International Journal of Botany Studies
ISSN: 2455-541X; Impact Factor: RJIF 5.12
Received: 25-03-2021; Accepted: 18-04-2021: Published: 27-04-2021
www.botanyjournals.com
Volume 6; Issue 2; 2021; Page No. 628-631

Nutritional composition and health benefits of mushroom: A review

Kirti Joshi, Krutika, Sakshi Pandey, Manisha Singh
Assistant Professor (Nutrition & Food Science) Jayoti Vidyapeeth Women's University, Jaipur, Rajasthan, India

Abstract
Mushrooms play an important role in human diet as food, as medicine, as legends, in folk lore and religion. Mushrooms are basically consumed for their taste, aroma and texture. Nutritional composition of mushrooms lies among that of vegetables and meat. Mushrooms contain good amount of proteins, minerals and vitamins and low in fat content (2-8%) unique nutritional constitution of mushrooms makes low calorie food and choice diet for those suffering from hypertension, obesity, arthrosclerosis and diabetes. Many higher mushrooms are known to contain a number of biologically active components that show promising antitumor and immunomodulating, cardiovascular, hypocholesterolemic, hepatoprotective, antiviral, antiphrastic, antibacterial and antidiabetic effects. In recent years Mushrooms become trended as health - beneficent food and also in pharmaceutical industries as sources for the development of drug. From the review it was observed that developing countries should harness the potentials of mushrooms as this would boost healthy living and the revenue income.

Keywords: mushrooms, medicinal value, nutritional value, human health

Introduction

Mushrooms are macro fungi with distinctive fruiting bodies which are either hypogenous or epigenous, sufficiently noticeable with naked eye and hand-picked (Chang and Miles, 1982). Mushrooms are lively in legends as, fairy egg and witches egg (Molitoris, 2001). Human use of mushrooms extent as early to 5000 BC. About 2000 species of edible mushrooms are known all over the world. Some mushrooms have been used in religious ceremonies of many ancient people and primitive tribes. Mushrooms are believed by the Romans to have properties that could produce super human strength, help in finding lost objects and lead the soul to the realm of the gods (Grube *et al*., 2001) [3]. The appraisal of mushrooms as highly nutritive foodstuff is well founded. Many kinds of mushrooms are edible, and at the same time possess tonic and medical attributes (Chang, 1999). Edible mushrooms are important sources of food. They are consumed not only for their natural flavour and taste, but also for their important nutritional value. On fresh weight basis mushrooms are higher in protein content (Aremu *et al*., 2009) [1] to all vegetables and fruits, but are lesser to meat and dairy products, which are the conventional protein sources. On dry-weight basis, however, mushrooms are similar with respect to dried-yeast and superior to dried peas and beans.

The most cultivated mushroom species were divided into edible mushrooms with the representatives of *Pleurotus ostreatus, Lentin-ulaedodes, Agaricus bisporus, Flammulina velutipes* and *Auricularia auricular*, and medicinal mushrooms mainly includes *Ganoderma lucidum*, *Cordyceps sinensis* and *Poria Cocos.* China was documented as the most primitive country to grow mushrooms, with the highest mushrooms production the United States, Italy, Poland and Netherlands. Particularly, civilizations from China, Early Greek, Egypt, Roman and Mexico were treated and appreciated mushrooms as functional culinary delicacies and even as medicine for a long history. Most mushroom derived preparation and substances find their use not as pharmaceutical but as a novel class of Dietary Supplements (DS) or 'nutraceutical'. A mushroom nutraceuticals is a dried biomass and refined or partially refined extract from either the mycelium or the fruiting body of the mushroom, which is consumed in the form of capsule or tablets as a dietary supplement and which may enhance the immune response of human body, thereby increasing resistance to disease and in some cases causing regression of a disease state (Wasser *et al*., 2000).

Many pharmaceutical substances with potent and unique properties were isolated from mushroom and distributed worldwide (Wasser and Weis, 1999). Extensive clinical studies have explicitly illustrated that a number of mushroom species have medicinal as well as therapeutic impotance in the treatment or prevention of cancer, viral disease, hypercholesterolemia, blood platelet aggregation, and hypertension (Jong *et al*., 1991 etc. (Subramanian, 1995). Among the 14,000 species known, 2000 are safe and about 600 have significant pharmacological properties (Wasser *et al*., 2000). Information about the bioactive arrangements and healthy benefits of various mushrooms have been expanded greatly significant in the previous quite a while, from which the mushrooms were characterized as an expected practical food with the high substance of dietary fiber and low content of fat. Moreover, the high quality of protins including most of the essential amino acids were also found in mushrooms, as well as the numerous vitamins and mineral sub-stances (Thatoi and Singdevsachan, 2014). Specifically, the bioactive nutraceuticals detected in mushrooms were polysaccharides (Cheung, 2013; Ruthes, 2016) [5, 2] proteins (Enshasy, R. Hatti-Kaul, 2013), glycoproteins (Kumar, 2015) [7], unsaturated fatty acids (Tel-Cayan, *et al*., 2017) [8], phenolic compounds (Heleno, 2015], tocopherols (Khatua, and Paul, 2013) [9], ergosterols (Barreira and Oliveira, 2014) [10], lectins (Singh *et al*., 2014) etc.

Additionally, the high caliber of protins including the majority of the essential amino acids were likewise found in

mushrooms, just as the various nutrients and mineral substances (Thatoi and Singdevsachan, 2014). In particular, the bioactive nutraceuticals distinguished in mushrooms were polysaccharides (Cheung, 2013; Ruthes, 2016) [5, 2] proteins (Enshasy, R. Hatti-Kaul, 2013) [6], glycoproteins (Kumar, 2015) [7], unsaturated fats (Tel-Cayan, *et al*., 2017) [8], phenolic mixes (Heleno, 2015], toco-pherols (Khatua, and Paul, 2013) [9], ergosterols (Barreira and Oliveira, 2014) [10], lectins (Singh *et al*., 2014) [11] and so on. Innumerable studies focusing on the health and therapeutic benefits of mushrooms explicit bioactive nutraceuticals have been done as of late, including the invulnerable capacity improvement, antitumor, against irritation, cell reinforcement, antifungal, Antibacterial and antiviral exercises (Rathore, 2017) [12]. Besides, mushroom have likewise been demonstrated owes the capacities of constricting the wellbeing dangers instigated by obesity hypotensive, hypolipedemic, hypertension and the debilitated capacities brought about by maturing (Ghosh, 2016; Person, 20161; Yahaya, 2014; Thangthaeng, 2015; Sayeed, 2015) [13].

As per the depictions, knowledge concerning the health benefits and functioning mechanisms of mushrooms supplementation has become a captivating interest in the area of food and nutrition and added to the detailing of the more balanced diet pattern by all human, which will develop another way for the prevention even cure some major diseases, malignant growth, heart and anxiety issues. In this unique circumstance, we pointed toward giving a summarization and overview of nutritional and therapeutic benefits the of mushrooms, including the bioactive nutraceuticals in mushrooms and their functioning mechanisms, which could be conducive to the better understanding of the correlations between the mushroom consumption and health improvement, and evaluate the advantages of the insertion of mushrooms into human diet, consequently.

Nutritional Benefits

Ediable Mushrooms are significant sources of nutrient. They form very nourishing meals especially for invalids, for they are easily digestible. Mushrooms are consumed not only for their natural flavor and taste, but also for their important nutritional value. The nutrient content varies from species and depends on their growth requirement. Mushrooms have a high percentage of water 93-95% as compared to learn beef (70%) and fresh vegetables (92%). On fresh weight basis mushrooms are superior in protein content (Aremu *et al*., 2009) [1] to all vegetables and fruits, but are inferior to meat and dairy products, which are the conventional protein sources. 100 g of fresh mushrooms contains 5.3-14.8 g of dry matter, 1.5-6.7 g of carbohydrates, 1.5-3.0 g of protein and 0.3-0.4 g of fat. On dry-weight basis, however, mushrooms are similar with respect to dried-yeast and superior to dried peas and beans. On dry weight basis mushrooms contribute 56% carbohydrate, 30% protein, 2% fat and also 10% ash. The absence of starch in mushrooms makes it an ideal food for diabetic patients and for persons who wants to shed excess fat. Mushrooms are non-photosynthetic organisms therefore, sugars, carbohydrates are present in lower proportions than vegetables such as carrots and sprouts, and so provide only a fraction of the energy requirement. Kettawan *et al.*, (2011).

Mushrooms provide a high protein and low caloric diet and can thus be recommended to heart patients. They also contain all the essential amino-acid required by an adult (Koyyalamudi *et al*., 2009). Tryptophan and lysine are present in high amount as compared to cystein and methionine. Mushroom proteins contain all the essential amino acids and are especially rich in lysine and leucine, which are lacking in most staple cereal food. There are about eight essential amino acids, that is, those which cannot be produced by the human body, and so must be consumed in the diet daily. Mushroom protein appears to be intermediate in nutritional qualities between meat and vegetable proteins. Some species like provide nutritive value comparable to that of meats and milk, but *P.ostreatus* due to low protein content, and deficiency in some essential amino acids has a low nutritive value (Bano and Rajarathnam, 1982). Apart from protein compounds, free amino acids, chitin, amines, nucleic acids and urea can also be found in mushrooms.

Mushrooms like most vegetable are characteristically cholesterol-free food comprising of 2-8% fat on dry weight basis. The crude fat includes representatives of all classes of lipid compounds including free fatty acids, glycerides, sterols, and phospholipids. Of existing fatty acids, a high proportion are linoleic acid (the only essential fatty acid required in the human diet), that constituting63-74% of total fatty acids. Oyster mushrooms also possess bioactive compounds with hypocholesterolaemic activities, such as polysaccharides, mevinolin and other statins (Gunde-Cimerman and Plemenitas, 2001). *P. citrinopileatus* fruiting body extracts have been shown to have antihyperlipidaemic effects that may lower serum triglyceride and cholesterol (Hu *et al*., 2006). The low total fat content, and high proportion of polyunsaturated fatty acids (72-85%) relative to total fatty acids, is considered a significant contribution to the health value to mushrooms

The fructifications of mushrooms are characterized by high levels of well assimilable mineral constituent (Mattila *et al*., 2001) whose level depends on the species and age of the mushrooms, the diameter of the pilei and on the substratum (Demirbas, 2001). There are many essential vitamins required daily in our diet. Mushrooms are important sources of vitamins especially of group B particularly thiamine, riboflavin, pyridoxine, pantothenic acid, nicotinic acid, nicotinamide, folic acid and cobalamine, other vitamins, such as ergosterol, biotin, vitamin C and tocopherols are also present (Ukpebor *et al*., 2007; Mattila *et al*., 2001). Vegetarians are aware of that mushrooms are one of the best plant-based sources of niacin around the world and 100 g of fresh mushrooms provide more than a quarter of the adult daily requirement of this vitamin. Mushrooms are unique in that they contain vitamin B12, something that is not present in vegetables. Since B12 is mainly of animal origin, deficiency is commonly associated with vegetarian diets. Mushrooms were found to contain 0.32-0.65 mg of B12 per g, allowing just 3 g of fresh mushrooms to provide the RDA of this vitamin. Vegetarians may find this a useful way of getting this important nutrient. Vitamin A is uncommon although several mushrooms contain detectable amounts of pro-vitamin-A measured as the β-carotene equivalent. Most cultivated mushrooms are believed to contain low amounts of the fat soluble vitamins, K and E, expect vitamin D which is present in good amount and only a small of vitamin C (Bernas *et al*. 2006). Mushrooms also contain many mineral salts (Mattila *et al*., 2001). They also contain valuable

minerals such as iron, potassium, phosphorus, calcium and copper,

Kettawan *et al*., (2011) and Selvi *et al* (2007) have demonstrated that mushrooms contain antioxidants. They can be successfully used as appetizers in marinated form and also as an ingredient in soups, sauces, salads, stuffing and meat dishes (Achremowicz *et al*., 1983).

Medicinal Benefits

A nutraceuticals can be defined as a substance that may be considered a food or part of a food that provides medical or health benefits like the prevention and treatment of disease. Mushrooms have become attractive as a functional food and as a source for the development of drugs and nutraceuticals (Lakhanpal and Rana, 2005) responsible with their antioxidant, antitumor (Jones and Janardhanan, 2000) and antimicrobial properties.

Antioxidant compounds prevent oxidative damage related to aging and diseases, such as atherosclerosis, diabetes, cancer and cirrhosis. Mushrooms that contain antioxidants or increase antioxidant enzyme activity may be used to reduce oxidative damage in humans (Yang *et al*., 2002). Recently extracts from fruiting bodies and mycelia of Ganoderma species and Volvariella found to possess *in vitro* antioxidant activity (Jones and Janardhanan, 2000; Lakshmi *et al*., 2003; Mau *et al*., 2002; Mathew *et al*., 2008) and antimutagenic activities (Lakshmi *et al*., 2003). Oyster mushrooms (species of genus Pleurotus) are highly edible and nutritious, rank second among the commercially cultivated mushrooms in the world (Chang, 1999) and are demonstrated to possess antioxidant, anti-inflammatory and antitumor activities (Jose and Janardhanan, 2000. Currently, several extracts have wide spread use in Japan, Korea, and China, as adjuncts to radiation treatments and chemotherapy (Smith *et al*, 2002; Borchers *et al*, 2008). Mushrooms that have psychoactive substances have been used as sacraments for healing (Mental and physical) (Hudler 2000). Certain mushrooms, especially polypores like Reishi were thought to be able to benefit a wide variety of health ailments (Sarfaraz *et al*, 2009.). Of 89 mushroom species tested, an extract from *P.cornucopiae* possessed the most effective antigenotoxic and bio-antimutagenic activities when tested on *Salmonella typhimurium* and *Escherichia coli* (Filipic *et al*., 2002). Oyster mushrooms possess bioactive compounds with hypocholesterolaemic activities, such as polysaccharides, mevinolin and other statins (Gunde-Cimerman and Plemenitas, 2001). It has recently been reported that *P.citrinopileatus* fruiting body extracts exerted antihyperlipidaemic effects. Antibacterial and antifungal activities have been observed in *Pleurotus spp* extracts and isolated compounds, presumably produced as a defense mechanism against other organisms (Ngai & Ng, 2006).

Apart from their nutritive values, mushrooms also have potential medicinal benefits especially as antitumour. Abulude, (2005); Kuforiji and Fasidi, (2008) and Kettawan *et al*., (2011) elaborated on the medicinal uses of Pleurotus tuber-regium and stated that these mushrooms can be used in combination with other herbs as ingredients to care ailments such as chest pain, cold, dropsy, fever, headache, smallpox and stomach pains. The low carbohydrate content of mushrooms makes it an ideal food for diabetics and people who intend to control their body weight.

A number of mushroom species are known to possess medicinal properties where Ganoderma, king of medicinal mushrooms, and Lentinula, are the most important genera (Chang, 1996). *Lentinula edodes* (shiitake), *Grifola frondosa* (maitake) have a history of medicinal use spanning millennia in parts of Asia. Medicinal mushroom research has indicated possible cardiovascular, anticancer, antiviral, antibacterial, antiparasitic, anti-inflammatory, hepatoprotective, and antidiabetic activities (Lentinan, 2009). Amanita muscaria used therapeutically as a powder, tincture for swollen glands, nervous troubles and epilepsy etc. A lotion made out of this can be used externally and internally for the ailments of heart and inflammation of eye. *Amanita phalloids* is used against cholera and intermittent fever. Psilocybin and psilocin are two other drugs extracted from *Psilocybe mexicana* used to treat mental disorders (Bahl, 1987). Significant pharmacological effects or physiological properties of mushrooms are bioregulation (immunological enhancement), maintenance of homeostasis, and regulation of biorhythm, cure of various diseases and prevention and 10 improvement of life threatening diseases such as cancer, cerebral stroke and heart diseases. It is also confirmed that mushrooms have effective substances for antifungal, anti-inflammatory, antitumor, antiviral, antibacterial, hepatoprotective, antidiabetic, hypolipedemic, antithrombotic, hypertensive and other applications (Wasser and Weis, 1999).

Conclusion

The present review described, nutritional as well as medicinal benefits, suggesting the mushrooms could considered as a valuable, complete and suitable health dietary food, which could be consumed by all age groups depending on its richness in polysaccharides, proteins and other functional ingredients with multiple bioactivities. Moreover, the mushrooms, along with the numerous bioactive nutraceuticals, could also be utilized as the efficient material for the development of functional foods based on the immense nutritional supremacy. Such bioactive molecules like polysaccharides, terpenoids, proteins and polyphenols, which displayed a critical role in enhancing the immune strength, lowering and preventing risks of cancers, inhibiting the proliferation of tumor cells growth, protecting the nervous system from the damage of aging etc. Moreover, the prebiotic effects estimated by mushrooms were attracting the main attentions of the researchers all around.

References

1. Aremu MO, Basuk, Gyan SD, Goyal A, Bhowmik PK, Datta Banik. S. Proximate composition and functional properties of mushroom flours from *Ganoderma* spp, Omphalotus Olearius (DC) sing and Hebeloma mesphaeum(Pers) Quels used in Nassarawa State, Nigeria. Mal of Journal Nutrition,2009:15(2):233-241.
2. Ruthes AC, Smiderle FR, Iacomini M. Mushroom hetero polysaccharides: areview on their sources, structure and biological effects, Carbohydrate. Polym,2016:136(2016):358-375.
3. Grube BJ, England ET, Kao YC. White bottom mushroom phytochemicals inhibit arometase activity and breast cancer cell proliferation. Journal of Nutrition,2001:12:3288-3293.
4. Thatoi H, Singdevsachan SK. Diversity, nutritional composition and medicinal potential of Indian

mushrooms: a review. Afr. J Biotechnol,2014:13:523-545.
5. Cheung PC. Mini-review on edible mushrooms as source of dietary fiber: preparation and health benefits. Food. Sci. Hum. Welln.2013:2:162-166.
6. El Enshasy HA, Hatti-Kaul R. Mushroom immune modulators: unique molecules with unlimited applications. Trends Biotechno,2013:31:668-677.
7. Kumar K. Role of edible mushrooms as functional foods-a review. South Asian J Food Technol. Environ,2015:1:211-218.
8. Tel-Cayan GT, Ozturk M, Duru R. Fatty acid profiles in wild mushroom species from Anatolia. Chem. Nat. Compd,2017:53:351-353
9. Khatua S, Paul S, Acharya K. Mushroom as the potential source of new generation of antioxidant: a review. Res. J Pharm. Technol,2013:6:496-505.
10. Barreira JC, Oliveira MBP, Ferreira IC. Development of a novel methodology for the analysis of ergosterol in mushrooms. Food Anal. Method,2014:7:217–223.
11. Singh SS, Wang H, Chan YS. B. Lectins from edible mushrooms. Molecules,2014:20:446-469.
12. Rathore H, Prasad S, Sharma S. Mushroom nutraceuticals for improved nutrition and better human health: a review. Pharma Nutr,2017:5:35-46.
13. Goyal R, Grewal R, Goyal RK, Grewal RB. Vitamin and mineral content of Agaricus bisporus (white button) and Pleurotus sajor-caju (dhingri) mushrooms. Int. J. Food Sci. Nutr. 2020;5:100-2.
14. Ghosh K. A review: edible mushrooms as source of dietary fiber and its health effects. J Phys. Sci, 2016, 21.