

Edible Mushrooms as Functional Foods: Nutritional Value and Health Benefits

Chintumani Ramchiary¹, Nitu Saloi²

¹Research Scholar, Department of Commerce, Gauhati University

Email ID: chintumani66@gmail.com

²Research Scholar, Department of Commerce, Gauhati University

Email ID: nitusalo2019@gmail.com

Abstract:

Mushrooms are among the most valuable edible fungi consumed worldwide due to their high nutritional value and numerous health-promoting properties. They are rich in proteins, dietary fibre, vitamins, minerals, antioxidants, and various bioactive compounds while being low in calories and fat. Besides serving as a nutritious food source, mushrooms possess medicinal properties that contribute to disease prevention and overall well-being. Growing consumer awareness of healthy diets, coupled with increasing demand for functional foods, has led to a significant rise in mushroom cultivation across the world. This paper is a review of various literatures regarding the nutritional composition of mushrooms, their health benefits, and their importance in ensuring food security, nutrition, and sustainable agriculture.

Keywords: Mushroom, Nutrition, Functional Food, Sustainable, Health Benefits, Food Security

1. Introduction

Mushrooms are edible fungi that have been consumed by humans for centuries because of their unique taste, nutritional quality, and medicinal value. They belong to the Kingdom Fungi and are cultivated in many parts of the world under different climatic conditions. Although thousands of mushroom species exist, only a limited number are commercially cultivated and consumed. Among these, white button mushroom (*Agaricus bisporus*), oyster mushroom (*Pleurotus ostreatus*), shiitake mushroom (*Lentinula edodes*), and paddy straw mushroom (*Volvariella volvacea*) are the most popular.

In recent years, mushrooms have attracted considerable attention as functional foods because they provide essential nutrients while also offering health-promoting compounds. Unlike many vegetables, mushrooms contain bioactive substances that exhibit antioxidant, antimicrobial, anti-inflammatory, and immunomodulatory properties. Their low fat and calorie content makes them suitable for healthy diets, while their high nutritional density contributes to combating malnutrition and lifestyle-related diseases.

India has witnessed substantial growth in mushroom cultivation due to increasing awareness, Government support, and changing dietary preferences. Besides generating income and employment, mushroom farming utilizes agricultural residues efficiently, making it an environmentally sustainable enterprise.

2. Types of Edible Mushrooms

Mushrooms are cultivated worldwide for their nutritional, medicinal, and commercial value. Among the numerous edible species, button mushroom, shiitake mushroom, oyster mushroom, and paddy straw mushroom are the most widely known.

(i) Button Mushroom (*Agaricus bisporus*):

Button mushroom is native to Europe and North America and is available in two varieties, namely white and brown. In India, the white button mushroom is the most extensively cultivated species. According to the ICAR–Directorate of Mushroom Research, it accounts for more than 85 per cent of the country's total mushroom production. Owing to its mild flavour and versatility, it is widely preferred by households as well as the food service industry.

(ii) Shiitake Mushroom:

Shiitake mushroom is indigenous to East Asia and is one of the most popular edible mushrooms in Asian countries. It naturally grows on hardwood trees such as oak, chestnut, and maple. The crop thrives under warm and humid climatic conditions and is valued for both its culinary and medicinal properties.

(iii) Oyster Mushroom (*Pleurotus ostreatus*):

Oyster mushroom belongs to the genus *Pleurotus* and is commonly known as "Dhingri" in India. It is characterized by its oyster- or fan-shaped cap and is one of the easiest mushrooms to cultivate. It grows efficiently on agricultural residues such as paddy straw and other lignocellulosic wastes, making it a suitable option for small-scale and commercial cultivation.

(iv) Paddy Straw Mushroom (*Volvariella volvacea*):

Paddy straw mushroom is primarily cultivated on beds of rice straw and is widely used in Asian cuisine. It grows rapidly under warm and humid conditions and is especially suitable for tropical and subtropical regions.

At present, the major mushroom species commercially cultivated in India are oyster mushroom (*Pleurotus sajor-caju*), white button mushroom (*Agaricus bisporus*), and paddy straw mushroom (*Volvariella volvacea*). According to Singh, Ahmad, Sinha, and Mishra (2019), mushroom cultivation has considerable potential for improving farmers' livelihoods. Greater awareness among both producers and consumers regarding its economic, nutritional, and health benefits can significantly contribute to the expansion of mushroom production in the country.

3. Nutritional Composition of Mushrooms:

Nutritional Value per 100 g (3.5 oz.)	
Energy	113 kJ (27kcal)
Water	92.45 g
Carbohydrates	4.1g
Fat 0.1 g	0.1 g
Protein	2.5g
Thiamine (Vit B1)	0.1 mg (9%)
Riboflavin (Vit B2)	0.5 mg (42%)
Niacin	3.8 mg (25%)
Pantothenic Acid (B5)	1.5 mg (30%)

Vitamin C	0 mg (0%)
Calcium	18 mg (2%)
Phosphorous	120 mg (17%)
Potassium	448 mg (10%)
Sodium	6 mg (0%)
Zinc	1.1 mg (12%)
Vitamin D (D2 + D3)	0.2 µg
Sugar	1.98 g

Percentages are relative to US recommendations for adults.

Source: USDA Nutrient Database

Mushrooms are considered highly nutritious because they provide a wide range of essential nutrients while being naturally low in calories and fat. As per the USDA Nutrient Database, every 100 g of edible mushrooms contains approximately 27 kcal of energy, 92.45 g of water, 4.1 g of carbohydrates, 2.5 g of protein, and only 0.1 g of fat. They also contain small amounts of natural sugars (1.98 g), making them a healthy food choice.

In addition to their macronutrient content, mushrooms are an excellent source of several vitamins and minerals. They are particularly rich in B-complex vitamins, including thiamine (Vitamin B1), riboflavin (Vitamin B2), niacin, and pantothenic acid (Vitamin B5), which play an important role in energy metabolism and overall health. Mushrooms also provide valuable minerals such as calcium, phosphorus, potassium, zinc, and small amounts of vitamin D, all of which contribute to maintaining healthy bones, muscles, and the immune system.

The nutritional composition of mushrooms makes them especially beneficial for maintaining good health. Their low calorie and low-fat content make them suitable for weight management, while their dietary fibre supports digestive health. Furthermore, mushrooms contain antioxidants and bioactive compounds that help strengthen the immune system and protect the body against oxidative stress. They are also a valuable source of potassium, selenium, copper, and B vitamins, which contribute to cardiovascular health, nerve function, and cellular metabolism. Regular consumption of mushrooms can support overall health by improving immunity, promoting better digestion, assisting in weight management, and enhancing bone health due to the presence of vitamin D and essential minerals.

4. Health Benefits of Mushrooms

(i) Strengthens the Immune System:

Mushrooms contain bioactive compounds, particularly beta-glucans, which help stimulate the body's immune system. These compounds activate immune cells such as macrophages and natural killer cells, enabling the body to fight infections more effectively. In addition, antioxidants present in mushrooms help protect the immune system from damage caused by harmful free radicals.

(ii) Supports Heart Health:

Mushrooms are naturally low in fat, sodium, and cholesterol, making them a heart-friendly food. They are also a good source of potassium, which helps regulate blood pressure by

2024353

balancing sodium levels in the body. The dietary fibre and antioxidants in mushrooms help reduce bad cholesterol (LDL), improve blood circulation, and lower the risk of cardiovascular diseases.

(iii) Helps in Weight Management:

Due to their low calorie and fat content, mushrooms are an ideal food for individuals trying to maintain or reduce body weight. Their high water and fibre content promotes a feeling of fullness, reducing overeating and unnecessary calorie intake. Replacing high-calorie foods with mushrooms can therefore support healthy weight management.

(iv) Helps Control Blood Sugar Levels:

Mushrooms have a low glycaemic index and contain complex carbohydrates and dietary fibre, which slow down the absorption of glucose into the bloodstream. This helps maintain stable blood sugar levels and may improve insulin sensitivity, making mushrooms beneficial for people with diabetes or those at risk of developing the disease.

(v) Rich Source of Antioxidants:

Mushrooms contain powerful antioxidants such as ergothioneine, glutathione, selenium, and phenolic compounds. These antioxidants help neutralize harmful free radicals that cause oxidative stress, which is associated with ageing and several chronic diseases. Regular consumption of antioxidant-rich foods like mushrooms may help protect cells from damage and improve overall health.

(vi) Promotes Bone Health:

Some edible mushrooms naturally contain vitamin D or can produce vitamin D₂ when exposed to sunlight or ultraviolet light. Vitamin D is essential for calcium absorption and bone mineralization. Along with phosphorus and other minerals present in mushrooms, it helps maintain strong bones and teeth and reduces the risk of osteoporosis.

(vii) Improves Digestive Health:

Mushrooms are a good source of dietary fibre and prebiotic compounds that support the growth of beneficial bacteria in the intestine. A healthy gut microbiome improves digestion, enhances nutrient absorption, and supports the body's immune system. Regular consumption of mushrooms can therefore contribute to better digestive health.

(viii) May Reduce the Risk of Cancer:

Research suggests that mushrooms contain several bioactive compounds, including polysaccharides, lectins, and phenolic compounds, which possess anticancer properties. These compounds may help inhibit the growth of cancer cells, strengthen the immune response, and reduce inflammation. Although mushrooms cannot cure cancer, including them in a balanced diet may contribute to lowering the risk of certain cancers.

(ix) Supports Brain Health:

Mushrooms contain antioxidants, particularly ergothioneine, which help protect brain cells from oxidative stress and inflammation. Some studies indicate that regular mushroom consumption may improve memory, support cognitive function, and reduce the risk of age-related neurological disorders such as Alzheimer's and Parkinson's diseases.

(x) Reduces Inflammation:

Chronic inflammation is associated with many diseases, including diabetes, arthritis, and cardiovascular disorders. Mushrooms contain natural anti-inflammatory compounds that help reduce inflammation in the body. Their regular consumption may contribute to better overall health and reduce the risk of inflammation-related diseases.

(xi) Provides Essential Vitamins and Minerals:

Mushrooms are an excellent source of several important nutrients, including B-complex vitamins (thiamine, riboflavin, niacin, and pantothenic acid), potassium, phosphorus, selenium, copper, zinc, and iron. These nutrients support energy production, nervous system function, muscle activity, enzyme function, and the maintenance of healthy skin and tissues.

(xii) Promotes Healthy Ageing:

The combination of antioxidants, vitamins, minerals, and other bioactive compounds found in mushrooms helps protect body cells from damage caused by ageing and environmental stress. Regular consumption may help slow age-related cellular damage, improve vitality, and support healthy ageing.

5. Role of Mushrooms in Food and Nutritional Security

The Food and Agriculture Organization (FAO) recognizes mushrooms as an important component of sustainable food systems. Their cultivation requires relatively little land, water, and capital while producing highly nutritious food (Food And Agriculture Organization, n.d.)

Mushrooms contribute to nutritional security by supplying quality protein, vitamins, minerals, and dietary fibre. They are especially beneficial in regions suffering from protein-energy malnutrition because they can supplement diets with affordable and nutritious food.

Furthermore, mushrooms efficiently convert agricultural wastes such as rice straw, wheat straw, cotton waste, sugarcane bagasse, sawdust, maize stalks, and banana leaves into valuable food, thereby supporting the principles of the circular economy.

6. Economic and Agricultural and Environmental Importance of Mushroom Cultivation

Apart from their nutritional significance, mushrooms offer substantial economic benefits. Mushroom cultivation requires relatively small landholdings, low investment, and short production cycles. Agricultural wastes such as paddy straw, wheat straw, sawdust, and sugarcane bagasse can be converted into valuable food products, thereby promoting sustainable waste management.

Mushroom farming generates employment opportunities, particularly for women, youth, and small-scale entrepreneurs. It also contributes to income diversification among rural households.

Since mushrooms can be cultivated indoors throughout the year, they provide continuous income and reduce dependence on seasonal agriculture.

Mushroom cultivation is considered environmentally sustainable because it utilizes agricultural residues that would otherwise be burned or discarded. This reduces environmental pollution while generating additional income for farmers.

The spent mushroom substrate remaining after harvesting serves as an excellent organic manure, livestock feed, vermicomposting material, and soil conditioner. Thus, mushroom cultivation promotes sustainable agriculture, resource recycling, and environmental conservation.

Compared with many agricultural enterprises, mushroom farming requires:

- Less land
- Less water
- Lower energy consumption
- Short production cycles
- Minimal environmental pollution

These characteristics make mushrooms an important enterprise for climate-smart agriculture.

7. Global Scenario of Mushroom Production

Global mushroom production has increased rapidly over the past three decades due to growing consumer awareness of healthy diets and functional foods. China dominates world mushroom production, accounting for nearly 75 per cent of global output (CABI, 2015). Other major producers include Japan, the United States, the Netherlands, Poland, Italy, Spain, France, and India. India ranks among the leading mushroom-producing countries, with white button mushroom accounting for nearly 70-80 per cent of total production, followed by oyster and paddy straw mushrooms (ICAR, n.d.). Government agencies, including ICAR-Directorate of Mushroom Research, have played a significant role in promoting mushroom cultivation through research, training, and technology dissemination.

8. Challenges

Despite their immense potential, mushroom cultivation faces several constraints:

- Limited availability of quality spawn.
- Inadequate technical knowledge among growers.
- High post-harvest losses due to perishability.
- Insufficient cold storage and transportation facilities.
- Low consumer awareness in certain regions.
- Limited processing and value-addition infrastructure.
- Inadequate institutional support and market linkages.

Addressing these challenges through training, research, infrastructure development, and policy support can significantly enhance mushroom production and consumption.

9. Future Prospects

The future of mushroom cultivation is promising due to increasing health consciousness, rising demand for functional foods, and expanding vegetarian and vegan populations. Scientific advancements in mushroom breeding, biotechnology, processing, and value addition are expected to enhance productivity and market opportunities. Government initiatives promoting entrepreneurship, rural development, and sustainable agriculture further strengthen the prospects of mushroom farming.

10. Conclusion

Mushrooms represent an excellent combination of nutrition, health, and economic value. They are rich in proteins, vitamins, minerals, dietary fibre, and bioactive compounds while remaining low in calories and fat. Their antioxidant, antimicrobial, anti-inflammatory, and immune-enhancing properties make them valuable functional foods capable of contributing to disease prevention and improved public health. From an economic perspective, mushroom cultivation provides employment opportunities, supports rural livelihoods, and promotes the efficient utilization of agricultural residues. Expanding awareness, improving production technologies, strengthening market infrastructure, and encouraging value addition can further enhance the role of mushrooms in achieving nutritional security, sustainable agriculture, and rural economic development.

References

1. Ajith, T., & K. Janardhanan, K. (2007). Indian Medicinal Mushrooms as a Source of Antioxidant and Antitumor Agents. *Journal of Clinical Biochemistry and Nutrition*, 157-162.
2. Anusiya, G., Prabu, U. G., Yamini, N., Sivarajaseka, N., Rambabu, K., Bharath, G., & Banat, F. (2021). A review of the therapeutic and biological effects of edible and wild mushrooms. *Bioengineered*, 11239–11268.
3. Barmon, B. K., Sharmin, I., Abbasi, P. K., & Mamun, A. (2012). Economics of Mushroom (*Agaricus bisporus*) Production in a Selected Upazila of Bangladesh. *A Scientific Journal of Krishi Foundation*, 77-89.
4. Boarua, S., Borthakur, S., & Neog, M. (2021). Oyster Mushroom cultivation- A budding enterprise for self employment of Rural Youth and farm Women in Tinsukia District of Assam. *International Journal of Current Microbiology and Applied Sciences*, 2155-2161.
5. Bulam, S., Nebahat, U. S., & Aysun Peksen. (2019). Health Benefits of *Ganoderma lucidum* as a Medicinal Mushroom. *Turkish Journal of Agriculture -Food Science and Technology*, 84-93.
6. CABI, D. L. (2015, December 23). Changing global scenario in mushroom industry. Retrieved from CABI Digital Library: <https://www.cabidigitallibrary.org/doi/full/10.5555/20153365547>
7. Das, L., Lugun, N., Mahapatra, S., Mahapatra, S., Mishra, S., Hemron, A., & Pattanaik, S. (2020). Role performance of farm women in mushroom farming and development of a gender sensitive entrepreneurship model for enhancing income. *Journal of Pharmacognosy and Phytochemistry*, 354-357.
8. Food and Agriculture Organization, F. (2009). Make money by growing mushrooms. Rome: Food and Agriculture Organization of the United Nations.

9. Food And Agriculture Organization, F. (n.d.). Part II. MUSHROOM CULTIVATION BY PEOPLE WITH DISABILITIES - A guide. Retrieved from FAO: <https://www.fao.org/4/ab497e/ab497e07.htm>
10. IAS, O. (2022, January 2). Optimize IAS. Retrieved from Mushroom Farming: <https://optimizeias.com>
11. ICAR, D. o. (n.d.). ICAR-Directorate of Mushroom Research. Retrieved from ICAR-Directorate of Mushroom Research: <https://dmrsolan.res.in/>
12. Jha, M. (2019). Mushroom Cultivation: A tool of self-employment. SANSKODHAN, 128-132.
13. Khare, K., Khonga, E., Jongman, M., & Leteane, M. (2015). Economic profitability of oyster mushroom production in Botswana. Mushroom Research, 49-55.
14. Khatun, S., Islam, A., Cakilcioglu, U., & Chatterjee, N. C. (2012). Research on Mushroom as a Potential Source of Nutraceuticals: A Review on Indian Perspective. American Journal of Experimental Agriculture, 47-73.
15. Khatun, S., Islam, A., Cakilcioglu, U., & Chatterjee, N. (2012). Research on mushroom as a potential Source of nutraceuticals: A review on Indian perspective. American Journal of Experimental Agriculture, 47-73.
16. Kumar, P., Kumar, S., Lal, M., & Ali, M. (2013). MUSHROOMS CULIVATION:AN EMERGING AGRIBUSINESS FOR SELF EMPLOYMENT AND ENTREPRENEUR DEVELOPMENT. RESEARCH AND EDUCATION DEVELOPMENT SOCIETY, 2321-8614.
17. Kumari, N., Anand, A., Kumar, S., Panda, C. K., & Kumari, M. (2022). Economics of Oyster Mushroom (*Pleurotus* spp) Production in Bhagalpur District of Bihar. Economic Affairs, 01-07.
18. Ma, G., Yang, W., Zhao, L., Pei, F., Fang, D., & Hu, Q. (2018). A critical review on the health promoting effects of mushrooms nutraceuticals. Food Science and Human Wellness, 125-133.
19. Mwangi, R., Macharia, J. M., Wagara, I. N., & Bence, R. M. (2022). The antioxidant potential of different edible and medicinal mushrooms. Biomedicine & Pharmacotherapy , 1-15.
20. Sharma, K. (2015). Mushroom: Cultivation and Processing. International Journal of Food Processing Technology,, 9-12.
21. Sharma, V., Annepu, S. K., Gautam, Y., Singh, M., & Kamal, S. (2017). Status of mushroom production in India. Mushroom Research.
22. Singh, D. (2017). A Review on Different Benefits of Mushroom. IOSR Journal of Pharmacy and Biological Sciences , 107-111.
23. Singh, B. D., Verma, M., Kumar, R., Gupta, P. C., & Aditya. (2017). Mushroom Production for self Employment - an impact study. International Journal of Current Microbiology and Applied Sciences, 2991-2997.
24. Singh, K. M., Ahmad, N., Sinha, D. K., & Mishra, R. R. (2019). Augmenting Income and employment through mushroom production: A micro level study of Samastipur district of Bihar (India). International Journal of Chemical studies, 4389-4392.
25. USDA, U. D. (n.d.). Food Data Central Food Search. Retrieved from USDA Food Data Central: <https://fdc.nal.usda.gov/food-search?query=mushroom>
26. Usman, M., Murtaza, G., & Ditta, A. (2021). Nutritional, Medicinal, and Cosmetic Value of Bioactive Compounds in Button Mushroom (*Agaricus bisporus*): A Review. Applied Sciences, 1-16.

27. Venturella, G., Ferraro, V., Cirlincione, F., & Gargano, M. L. (2021). Medicinal Mushrooms: Bioactive Compounds, Use, and Clinical Trials. *International Journal of Molecular Sciences*, 1-30.
28. Wani, B. A., Bodha, R. H., & Wani, A. H. (2010). Nutritional and medicinal importance of mushrooms. *Journal of Medicinal Plants Research*, September.