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The Impact of Indian Edible and Medicinal Mushrooms on Human Health- An Overview

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ABSTRACT

Indian traditional medicine and nutrition would not be the same without mushrooms, especially the edible and medicinal kind. These fungi are well-known for their bioactive substances, which include ergosterol, flavonoids, terpenoids, polysaccharides, and phenolic acids. These substances also help to explain their wide range of medicinal uses. Indian mushrooms that have demonstrated great promise in tackling contemporary health issues include *Termitomyces species, Pleurotus species, Ganoderma lucidum,* and *Calocybe indica*. Their antioxidant qualities reduce oxidative stress, which is a major contributing cause to long-term disorders, like diabetes and cancer. Compounds such as β-glucans have immunomodulatory actions that support both innate and adaptive immunity, and their antibacterial and antiviral properties broaden their use in the treatment of infectious diseases. In neurodegenerative diseases like Alzheimer's disease, neuroprotective qualities have been connected to nerve growth factor stimulation, providing hope. Furthermore, mushrooms importance in treating metabolic diseases is highlighted by their capacity to maintain the lipid profiles and blood glucose. Indian mushrooms are positioned to be essential in modern healthcare as pharmacological agents, nutraceuticals, and functional foods. To fully realize their promise, however, issues including public awareness, clinical validation, and cultivation standardization must be resolved. In order to present an integrative viewpoint on the health advantages and uses of Indian edible and medicinal mushrooms, this review synthesizes recent research.

Keywords: Mushrooms, Nutrition, Bioactive Compounds, Human Health

INTRODUCTION

Mushrooms have long been recognized as a valuable source of nutrition and medicine, with India having a rich biodiversity of various species. These fungi, including *Ganoderma lucidum, Pleurotus spp.,* and *Calocybe indica*, are known for their bioactive substances, vitamins, phenolic compounds, terpenoids, and polysaccharides. They adapt to the agroclimatic conditions of India, making them a viable resource for food and medicine (Kumar et al., 2023).

Mushrooms have been used in traditional Indian medicine systems like Ayurveda and Siddha due to their medicinal qualities in treating conditions ranging from infections to chronic disorders. The fusion of contemporary technologies and ancient wisdom has elevated mushrooms to the forefront of health sciences. *G. lucidum* has been used to heal chronic illnesses and boost vitality, while *Pleurotus species*, commonly known as oyster mushrooms, are beneficial in treating diseases linked to oxidative stress and malnutrition (Singh et al., 2025; Sharma et al., 2021). Mushrooms are also essential for preventing malnutrition in susceptible groups. Their nutritional composition is high in vital nutrients like potassium, vitamin D, and selenium, yet low in calories and fat. They can control blood sugar levels and lipid profiles, leading to better metabolic health (Verma et al., 2024).

Mushrooms are also an essential tool for preventing malnutrition in susceptible groups, as they offer a nutritional remedy for protein-energy deficiency that is both accessible and reasonably priced . Additionally, mushrooms are an essential tool for preventing malnutrition in susceptible groups. The production of protein-rich mushrooms, such as *Pleurotus spp* and *Calocybe indica,* offers a nutritional remedy for protein-energy deficiency that is both accessible and reasonably priced. In India, where dietary inadequacies continue to be a major public health problem, this is especially pertinent. Their popularity as an environment-friendly food production alternative has increased due to innovative agricultural approaches, such as growing mushrooms on agricultural waste like paddy straw, wheat straw, wooden flakes, sawdust.(Gupta et al., 2025).

In addition to their nutritional value, mushrooms have exceptional medicinal qualities. Bioactive substances like ergothioneine and β-glucans have been thoroughly researched for their immunomodulatory and antioxidant properties. *Hericium erinaceus* (Lion's mane) has been studied for its potential to improve cognitive function and lessen the effects of neurodegenerative diseases like Alzheimer's (Wang et al., 2024). *Cordyceps militaris* has demonstrated potential in improving physical endurance and lowering inflammation (Dutta et al., 2024).

Mushrooms are becoming more widely accepted in contemporary healthcare systems, such as in nutraceutical products designed to strengthen immunity and fight chronic illnesses (Patil et al., 2024). Recent developments in extraction procedures have improved the bioavailability of their medicinal components (Verma et al., 2023).

Indian edible and medicinal mushrooms have significant potential, but there are still challenges such as low consumer knowledge, lack of standardised cultivation and quality control procedures, and a lack of research on wild and lesser-known species. Integrating these fungi into mainstream healthcare requires bridging these gaps through multidisciplinary research, public health education, and appropriate policy frameworks.

METHODS

We used the search terms "mushroom", "fungi" in the PubMed and Google Scholar database using the filters "Human health," and "Clinical study". PubMed was chosen as the primary search engine because of its extensive query filtering features. Additionally, other manuscripts were looked for in references from chosen articles. Reviews and research conducted on animals were also included. Additionally, research germane to the core theme of nutrition and health were chosen . The results from searching shows a total of 1753 papers; of them, over 359 are review studies. This demonstrates how keenly interested nutritionists, biologists, and physicians are in the scientific underpinnings of mushrooms' beneficial characteristics.

Mushroom Nutritional Factors

A nutrient-dense, low-calorie meal, mushrooms provide a wide range of health advantages because of their rich macronutrient, micronutrient, and bioactive chemical composition. They are extremely useful for controlling illnesses and advancing human health because of their special nutritional qualities. **Table -1** displays the nutritional value of a mushroom in 100g for adults.

Composition of Macronutrients:

Proteins

With a protein content ranging from 2–6% of fresh weight and 19–35% of dry weight, mushrooms are known for their high and easily digestible proteins. Vegetarians and vegans can use them as a plant-based protein source since they include critical amino acids such lysine, methionine, and valine (Bhatia and Yadav., 2024). *Pleurotus ostreatus* and other mushroom proteins have been linked to antibacterial and immunomodulatory properties.

Fibres and carbohydrates:

Dietary fibre is made up of complex carbohydrates found in mushrooms, such as chitin, mannans, and β-glucans. It is well recognised that these polysaccharides control blood glucose levels, enhance intestinal health, and reduce cholesterol (Fernandes et al., 2021). In addition to improve digestion, dietary fibre from mushrooms supports a balanced gut flora.

The fats

According to Mattila et al. (2017), mushrooms have a low fat content (between 1 to 8% of dry weight) and are mostly composed of heart-healthy unsaturated fatty acids like linoleic acid, Oleic acid.

Content of Energy

With 15–35 kcal per 100 g of fresh weight, mushrooms are regarded as low-calorie meals that are perfect for diets aimed at controlling weight (Roupas et al., 2012).

Composition of Micronutrients

Vitamins

Vitamin D2 is naturally found in mushrooms, which are made from ergosterol when exposed to sunshine or ultraviolet light. This is especially crucial for communities that receive little exposure to the sun.

They include high levels of B-complex vitamins, such as pantothenic acid, niacin, and riboflavin, which are essential for nerve and energy metabolism (Gargano et al., 2017).

Agaricus bisporus and other mushrooms contain folate (B9), which aids in DNA synthesis and repair, particularly in pregnant women.

Minerals

High concentrations of vital minerals including potassium, selenium, copper, phosphorus, and zinc found in mushrooms. While selenium functions as an antioxidant, shielding cells from oxidative stress, potassium aids in blood pressure regulation. The immune system and enzymatic processes are supported by copper and zinc (Ju et al.,2025). Because wild mushrooms naturally grow in nutrient-rich soils, they frequently contain more minerals than produced kinds.

Specific molecules from mushrooms

Bioactive compounds such as inotodiols, aegorolysins, pleurotolysins, ageritin, ergothioneine, and β-glucans are abundant in mushrooms and have substantial therapeutic potential. Lanostane-type triterpenoids called inotodiols, which are mostly found in *Inonotus obliquus*, have antiviral, anticancer, and anti-inflammatory properties through apoptosis induction, viral replication inhibition, and the suppression of pro-inflammatory cytokines such as TNF-α and IL-6 (Zhou et al., 2021; Tian et al., 2021). Potential possibilities for antifungal and cancer therapeutics include *Pleurotus ostreatus's* aegorolysins and pleurotolysins, which are pore-forming proteins and cytolysins, respectively, with antifungal, anticancer, and immunomodulatory qualities (Berne et al., 2002). Ageritin, a ribotoxin-like protein found in *Cyclocybe aegerita*, has antiviral and cytotoxic properties while preserving healthy tissues by specifically inhibiting ribosome activity in cancerous and virus-infected cells (Ragucci et al.,2023).

Ergothioneine is a potent antioxidant and neuroprotective substance that lowers oxidative stress, promotes neuronal survival, and has anti-aging properties. It is a thiol derivative of histidine found in mushrooms such as *Agaricus bisporus* and *Pleurotus spp*. (Cheah et al., 2017). The β-glucans are polysaccharides with immunomodulatory, anticancer, cholesterol-lowering, and prebiotic properties that are found in large quantities in *Ganoderma lucidum* and *Pleurotus species*. They enhance gut health and metabolic balance, trigger tumour cell death, stimulate natural killer cells and macrophages, and more (Yang et al., 2024). When combined, these bioactive substances highlight the medicinal benefits of mushrooms and show promise for use in medicines and nutraceuticals.

Table 1: Nutrient value of mushroom per 100 g fresh weight

Nutrient	Amount per 100 g (Fresh weight)	Health Benefits
Energy	22 kcal	Low-calorie food is suitable for weight management
Protein	3.1 g	Supports muscle repair and growth
Carbohydrates	3.3 g	Provides a quick energy source
Dietary Fiber	1.0 g	Promotes digestive health and regulates blood sugar
Fat	0.3 g	Low-fat content is beneficial for heart health
Vitamin D	7.9 µg	Strengthens bones and supports immune function
Riboflavin (B2)	0.35 mg	Helps in energy production and skin health
Niacin (B3)	4.8 mg	Supports metabolism and nervous system function
Potassium	318 mg	Regulates fluid balance and supports heart health
Selenium	9.3 µg	Acts as an antioxidant and supports thyroid function
Iron	1.7 mg	Aids in oxygen transport and reduces fatigue
Phosphorus	86 mg	Supports bone health and energy metabolism
Ergothioneine	2.4 mg	Provides antioxidant protection and reduces inflammation

Diversity and Bioactive Compounds of Indian Edible and Medicinal Mushrooms

India has a diverse climatic zones and rich biodiversity support a remarkable diversity of fungi, including mushrooms, which have been used for centuries as a food source and in traditional medicine because of their high nutritional value and therapeutic potential. In recent decades, scientific studies have examined the bioactive compounds in mushrooms, revealing their many health benefits. Indian edible and medicinal mushrooms have enormous potential in pharmaceutical and nutraceutical applications.

Indian Mushroom Diversity

From tropical rainforests to the frigid Himalayan regions, India's varied temperatures provide an optimal environment for a large number of different types of mushrooms. These consist of edible, medicinal, and wild mushrooms.

Edible Mushrooms

A mainstay in Indian homes, edible mushrooms are also a developing sector of contemporary agriculture.

Domesticated Species

The button mushroom, or *Agaricus bisporus*, is the most commonly grown fungus in India and is prized for its extensive protein content and culinary diversity. Oyster mushrooms, or *Pleurotus spp*., are widely grown because of their high production and simplicity of growing. The milky mushroom, or *Calocybe indica*, is native to India and is prized for its high output and adaptability. It grows well in tropical areas (Wickramasinghe et al.,2023).

Wild mushrooms

Termitomyces spp.: A highly valued wild mushroom that is gathered throughout the monsoon season, especially in the tribal areas of Himachal Pradesh, Punjab, Chhattisgarh, Odisha, and Jharkhand.

Volvariella volvacea: Well-known for its nutritious content and quick development.

Medicinal Mushrooms

A number of Indian medicinal mushroom species are known to have therapeutic uses.

Reishi, or *Ganoderma lucidum*, is a fungus that has been extensively researched for its immunomodulatory, anti-inflammatory, and anticancer properties.

Cordyceps militaris: Known for boosting immunity and endurance, this fungus is also known as a natural adaptogen.

Turkey tail, or *Trametes versicolor*, is a robust source of polysaccharides that are utilised in traditional medicine to boost the immune system. Studies carried out throughout India have shown that native species such as *Schizophyllum commune* and *Phellinus sp*p. exhibit exceptional bioactive qualities (Sharma et al., 2020; Azeem et al., 2020). Table 2 implies the bioactive compounds that are responsible for the drugs in the treatment of human ailments.

Table 2: Bioactive compounds in Indian mushrooms responsible for Biomedical Applications

Mushroom Species	Bioactive Compounds	Biomedical Applications	References
Ganoderma lucidum	Triterpenoids, Polysaccharides	Immunomodulation, Anticancer, Anti-inflammatory	Balkrishna et al., 2024
Pleurotus spp.	β-glucans, Phenolic compounds	Antioxidant, Anti-diabetic, Cardioprotective	Sharma et al., 2024
Hericium erinaceus	Erinacines, Hericenones	Neuroprotection, Cognitive Enhancement, Alzheimer’s Management	Qi et al., 2025
Cordyceps militaris	Cordycepin, Polysaccharides	Anti-inflammatory, Physical Endurance, Immunostimulation	Das et al., 2024
Calocybe indica	Proteins, Ergosterol	Nutritional Support, Antioxidant	Gupta et al., 2025
Termitomyces spp.	Phenolics, Proteins	Antimicrobial, Nutritional Supplement	Kumar et al., 2023
Agaricus bisporus	Phenolic acids, Lectins	Anti-inflammatory, Antioxidant	Jain et al., 2024

Mushroom Species	Bioactive Compounds	Biomedical Applications	References
Lentinula edodes	Lentinan, Polysaccharides	Immunomodulation, Anticancer	Srivastava et al., 2024
Volvariella volvacea	Phenolics, Polysaccharides	Antioxidant, Anti-diabetic	Kalu et al., 2024
Schizophyllum commune	β-glucans, Phenolics	Antioxidant, Antimicrobial	Debnath et al., 2022
Flammulina velutipes	Ergosterol, Polysaccharides	Antioxidant, Antitumor	Yang et al., 2020
Auricularia polytricha	Polysaccharides, Phenolic acids	Cardioprotective, Antioxidant	Sillapachaiyaporn et al., 2019
Phellinus linteus	Polysaccharides, Hispidin	Antitumor, Antioxidant	Chen et al., 2019
Grifola frondosa	D-fraction, Ergosterol	Immunomodulation, Anticancer	Ren et al., 2023
Tremella fuciformis	Polysaccharides, Vitamin D	Skin Health, Antioxidant	Badalyan et al., 2023
Polyporus umbellatus	Polysaccharides, Ergosterol	Diuretic, Hepatoprotective	He et al., 2022
Pycnoporus cinnabarinus	Laccase, Phenolic compounds	Antioxidant, Antimicrobial	Bourdette et al., 2020
Trametes versicolor	PSP, Polysaccharides	Immunomodulation, Anticancer	Puia et al., 2018
Xerocomus badius	Phenolics, Polysaccharides	Antioxidant, Antimicrobial	Gao et al., 2016
Inonotus obliquus	Betulinic acid, Polysaccharides	Antitumor, Antioxidant	Song et al., 2013
Laetiporus sulphureus	Polysaccharides, Phenolics	Antioxidant, Antimicrobial	Sharma et al., 2023
Ganoderma applanatum	Triterpenoids, Polysaccharides	Immunomodulation, Antioxidant	Cheng et al., 2024
Pholiota nameko	Ergothioneine, Polysaccharides	Antioxidant, Skin Health	Lin et al., 2022
Agaricus subrufescens	Polysaccharides, Selenium	Antitumor, Cardioprotective	Rao et al., 2024
Coprinus comatus	Polysaccharides, Phenolic acids	Anti-diabetic, Antioxidant	Jain et al., 2023
Clitocybe gibba	Phenolic compounds, Polysaccharides	Antioxidant, Antimicrobial	Verma et al., 2024
Lactarius deliciosus	Polysaccharides, Phenolics	Antioxidant, Immunomodulation	Patil et al., 2023
Suillus luteus	Terpenoids, Polysaccharides	Anti-inflammatory, Antioxidant	Menon et al., 2023
Russula cyanoxantha	Phenolics, Ergosterol	Antioxidant, Antibacterial	Yang et al., 2025
Cantharellus cibarius	Carotenoids, Polysaccharides	Antioxidant, Eye Health	Kumar et al., 2025
Lepista nuda	Phenolic acids, Flavonoids	Antioxidant, Antimicrobial	Erbiai et al., 2023
Scleroderma citrinum	Polysaccharides, Phenolics	Immunomodulation, Anticancer	Neto et al., 2024
Calvatia gigantea	Polysaccharides, Ergosterol	Antioxidant, Antitumor	Zeng et al., 2022
Hygrophorus marzuolus	Phenolics, Polysaccharides	Antioxidant, Cardioprotective	Deveci et al., 2023

Mushroom Species	Bioactive Compounds	Biomedical Applications	References
Armillaria mellea	Polysaccharides, Hispidin	Antitumor, Antioxidant	Ren et al., 2023
Sparassis crispa	β-glucans, Ergosterol	Immunomodulation, Skin Health	Sharma et al., 2022
Boletus edulis	Polysaccharides, Phenolic acids	Antioxidant, Cardioprotective	Tan et al., 2023
Tricholoma matsutake	Polysaccharides, Ergothioneine	Antioxidant, Anti-inflammatory	Li et al., 2022
Rhizopogon roseolus	Phenolic acids, Terpenoids	Antioxidant, Antimicrobial	Sevindik, M., and Bal, C., 2022
Coprinellus micaceus	Ergosterol, Polysaccharides	Antioxidant, Antimicrobial	Canpolat et al., 2024
Leccinum scabrum	Phenolics, Ergosterol	Antioxidant, Antibacterial	Rao et al., 2024
Cortinarius caperatus	Flavonoids, Polysaccharides	Antioxidant, Immunomodulation	Teplyakova et al., 2021
Paxillus involutus	Phenolic acids, Terpenoids	Antioxidant, Anti-inflammatory	Petrovic et al., 2025

Methods of Growing Edible Mushrooms

In order to assure sustainability and efficiency, India's edible mushroom production has undergone tremendous change, combining ancient expertise with contemporary agricultural techniques. The approaches that are often used are as follows:

Substrate Preparation

Paddy straw, sugarcane bagasse, wheat bran, and sawdust are among the substrates used to cultivate mushrooms. To get rid of pathogens and enhance the mushroom development environment, these substrates are sterilized before use (Muswati et al., 2021).

Production of Spawn

Grains inoculated with mushroom mycelium, such as wheat or millet, are used to create spawn, the seed for mushroom production. High-quality spawn production is guaranteed by carefully regulated laboratory settings (Amir et al., 2023).

Cultivation Methods

Bed method: Often employed for Pleurotus species, this method involves arranging layers of substrate and spawn in beds and maintaining humid conditions for the best development.

Bag method: After filling polythene bags with substrates, spawn is added, and the temperature and humidity are regulated. This technique works quite well for species such as *Calocybe indica*.

Log method: Often used for wood-decaying mushrooms such as Ganoderma lucidum, Lentinula *edodes* this method involves inoculating wooden logs with spawn and storing them in a damp, shady environment (Sariyar et al., 2023).

Environmental Control

During cultivation, great attention is paid to temperature, humidity, and ventilation. For instance, Pleurotus species need 80–90% humidity to produce at their best and do best in temperatures between 20 and 30°C (Chong et al., 2023).

Harvesting and Post-Harvest Management

To increase shelf life, mushrooms are collected when they are mature and treated by drying or packing. To preserve quality, cutting-edge methods including vacuum packing and freeze-drying are used (Dawadi et al., 2022).

Use of Agricultural Waste

Using agricultural wastes as substrates lowers environmental waste while also advancing circular economies. In rural locations, where farmers may incorporate mushroom cultivation with current agricultural processes, this strategy has been very successful (Philippoussis et al., 2011).

Pharmaceutical and pharmacological applications

Anti-oxidant activity

Chronic illnesses are mostly caused by oxidative stress, and mushrooms have demonstrated strong antioxidant properties. *Ganoderma lucidum* and *Pleurotus species* contain phenolic chemicals that counteract free radicals and prevent oxidative damage (Heleno et al., 2012). *Agaricus bisporus* and *Pleurotus species* are rich in ergothioneine, a thiol derivative of histidine that has cytoprotective benefits against oxidative stress (Izham et al., 2022). Because of these characteristics, nutraceutical formulations have been used to prevent oxidative stress-related illnesses such as neurodegenerative disorders and cardiovascular diseases.

Potential anticancer effects

Through immunological modulation, apoptosis induction, and angiogenesis suppression, mushrooms demonstrate anticancer action. *Ganoderma lucidum* polysaccharides stimulate natural killer (NK) cells, strengthening the immune system's defences against cancer (Patel et al., 2012). Chemotherapy is more effective when Lentinan from *Lentinula edodes* is consumed. Triterpenoids, such as ganoderic acids from *Ganoderma lucidum*, also prevent angiogenesis and metastasis. These substances are highly useful as supplemental treatments for cancer.

Impact on Immunomodulation

Indian mushrooms are useful in the treatment of autoimmune diseases and infections because they boost both innate and adaptive immunity. β-Glucans, which are present in *Schizophyllum commune and Ganoderma lucidum*, stimulate T-cells, dendritic cells, and macrophages (Ren et al., 2024). Proteoglycans improve host immunity by increasing the production of cytokines. These properties are leveraged in the development of immunomodulatory drugs and dietary supplements.

Antimicrobial action

Antimicrobial substances that are efficient against viruses, fungi, and bacteria are produced by mushrooms. According to Wasser (2014), ganoderic acids derived from *Ganoderma lucidum* exhibit antibacterial action against *Staphylococcus aureus* and *Escherichia coli*. *Pleurotus ostreatus* produces cytolytic proteins called pleurotolysins, which have antifungal properties. Mushrooms are useful as alternative treatments for illnesses that are resistant to drugs because of their antibacterial qualities.

Effects of antidiabetics

Through a variety of methods, mushrooms enhance glycemic management. By improving insulin sensitivity, polysaccharides reduce blood glucose (Sharma et al., 2021). In pancreatic cells, cordycepin, which is present in *Cordyceps militaris*, lessens oxidative stress. For the treatment of diabetes, these bioactive substances are added to nutraceuticals and functional meals.

Neuroprotective qualities

In neurodegenerative illnesses, mushrooms such as *Hericium erinaceus*, sometimes known as Lion's Mane, are helpful. Erinacines help in brain regeneration by promoting the production of nerve growth factor (NGF) (Li et al., 2020). Ergothioneine protects against oxidative damage and neuroinflammation. Because of these qualities, mushrooms may be used to treat Parkinson's and Alzheimer's disorders.

Effects on hepatoprotection

A few types of mushrooms shield the liver from oxidative stress and poisons. Ganoderic acids decrease cholesterol buildup and improve liver detoxification (Sharma et al., 2021). Serum indicators of liver damage are decreased by *Auricularia auricula*. Their use in treatments for fatty liver disease and hepatitis is supported by these hepatoprotective qualities.

CONCLUSION

A wide range of bioactive substances with substantial pharmacological and pharmaceutical potential are found in Indian edible and medicinal mushrooms. Numerous studies have confirmed their wide range of bioactivities, which include hepatoprotective, immunomodulatory, antibacterial, antidiabetic, neuroprotective, antioxidant, and anticancer properties. These characteristics demonstrate their transformational potential in contemporary therapies as well as their applicability in conventional medicine. Compounds produced from mushrooms are becoming more widely acknowledged as effective substitutes or supplements to synthetic medications, opening the door to safer and more long-lasting therapies.

It is anticipated that continuous improvements in extraction methods and biotechnology strategies would improve the effectiveness and availability of products derived from mushrooms. The range of their uses will be further increased by future studies that concentrate on clinical trials, dose standardisation, and the investigation of new bioactive substances. With their rich history and scientific potential, Indian edible and medicinal mushrooms represent a bridge between traditional wisdom and state-of-the-art medical advancement, providing hope for a more sustainable and healthy future.

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