

An Illustration of a Review on Morphology and Medicinal Aspects of Mushroom Cultivated Worldwide

Babita Kumari^{1*}, Sangeeta Pal², Hitesh Solanki³

Abstract

Mushrooms are accepted as a superfood that provides a high content of nutrients. It offers many health benefits. Mushrooms can be enjoyed at various times but including them as part of a balanced meal in our daily routine. The consumption of mushrooms is becoming popular day by day as an unbalanced diet of people in developing countries. Fresh mushrooms, reported to have a high water content, are an effective way to both prolong their shelf life. They preserve their flavor and nutrients for a long day. In India, Bihar, Punjab, Himachal Pradesh, Rajasthan, Haryana, Uttar Pradesh, and Jammu & Kashmir are the major producing states with 90% of production. Button mushrooms are grown in temperate regions of India. Button, oyster, sap, and rice grass mushrooms are grown in tropical and subtropical climates. Under controlled conditions, button mushroom plants can be harvested 2–3 times a year, while seasonal mushrooms are harvested once a year. There is now an increased demand for mushrooms in the market. Additionally, out of different types of mushrooms, button mushrooms are highly grown in small fields, which boosts their popularity. They are a staple diet of health-conscious people all over the world. Mushrooms are the subsequent production throughout the world. Scientists reported approximately 7,000 different species, of which 1300 species seem to be edible. The entrepreneur always tries to promote his profits through innovation. Innovation links to solve the problem by using capabilities. The rising demand for mushrooms popularity among vegetarians is increasing day by day. However, now a day the minimum cost of Indian mushrooms in the international market seems to be more attractive to consumers. The objective of this review is to assess the demand for mushrooms in the global market. It's a delicious, medicinal, and nutritionally healthy concept.

Keywords: Mushroom, medicinal properties, mushroom commercialization, nutrition, health

INTRODUCTION

Mushrooms are globally accepted as a delicacy food with high medicinal value. Several literature surveys showed China producing 70% of the world's mushrooms [1]. The worldwide data shows 7% China accounting for 70% of total production. India with 1.5% contributions, eight with other major mushroom-producing countries like Poland, France, Italy, Indonesia, and Germany. Six countries (USA, Germany, UK, France, Italy, and Canada) consume 85% of the total world mushroom consumption [2]. In 2021, India was ranked sixth globally in mushroom production. India produced nearly 1,82,000 metric tons annually, which accounts for 1.53% of the world's total production. Presently, India is producing 201,000 tons of mushrooms and is ranked fifth in the total mushroom production. India's has registered as signifying role in agricultural innovation and diversification. The reports of several mushroom production institutes and companies emerge out mainly four types of

*Author for Correspondence

Babita Kumari
E-mail: bbtmsmr@yahoo.co.in

¹Guest Faculty, Department of Environmental Science, Moti Lal Nehru College University of Delhi, South Campus, New Delhi, India

²Assistant Professor, Department of Zoology, Brahmaand Degree College, The Mall, Kanpur Nagar, Uttar Pradesh, India

³Professor, Department of Botany, Gujarat University, Ahmedabad, Gujarat, India

Received Date: September 23, 2024

Accepted Date: October 03, 2024

Published Date: October 22, 2024

Citation: Babita Kumari, Sangeeta Pal, Hitesh Solanki. An Illustration of a Review on Morphology and Medicinal Aspects of Mushroom Cultivated Worldwide. International Journal of Fungi. 2024; 1(2): 42–48p.

mushrooms, viz., button, oyster, paddy straw, and milky mushroom. Out of which, button mushrooms account for 3/4th of the total mushroom production in the country. Besides, *Pleurotus ostreatus* seems to have a great impact on diseases [3–6]. In several literatures, Oyster is also reported to play a tremendous role in inhibition of some diseases [7, 8]. In India, commercial mushroom cultivation was begun in the late 1960s. Bihar seems to be nearly 9% of the country's total production. Thus, mushroom production would become a flourishing industry in the world very soon. Currently, Odisha ranks it in mushroom production; it contributes nearly 10% (Figure 1(a) and (b)).

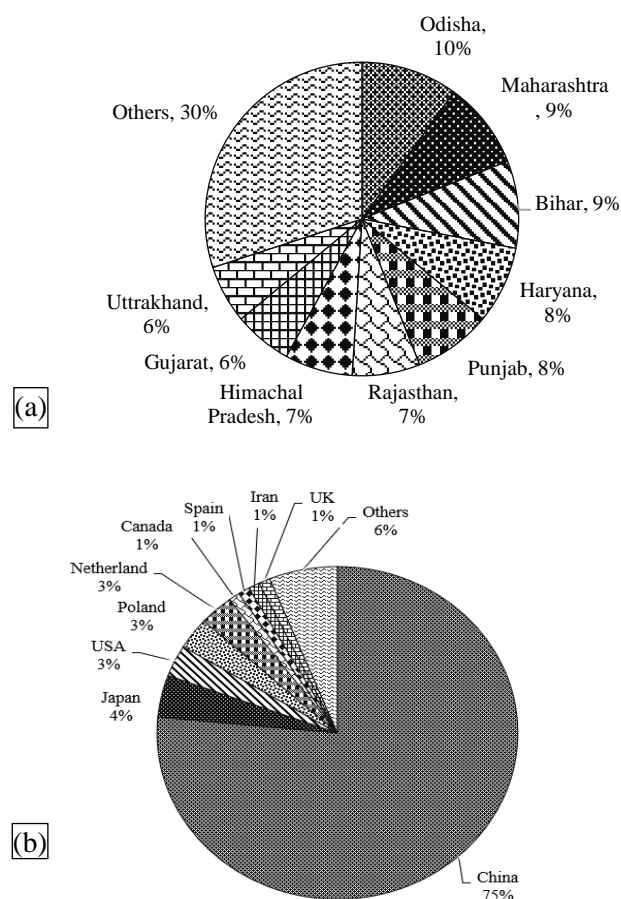


Figure 1. (a). State production of mushroom; (b). Worldwide production of mushroom.

MORPHOLOGY OF MUSHROOM

Mushrooms are characterized by an umbrella-shaped fruiting body. Mushroom belongs to order *Agaricales* in the phylum *Basidiomycota* [9, 10]. Umbrella-shaped sporophores are commonly found in a family called *Agaricaceae*. It bears thin, bladelike gills under the surface of the cap where spores are embedded. The sporophore consists of a cap and a stalk. The fruiting bodies of some mushrooms occur in rings called fairy rings. They grow out in all directions, forming hyphae threads. Some examples of mushroom can be shown in (Figure 2(a)–(f)).

TYPES OF EDIBLE MUSHROOM

- White button mushroom.
- Brown cremini mushroom.
- Portobello mushroom.
- Shiitake mushroom.
- Oyster mushroom.
- Wood ear mushroom.

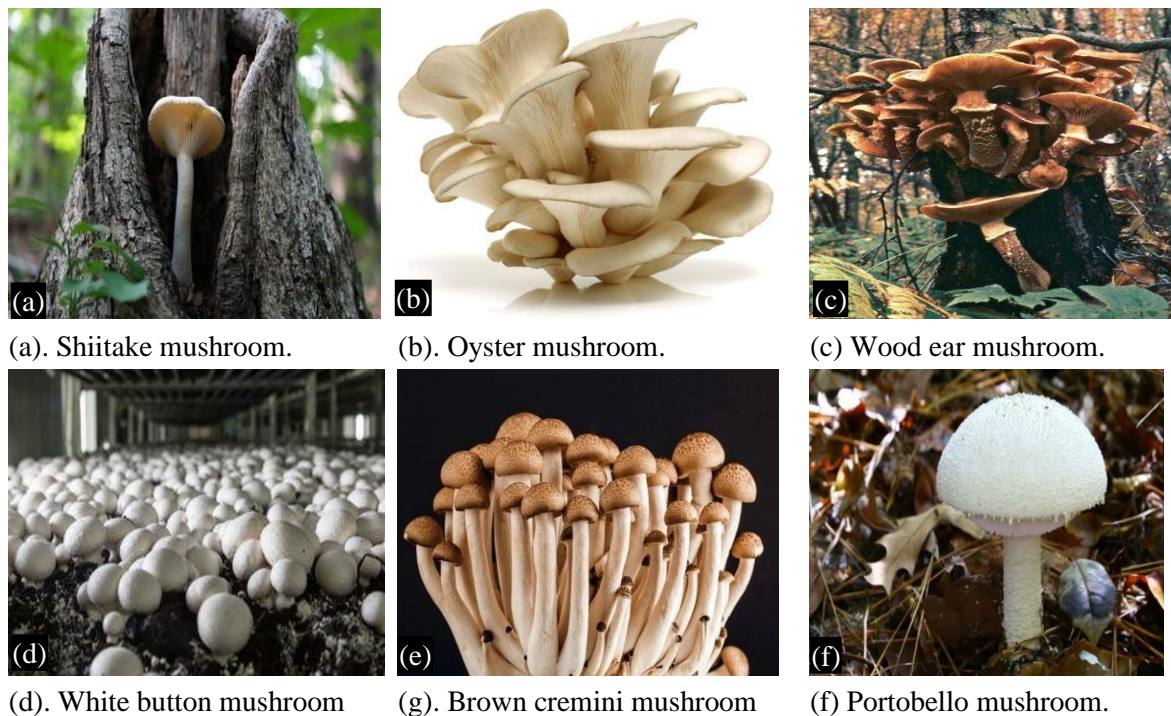


Figure 2. Different species of mushrooms in nature.

Recipes of Edible Mushrooms

Mushrooms are responsible for the production of various types of mushroom products [11] in the global market, like cosmetics, bakery, and millets supplements [12, 13]. Mushroom capsules, mushroom cookies, mushroom chocolates, and mushroom chutney, which can be shown in (Figure 3(a)–(h)).



Figure 3. (a–b) Bakery, chocolate, and bhujia, etc.



Figure 3. (c–e) Mushroom murabba, mushroom chutney, and mushroom millet cookies.



Figure 3. (f–h) Mushroom cosmetic, mushroom kits, and mushroom capsules.

Interestingly, Mushroom has a promising role in our daily cuisine with salty, yummy and spicy flavor. In worldwide kitchen, the different types of recipes of Mushroom cooked can be shown in Figure 4. It includes Mushroom pakoda, Mushroom Biryani, Mushroom soup, Mushroom salad, Mushroom tikaas, Mushroom curries, and Mushroom desert and so on.



Figure 4. Different types of recipes of mushroom.

MUSHROOM AS HEALTH BOOSTER

Medicinal Aspects of Mushroom [12, 14–19]

- *Wound healing:* The extracts of mushrooms may provide healing benefits for skin wounds.
- *Cancer:* Mushrooms have anticancer agents. The presence of antioxidants prevents numerous types of cancer
- *Diabetes:* Mushrooms are antidiabetic in nature. Dietary fiber may help to control type 2 diabetes. It also helps to reduce blood glucose levels.
- *Heart health:* Mushrooms may contribute to controlling cardiovascular health.
- *Potassium:* Mushrooms have a large amount of minerals, like Potassium, which helps to regulate hypertension and blood pressure.
- *Vitamin C:* Vitamin C of mushrooms plays a significant role in controlling skin-related diseases.
- *Fiber:* The presence of dietary fibers, beta-glucans, in the cell walls of mushrooms may lower the blood cholesterol levels.

- *Digestive health:* Mushroom has a power generating source of anti-inflammatory agents, which help to improve digestive health by fighting inflammation. Besides, the mushrooms are also proved to be a health booster to improve immune function.
- *Nervous system recovery:* They improve the nerve cells to grow and repair more quickly.
- *Other benefits:* Mushrooms are very good source of vitamins B. It also provides energy and forms red blood cells, which makes healthy brain and muscle movement.

NUTRITIONAL CONTENT OF MUSHROOMS

The nutritional concept of mushrooms has been accepted worldwide in our healthy diet. This type of health booster has a promising role to combat the challenges of several diseases [20–22]. Nutritional profiles seem to vary between different species of mushrooms (Table 1). Mushrooms are a good source of protein, vitamins, minerals, and antioxidants, which promote better health benefits [23–26].

Table 1. Nutritional impact of mushrooms.

	Per Serving	Daily Goals
Energy (calories)	15.4 g	1,600–2,400 kcal
Protein (g)	2.16 g	46–56 g
Carbohydrate (g)	2.28 g	130 g
Calcium (mg)	2.1 mg	1,000–1,300 mg
Iron (mg)	0.35 mg	8–18 mg
Magnesium (mg)	6.3 mg	310–420 mg
Phosphorus (mg)	60.2 mg	700–1,250 mg
Potassium (mg)	223 mg	2,300–3,400 mg
Sodium (mg)	3.5 mg	2,300 mg
Zinc (mg)	0.364 mg	8–11 mg
Vitamin C (mg)	1.47 mg	65–90 mg
Vitamin D (international units)	4.9 IU	600 IU
Folate (mcg of dietary folate equivalents)	11.9 mcg DFE	400 mcg DFE
Choline (mg)	12.1 mg	425–550 mg
Niacin (mg)	2.53 mg	14–16 mg

CONCLUSION

Thus, mushrooms seem to have best performance on health concepts for a decades. The nutritional profile not only fulfils the healthy diet but also becomes a good precursor to protect from disease. Many programmers must promote mushroom production, which can improve the socio-economic condition of the poor. Mushroom cultivation can be an important subsidiary enterprise for small and marginal farmers. The cultivation of mushroom seems to be very simple and low-cost, where raw materials and facilities are easily available. The export orders are too big to be encouraged to pool their produce for trading in international markets. Thus, results proved that the mushroom is a predominantly suitable food for producing health-promising food.

REFERENCES

1. Aida FMNA, Shuhaimi M, Yazid M, Maaruf AG. Mushroom as a potential source of prebiotics: a review. *Trends Food Sci Technol.* 2009;20(11–12):567–575. doi:10.1016/j.tifs.2009.07.007.
2. Alves MJ, Ferreira ICFR, Dias J, Teixeira V, Martins A, Pintado M. A review on antimicrobial activity of mushroom (Basidiomycetes) extracts and isolated compounds. *Planta Med.* 2012;78(16):1707–1718. doi:10.1055/s-0032-1315370.
3. Chang ST, Miles PG. *Mushrooms: Cultivation, Nutritional Value, Medicinal Effect, and Environmental Impact.* 2nd edition. Boca Raton, Fla, USA: CRC Press; 2008.
4. Barros L, Baptista P, Correia DM, Casal S, Oliveira B, Ferreira ICFR. Fatty acid and sugar compositions, and nutritional value of five wild edible mushrooms from Northeast Portugal. *Food Chem.* 2007;105(1):140–145. doi:10.1016/j.foodchem.2007.03.052.

5. Daba AS, Ezeronye OU. Anti-cancer effect of polysaccharides isolated from higher basidiomycetes mushrooms. *African J Biotechnol.* 2003;2(12):272–278. doi:10.5897/AJB2003.000-1123.
6. Ergönül PG, Akata I, Kalyoncu F, Ergönül B. Fatty acid compositions of six wild edible mushroom species. *Sci World J.* 2013;2013:4. doi:10.1155/2013/163964.163964.
7. Flegg PB, Maw G. Mushrooms and their possible contribution to the world. *Mushroom J.* 1997;48:395–403.
8. Ferreira ICFR, Barros L, Abreu RMV. Antioxidants in wild mushrooms. *Curr Med Chem.* 2009;16(12):1543–1560. doi:10.2174/092986709787909587.
9. Guillamón E, García-Lafuente A, Lozano M, et al. Edible mushrooms: role in the prevention of cardiovascular diseases. *Fitoterapia.* 2010;81(7):715–723. doi:10.1016/j.fitote.2010.06.005.
10. Hung PV, Nhi NNY. Nutritional composition and antioxidant capacity of several edible mushrooms grown in the Southern Vietnam. *Int Food Res J.* 2012;19(2):611–615.
11. Jagadish LK, Shenbhagaraman R, Venkatakrishnan V, Kaviyarasan V. Studies on the phytochemical, antioxidant and antimicrobial properties of three indigenous *Pleurotus* species. *J Mol Biol Biotechnol.* 2008;1:20–29.
12. Jedinak A, Dudhgaonkar S, Wu QL, Simon J, Sliva D. Anti-inflammatory activity of edible oyster mushroom is mediated through the inhibition of NF- κ B and AP-1 signaling. *Nutr J.* 2011;10:52. doi:10.1186/1475–2891–10–52.
13. Kanagasabapathy G, Malek SNA, Kuppusamy UR, Vikineswary S. Chemical composition and antioxidant properties of extracts of fresh fruiting bodies of *Pleurotus sajor-caju* (Fr.) singer. *J Agric Food Chem.* 2011;59(6):2618–2626. doi:10.1021/jf104133g.
14. Kalač P. A review of chemical composition and nutritional value of wild-growing and cultivated mushrooms. *J Sci Food Agric.* 2013;93(2):209–218. doi:10.1002/jsfa.5960.
15. Kumari B, Hitesh Solanki. Comprehensive study on different species of mushroom cultivation in adjacent parts of India with short scientific approaches. *J Chem Bio Phy Sci.* 2020;10(4):525–535.
16. Lavi I, Friesem D, Geresh S, Hadar Y, Schwartz B. An aqueous polysaccharide extract from the edible mushroom *Pleurotus ostreatus* induces anti-proliferative and pro-apoptotic effects on HT-29 colon cancer cells. *Cancer Lett.* 2006;244(1):61–70. doi:10.1016/j.canlet.2005.12.007.
17. Mishra KK, Pal RS, Arunkumar R, Chandrashekara C, Jain SK, Bhatt JC. Antioxidant properties of different edible mushroom species and increased bioconversion efficiency of *Pleurotus eryngii* using locally available casing materials. *Food Chem.* 2013;138(2-3):1557–1563. doi:10.1016/j.foodchem.2012.12.001.
18. Makropoulou M, Aligiannis N, Gonou-Zagou Z, Pratsinis H, Skaltsounis AL, Fokialakis N. Antioxidant and cytotoxic activity of the wild edible mushroom *Gomphus clavatus*. *J Med Food.* 2012;15(2):216–221. doi:10.1089/jmf.2011.0107.
19. Mattila P, Könkö K, Euro M, et al. Contents of vitamins, mineral elements, and some phenolic compounds in cultivated mushrooms. *J Agric Food Chem.* 2001;49(5):2343–2348. doi:10.1021/jf001525d.
20. Mori K, Kobayashi C, Tomita T, Inatomi S, Ikeda M. Antiatherosclerotic effect of the edible mushrooms *Pleurotus eryngii* (Eringi), *Grifola frondosa* (Maitake), and *Hypsizygus marmoratus* (Bunashimeji) in apolipoprotein E-deficient mice. *Nutr Res.* 2008;28(5):335–342. doi:10.1016/j.nutres.2008.03.010.
21. Ouzouni PK, Petridis D, Koller WD, Riganakos KA. Nutritional value and metal content of wild edible mushrooms collected from West Macedonia and Epirus, Greece. *Food Chem.* 2009;115(4):1575–1580. doi:10.1016/j.foodchem.2009.02.014.
22. Patel S, Goyal A. Recent developments in mushrooms as anticancer therapeutics: a review. *3 Biotech.* 2012;2(1):1–15. doi:10.1007/s13205-011-0036-2.
23. Smiderle FR, Olsen LM, Carbonero ER, et al. Anti-inflammatory and analgesic properties in a rodent model of a (1 \rightarrow 3), (1 \rightarrow 6)-linked β -glucan isolated from *Pleurotus pulmonarius*. *Eur J Pharmacol.* 2008;597(1–3):86–91. doi:10.1016/j.ejphar.2008.08.028.
24. Wasser SP. Current findings, future trends, and unsolved problems in studies of medicinal mushrooms. *Appl Microbiol Biotechnol.* 2011;89(5):1323–1332. doi:10.1007/s00253-010-3067-4.

25. Wasser S. Medicinal mushrooms as a source of antitumor and immunomodulating polysaccharides. *Appl Microbiol Biotechnol.* 2002;60(3):258–274. doi:10.1007/s00253-002-1076-7.
26. Yu S, Weaver V, Martin K, Cantorna MT. The effects of whole mushrooms during inflammation. *BMC Immunol.* 2009;10:12. doi:10.1186/1471-2172-10-12.