprotective, antimicrobial, and antioxidant properties, making *H. erinaceus* a promising candidate for alternative therapies. Moreover, the mushroom's role in supporting cardiovascular health underscores its potential as a nutraceutical. As research continues to uncover the full spectrum of health benefits associated with *Herichium erinaceus*, it is evident that incorporating this mushroom into dietary and medicinal practices could lead to significant advancements in health and wellness.

Reference: -

1. Thongbai, B., Rapior, S., Hyde, K. D., Wittstein, K., & Stadler, M. (2015). *Herichium erinaceus* is an amazing medicinal mushroom. *Mycological Progress*, 14, 1-23.
2. Gu YH, Belury MA. Selective induction of apoptosis in murine skin carcinoma cells (CH72) by an ethanol extract of *Lentinula edodes*. *Cancer Lett* 2005;220:21-8.

3. De Silva DD, Rapior S, Fons F, Bahkali AH, Hyde KD (2012a) Medicinal mushrooms in supportive cancer therapies: an approach to anticancer effects and putative mechanisms of action—a review. *Fungal Divers* 55:1–35
4. Mori, K., Inatomi, S., Ouchi, K., Azumi, Y., & Tsuchida, T. (2009). Improving effects of the mushroom Yamabushitake (*Herichium erinaceus*) on mild cognitive impairment: A double-blind placebo-controlled clinical trial. *Phytotherapy Research: An International Journal Devoted to Pharmacological and Toxicological Evaluation of Natural Product Derivatives*, 23(3), 367-372.
5. Khan, M. A., Tania, M., Liu, R., & Rahman, M. M. (2013). *Herichium erinaceus*: an edible mushroom with medicinal values. *Journal of Complementary and Integrative Medicine*, 10(1), 253-258.
6. Imtiaj, A., Jayasinghe, C., Lee, G. W., Shim, M. J., Rho, H. S., Lee, H. S., ... & Lee, T. S. (2008). Vegetative growth of four strains of *Herichium erinaceus* collected from different habitats. *Mycobiology*, 36(2), 88-92.
7. Phan, C. W., Lee, G. S., Hong, S. L., Wong, Y. T., Brkljača, R., Urban, S., ... & Sabaratnam, V. (2014). *Herichium erinaceus* (Bull.: Fr) Pers. cultivated under tropical conditions: isolation of hericenones and demonstration of NGF-mediated neurite outgrowth in PC12 cells via MEK/ERK and PI3K-Akt signalling pathways. *Food & Function*, 5(12), 3160-3169.
8. Spelman, K., Sutherland, E., & Bagade, A. (2017). Neurological activity of Lion's mane (*Herichium erinaceus*). *Journal of Restorative Medicine*, 6(1), 19-26.
9. Deepalakshmi, K., & Mirunalini, S. (2011). Therapeutic properties and current medical usage of medicinal mushroom: *Ganoderma lucidum*. *International Journal of Pharmaceutical Sciences and Research*, 2(8), 1922.
10. Noh, H. J., Yang, H. H., Kim, G. S., Lee, S. E., Lee, D. Y., Choi, J. H., ... & Kim, K. H. (2015). Chemical constituents of *Herichium erinaceum* associated with the inhibitory activity against cellular senescence in human umbilical vascular endothelial cells. *Journal of Enzyme Inhibition and Medicinal Chemistry*, 30(6), 934-940.
11. Yang, F., Wang, H., Feng, G., Zhang, S., Wang, J., & Cui, L. (2021). Rapid Identification of Chemical Constituents in *Herichium erinaceus* Based on LC-MS/MS Metabolomics. *Journal of Food Quality*, 2021(1), 5560626.
12. Xie, G., Tang, L., Xie, Y., & Xie, L. (2022). Secondary metabolites from *Herichium erinaceus* and their anti-inflammatory activities. *Molecules*, 27(7), 2157.
13. Jiang, S., Wang, S., Sun, Y., & Zhang, Q. (2014). Medicinal properties of *Herichium erinaceus* and its potential to formulate novel mushroom-based pharmaceuticals. *AppApplmicrobiology and biotechnology*, 98, 7661-7670.
14. Wong, K. H., Sabaratnam, V., Abdullah, N., Kuppusamy, U. R., & Naidu, M. (2009). Effects of cultivation techniques and processing on antimicrobial and antioxidant activities of *Herichium erinaceus* (Bull.: Fr.) Pers. extracts. *Food Technology and Biotechnology*, 47(1), 47-55.