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The Advantages of Incorporating Mushrooms into Your Diet

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Mushrooms are the fruiting bodies of some members of a lower group of plants known as fungi. The fungi are characterized by the absence of chlorophyll and undifferentiated bodies except the spore bearing structures. The fruiting bodies, mushrooms, are fleshy spore bearing structures of the fungi. They contain numerous spores, functionally similar to seeds of the higher plants for propagation of fungi. Mushrooms appearing after rains in various shapes, sizes and colour have fascinated human being since time immemorial and were sure to draw the attention of humans even when they were living as hunters and gatherers. Even though, man started agriculture 10,000 years ago, the cultivation of mushrooms is a relatively new phenomenon and has picked up across the globe only in the last century that has witnessed newer innovations and applications. The Chinese were reportedly the first to artificially cultivate tropical and sub-tropical mushrooms thousands of years back but commercial production started in Europe with button mushrooms in caves during 16th and 17th centuries. The mushroom cultivation then made its way to the United States.

The most cultivated mushroom worldwide is *Agaricus bisporus*, followed by *Lentinus edodes*, *Pleurotus* spp., and *Flammulina velutipes*. Mushrooms production continuously increases, China being the biggest producer around the world. However, wild mushrooms are becoming more important for their nutritional, sensory, and especially pharmacological characteristics. Moreover, edible mushrooms provide a nutritionally significant content of vitamins. Thus, they could be an excellent source of many different nutraceuticals and might be used directly in human diet and to promote health for the synergistic effects of all the bioactive compounds present. A balanced diet is the supporting treatment for the prevention of illness and especially against oxidative stress. In this context, mushrooms have a long history of use in the oriental medicine to prevent and fight numerous diseases. Nowadays, mushroom extracts are commercialized as dietary supplements for their properties, mainly for the enhancement of immune function and antitumor activity.

Mushrooms are divided into four categories

- **Edible mushrooms:** Those which are fleshy and edible, e.g., *Pleurotus* spp. *Agaricus* spp. and *Volvariella* spp. etc.
- **Medicinal mushrooms:** Those which are considered to have medicinal applications, e.g., *Ganoderma lucidum*, *Cordyceps sinensis* etc.
- **Poisonous mushrooms:** Those which are proven to be, or suspected of being poisonous e.g., *Amanita phalloides.*
- **Miscellaneous category:** A large number of mushrooms whose properties remain less understood.

Nutritional values of Mushrooms

Mushroom is considered to be a complete, health food and suitable for all age groups, child to aged people as it contains all nutrient element required for human in desired proportion. The nutritional value of mushroom is affected by numerous factors such as species, variety, stage of development and environmental conditions. Mushrooms are rich in protein, dietary fiber, vitamins and minerals. The major proportion of carbohydrate is occupied by dietary and fermentable fibers and it do not contain starch with insignificant proportion of sugars. Edible mushrooms contain rich proteins that are composed of theronine and valine but deficient in sulphur containing amino acids (ethionine and cysteine). The low lipid level with no cholesterol and higher proportion of polyunsaturated fatty acids is further advantage. The ergosterol present in mushrooms is the precursor for Vitamin D synthesis in human body. Nutrition compound of mushroom as below.

Protein - Most mushrooms have a high protein content, usually around 20-30% by dry weight. Digestibility of mushroom protein to be as high as 72 to 83%. Protein content depends on the composition of the substratum, size of pileus, harvest time and species of mushrooms. 46.5% protein on dry weight basis in Agaricus bisporus. 30.16, 28.16, 34.7 and 29.16% protein in dried mycelium of A. campestris, Agaricus arvensis, M. esculenta and Morchella deliciosa respectively. On a dry weight basis, mushrooms normally contain 19 to 35% proteins as compared to 7.3% in rice, 12.7% in wheat, 38.1% in soybean and 9.4% in corn. Mushrooms contain all the essential amino acids required by an adult.

Corbohydrate - 50 to 65% on dry weight basis. Free sugar (Mono & disaccharides) Free sugars amounts to about 11%, Mannitol, 80% of the total free sugar (used as sweetener for diabetic patient diet). Raffinose, sucrose, glucose, fructose and xylose are dominant in Agaricus bisporus. Water soluble polysaccharides of mushrooms are antitumor.

Fiber - Helps lower cholesterol and is important for the digestive system.

Vitamin D - Essential for the absorption of calcium.

Minerals - Major mineral constituents in mushrooms are K, P, Na, Ca, Mg Cu, Zn, Fe, Mo, Cd form minor constituents. K, P, Na and Mg constitute about 56 to 70% of the total ash content of the mushrooms. Mushrooms have been found to accumulate heavy metals like cadmium, lead, arsenic, copper, nickel, silver, chromium and mercury The mineral proportions vary according to the species, age, the diameter of the fruiting body, type of the substratum, mineral content of wild edible mushrooms has been found higher than cultivated ones. Some as below.

Copper- Aids in helping the body absorb oxygen and create red blood cells.

Selenium - An antioxidant that helps neutralize free radicals, thus preventing cell damage and reducing the risk of cancer and other diseases. Mushrooms contain more selenium than any other form of produce.

Potassium - An extremely important mineral that regulates blood pressure and keeps cells functioning properly.

Other Important minerals - Such as phosphorous, zinc, and magnesium. Low levels of fat, calories, and sodium no cholesterol.

Table 1: Nutritive values of different mushrooms (dry weight basis g/100g)

Mushroom	Carbohydrate	Fibre	Protein	Fat	Ash	Energy k.cal
Agaricus bisporous	46.17	20.90	33.48	3.10	5.70	499
Pleurotus sajor-caju	63.40	48.60	19.23	2.70	6.32	412
Lentinula edodes	47.60	28.80	32.93	3.73	5.20	387
Pleurotus ostreatus	57.60	8.70	30.40	2.20	9.80	265
Vovarella volvaceae	54.80	5.50	37.50	2.60	1.10	305
Calocybe indica	64.26	3.40	17.69	4.10	7.43	391
Flammulina velutipes	73.10	3.70	17.60	1.90	7.40	378
Auricularia auricula	82.80	19.80	4.20	8.30	4.70	351

Medicinal values

Since thousands of years, edible fungi have been revered for their immense health benefits and extensively used in folk medicine. Specific biochemical compounds in mushrooms are responsible for improving human health in many ways. These bioactive compounds include polysaccharides, tri-terpenoids, low molecular weight proteins, glycoprotins and immunomodulating compounds. Hence mushrooms have been shown to promote immune function; boost health; lower the risk of cancer; inhibit tumor growth; help balancing blood sugar; ward off viruses, bacteria, and fungi; reduce inflammation; and support the body's detoxification mechanisms. Increasing recognition of mushrooms in complementing conventional medicines is also well known for fighting many diseases.

Good for heart: The edible mushrooms have little fat with higher proportion of unsaturated fatty acids and absence of cholesterol and consequently it is the relevant choice for heart patients and treating cardiovascular diseases. Minimal sodium with rich potassium in mushroom enhances salt balance and maintaining blood circulation in human. Hence, mushrooms are suitable for people suffering from high blood pressure. Regular consumption of mushrooms like *Lentinula, Pleurotus spp* were stern to decrease cholesterol levels.

Table 2: Medicinal values of some important mushrooms

Mushroom	Compounds	Medicinal properties	Courtesy
Ganoderma lucidum	Ganoderic acid Beta-glucan	Augments immune system Liver protection Antibiotic properties Inhibits cholesterol synthesis	Lin and Zhang, 2004 Wang et al., 2007 Moradali et al., 2006 Komoda et al., 1989
Lentinula edodes	Eritadenine Lentinan	Lower cholestrol Anti-cancer agent	Enman et al., 2007
A. bisporous	Lectins	Enhance insulin secretion	Ahmad, 1984
P. sajor-caju	Lovastatin	Lower cholesterol	Gunde and Cimerman, 1995
G. frondosa	Polysaccharide Lectins	Increases insulin secretion Decrease blood glucose	Horio and Ohtsuru, 2001
Auricularia auricula	Acidic polysaccharides	Decrease blood glucose	Yuan et al., 1998
Flammulina velutipes	Ergothioneine Proflamin	Antioxidant Anti-cancer activity	Bao (2008) Ikekawa et al., 1985
Trametes versicolor	Polysaccharide-K (Kresin)	Decrease immune system depression	Coles and Toth, 2005
Cordyceps sinensis	Cordycepin	Cure lung infections Hypoglycemic activity Cellular health properties Anti-depressant activity	Li et al., 2006 Ko et al., 2009 Nishizawa et al., 2007

Low calorie food: The diabetic patients choose mushroom as an ideal food due to its low calorific value, no starch, and little fat and sugars. The lean proteins present in mushrooms help to burn cholesterol in the body. Thus, it is most preferable food for people striving to shed their extra weight.

Prevents cancer: Compounds restricting tumor activity are found in some mushrooms but only a limited number have undergone clinical trials. All forms of edible mushrooms, and white button mushrooms in particular, can prevent prostate and breast cancer. Fresh mushrooms are capable of arresting the action of 5-alpha-reductase and aromatase, chemicals

responsible for growth of cancerous tumors. The drug known as Polysaccharide-K (Kresin), is isolated from *Trametes versicolor* (*Coriolus versicolor*), which is used as a leading cancer drug. Some mushroom-derived polysaccharides have ability to reduce the side effects of radiotherapy and chemotherapy too. Such effects have been clinically validated in mushrooms like *Lentinula edodes, Tramtes versicolor, Agaricus bisporous* and others.

Anti-aging property: The polysaccharides from mushrooms are potent scavengers of super oxide free radicals. These antioxidants prevent the action of free radicals in the body, consequently reducing the aging process. Ergothioneine is a specific antioxidant found in *Flammulina velutipes* and *Agaricus bisporus* which is necessary for healthy eyes, kidney, bone marrow, liver and skin.

1. **Regulates digestive system:** The fermentable fiber as well as oligosaccharide from mushrooms acts as a prebiotics in intestine and therefore they anchor useful bacteria in the colon. This dietary fibre assists the digestion process and healthy functioning of bowel system.
2. **Strengthens immunity:** Mushrooms are capable of strengthening the immune system. A diverse collection of polysaccharides (beta-glucans) and minerals, isolated from mushroom is responsible for up-regulating the immune system. These compounds potentiate the host's innate (non-specific) and acquired (specific) immune responses and activate all kinds of immune cells.

Mushrooms, akin to plants, have a great potential for the production quality food. These are the source of bioactive metabolites and are a prolific resource for drugs. Knowledge advancement in biochemistry, biotechnology and molecular biology boosts application of mushrooms in medical sciences. From a holistic consideration, the edible mushrooms and its by-products may offer highly palatable, nutritious and healthy food besides its pharmacological benefits.

Still there are enough challenges ahead. Until now, how these products works is elusive and vast number of potential wild mushrooms are not explored. The utility of mycelia is paid little attention but it has tremendous potential, as it can be produced year around with defined standard. Knowledge on dose requirement, route and timing of administration, mechanism of action and site of activity is also lacking. Work is under progress in various laboratories across the world to validate these medicinal properties and isolation of new compounds. If these challenges are meet out in the coming days, mushroom industries will play a lead role in neutraceutical and pharmaceutical industries. The increasing awareness about high nutritional value accompanied by medicinal properties means that mushrooms are going to be important food item in coming days and at places may emerge as an alternate to non-vegetarian foods. Growing mushroom is economically and ecologically beneficial. Consuming mushroom is beneficial in every respect.

References

1. S.-T. Chang and P. G. Miles, Mushrooms: Cultivation, Nutritional Value, Medicinal Effect, and Environmental Impact, CRC Press, Boca Raton, Fla, USA, 2nd edition, 2008.
2. P. G. Ergon¨ ul, I. Akata, F. Kalyoncu, and B. Erg ¨ on¨ ul, "Fatty ¨ acid compositions of six wild edible mushroom species," The Scientific World Journal, vol. 2013, Article ID 163964, 4 pages, 2013.
3. S. Patel and A. Goyal, "Recent developments in mushrooms as anticancer therapeutics: a review," 3 Biotech, vol. 2, no. 1, pp. 1– 15, 2012.
4. M. Alves, I. F. R. Ferreira, J. Dias, V. Teixeira, A. Martins, and M. Pintado, "A review on antimicrobial activity of mushroom (Basidiomycetes) extracts and isolated compounds," Planta Medica, vol. 78, no. 16, pp. 1707–1718, 2012.

5. Manikandan, K., 2011. Nutritional and medicinal values of mushrooms. *Mushrooms cultivation, marketing and consumption*, pp.11-14.
6. S. A. Heleno, L. Barros, M. J. Sousa, A. Martins, and I. C. F. R. Ferreira, "Tocopherols composition of Portuguese wild mushrooms with antioxidant capacity," Food Chemistry, vol. 119, no. 4, pp. 1443–1450, 2010.
7. L. Barros, P. Baptista, D. M. Correia, S. Casal, B. Oliveira, and I. C. F. R. Ferreira, "Fatty acid and sugar compositions, and nutritional value of five wild edible mushrooms from Northeast Portugal," Food Chemistry, vol. 105, no. 1, pp. 140–145, 2007.
8. C. F. R. Ferreira, L. Barros, and R. M. V. Abreu, "Antioxidants in wild mushrooms," Current Medicinal Chemistry, vol. 16, no. 12, pp. 1543–1560, 2009.