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Health Secrets of Shiitake Mushroom

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Abstract
The shiitake mushroom, Lentinula edodes (Berkeley) Pegler [Lentinus edodes (Berkeley) Singer], is the second most popular edible mushroom in the global market. According to ancient Chinese medical theory, consumption of the shiitake was recommended for long life and good health. It is excellent in its nutritional value, it is particularly good source of the vitamin B (thiamine), B (riboflavin), B (niacin) and D. it also contains all the essential amino acids and dietary fibre. It is also full of other micronutrients. Lentinan is the main component of the shiitake and it provide many clinically significant functions for the human being. In the present study we have collected and listed several nutritional and medicinal value the Lentinula edodes.

Introduction
Mushroom are the edible fungus belongs to the phylum Basidiomycota. They are the multicellular, eukaryotic, macro-fungi, bearing spores and achlorophyllous as saprophytes on decomposed matter and also depends on the substrate which are rich in lignin for their survival. The shiitake has a medium- sized, umbrella-shaped, tan to brown cap, the edges of the cap roll inwards, the underside and stem are white. Shiitake mushroom (*Lentinula edodes*) is one among the six popular edible mushroom viz., grey oyster mushroom (*Pleurotus ostreatus*), button mushroom (*Agaricus bisporus*), paddy straw mushroom (*Volvariella volvacea*), Reishi or lingzhi mushroom (*Ganoderma lucidum*) and maitake mushroom (*Grifola frondose*) in the world accounting 26 per cent in term of tons (ICAR-DMR, Solan) of total mushroom production. This mushroom is the second most widely cultivated mushroom in the world.

It has been estimated that the origin of shiitake mushrooms can be traced to the cretaceous period, over one hundred million years ago. It is found growing wild in the mountainous regions of China, Japan, Indonesia and Taiwan.

Shiitake mushroom has been recognized and familiar as golden oak Mushroom, oak wood mushroom, black mushroom and black forest mushroom. This mushroom is fat free and containing less cholesterol, low gluten and sodium content (9 mg/100 g). Besides this, in fruit bodies elements such as potassium (304 mg/100 g). phosphorous (112 mg/100 g). magnesium (20 mg/100 g), iron (0.4mg/100 g), copper (0.142 mg/100 g), zinc (1 mg/100 g), calcium (2 mg/100 g) and manganese (20 mg/100 g) are plenty in nature. It is rich in protein, lipid, carbohydrates, fibres, ergosterols, antioxidants and vitamins like provitamin-D which are not found in other food supplements.

Most of the edible mushrooms are sold freshly in the market after harvesting while the shiitake mushroom has the special property of selling in both fresh and dried forms. Because of greater shelf-life and well characterized mushroom used for pharmaceutical industries. Shiitake is getting popularity in the current scenario. Several medicinal properties had

credited to this mushroom with important properties like antitumor polysaccharides activity, conjugated proteins activity, antivirals activity, platelet agglutinations and anti-cholesterol active substances. It is having antifungal, antibacterial, and anticarcinogenic properties, reduces cardiovascular effects, also it is having anti-thrombotic effects, anti-hepatitis effects, antihypertensive effects, anti-obesity effects. The extract of mushroom improves the appearance of skin (Tokuda, 1974; Fujii *et al.*1978; Tokuda and Kaneda, 1978; Suzukki *et al.*, 1979; Mizuno, 1995; Wasser, 2002).

General nutrition value

It is excellent in its nutritional value, it is particularly good source of the vitamin B (thiamine), B (riboflavin), B (niacin) and D. it also contains all the essential amino acids and dietary fibre. The caloric value of 100 g of dried shiitake is higher than 100 g of raw potatoes (80jcaal) or beef loin (224kcal), but lower than that of whole wheat or brown rice (328-350) the protein content of dried shiitake is comparable to that of chicken, pork and beef but the fat count is much lower and the dietary fibre is considerably higher than those meats. Shiitake contains almost all the essential amino acids, with lysine and arginine being particularly abundant (Liu and Bau, 1980) and methionine and phenylamine less abundant (Lasota and Sylwestrazak, 1980). It has been analysis in laboratory that amino acid, protein, glycogen, lipids, ascorbic acid, and the total ash contents increased as the fruiting body developed (Fasidi and Kadiri, 1990). Based on these finding, it is desirable to consume fully mature fruiting bodies for maximum nutritional value. Higher amount of ergosterol in the fresh shiitake makes dried shiitake an important vitamin D source because ergosterol converts to vitamin D2 in presence of sunlight

Eating shiitake can prevent various vitamin B and D deficiencies including beri-beri (thiamine); cheilosis, glossitis, corneal vascularization, seborrheic dermatitis, nerve tissue damage (riboflavin); abnormal growth in infants and children (niacin); and rickets (vitamin D). Vitamin D boosts calcium absorption and thus plays and important role in bone formation.

Major active compounds isolated from *Lentinula edodes*

Lentinan- Lentinan is a β-glucan (Hamuro et al., 1976)

- A cell- wall constituent extracted from the fruiting bodies or mycelium of *L. edodes*
- A highly purified, high molecular weight polysaccharide (Of about one million)
- Containing only glucose molecules with mostly Beta-(1-3)-D-glucan linkages
- Free of any nitrogen (and thus protein), phosphorus ,sulphur, or any other atoms except carbon, oxygen, and hydrogen (Chihara, 1981)
- Water soluble, heat -stable acid stable and alkali- labile (Aoki 1984b)
- Lentinan appears to improves homeostasis of the host against cancer or infection (Chihara et al., 1989). It has no direct cytotoxicity to target cells; its action is host mediated. It activates the classical and alternative pathways of the complement system and augments the responsiveness of the host through maturation, differentiation, and proliferation of lymphoid and other physiologically important cells. The fact that lentinan is a T-cell oriented adjuvant, in which macrophages play some part, distinguishes it from other well-known immunopotentiators (Hamuro et al., 1976). It potentiates the induction of different types of anti-tumour effector cells, such as killer T cells, NK cells, and cytotoxic macrophages (Chihara, 1983; Chihara et aI., 1987). The effector cells may act either selectively or non-selectively on target cells. They act on lymphocytes, hepatocytes, vascular endothelial cells, or synovial fibroblasts, causing the many host defence reactions associated with inflammation and immunity.

LEM

- *L. edodes* mycelial extract

- A preparation of powdered mycelia extracts of L. edodes harvested before the cap and stem grow
- Containing a heteroglycan protein conjugate, that is a protein- bound polysaccharide
- Containing protein sugar mostly the pentose, including xylose (a wood sugar) and arabinose (a pectin sugar) as well as glucose and smaller amount of galactose, mannose and fructose
- Containing nucleic acid derivatives, viatmins B compound especially B1 and B2, ergosterol; and eritadenine (Breeene 1990)
- Also containing water- soluble lignins (Hanafusa et al 1990)

KS-2

- A polysaccharide containing alfa linked mannose and a small amount of peptide isolates (Fuji et al.)

JLS

- A compound derived from the mycelium
- JLS -18, consisting of lignin, polysaccharides and proteins

Eritadenine

- A nucleic acid derivative

EPS and EPS4

- WATER soluble lignin

Medicinal and Therapeutic Properties

A. HYPOLIPIDEMIC ACTIVITY

The ability of the shiitake to lower blood cholesterol was first reported by Kaneda and Tokuda (1966), who found that a diet supplemented with the dried ground sporophores of L. edodes lowered average plasma cholesterol when fed to rats. The main and active component, 2(R),3(R)-dihydroxy-4-(9- adenylj-butyric acid, was called eritadenine, the name currently in use. Eritadenine lowers all lipid components of serum lipoproteins in both animals and humans (Takashima et a]., 1973; Tokuda et a]., 1976; Tokuda and Kaneda, 1979; Suhadolnik, 1979). Kabir and co-workers (1987) examined the effect of dried shiitake on the blood pressure and plasma lipids of spontaneously hypertensive rats (SHRs), and found that it decreased both the VLDL- and HDLcholesterol levels. In human testing S. Suzuki and Ohshima (1976) reported that serum cholesterol was decreased in groups of women fed fresh, dried, or UV-irradiated shiitake. A similar experiment, conducted on people 60 years or older, showed that serum cholesterol decreased after 1 week.

B. **ANTIBIOTIC ACTIVITY** - Bianco (1981) reported that L. edodes was active against *Candida albicans, Staphylococcus aureus, and Bacillus subtilis.*

C. ANTIVIRAL ACTIVITY- A peptidomannan (KS-2) extracted from cultured mycelia grown on stillage from whiskey manufacture (T. Fujii et a]., 1978) also exhibited antiviral activity (F. Suzuki et al., 1979). KS-2, composed of a-linked mannose and a small amount of peptide, has a molecular weight of -6 x lo4-9.5 x lo4. When administrated orally or i.p. to mice infected intranasally with influenza virus, KS-2 afforded therapeutic as well as prophylactic protection through its interferon-inducing activity. Yamamura and Cochran (1976b) determined that compound Ac2P isolated from the aqueous extract of dried shiitake was effective against the viral disease scrapie. Ac2P is a high molecular weight polysaccharide composed mainly of pentose sugars. IR vitro and in vivo tests in mice showed it to be a selective inhibitor of orthomyxoviruses, such as influenza viruses.

D. ANTI-CANCER/ANTI-TUMOR EFFECT- Sugano and co-workers (1982) obtained a water-soluble fraction (LEM) and two alcohol-insoluble fractions (LAP and LAP1) from the culture medium of mycelia with activity against Ehrlich ascites carcinoma in mice. LAP and LAP1 contained 58 and 65% sugar and 25 and 34% protein, respectively. Study

show that shiitake an its derivatives especially lentinan and LEM have strong anti-tumour/anti-viral activities, when taken both orally and by injection both in animals and in humans. these substance work by enhancing various immune system functions rather than attacking the tumour cells or viruses themselves . when shiitake content was increased to 30% tumour growth was inhibited by nearly 78%.

E. ANTI- ATHEROSCLEROSIS-Atherosclerosis is a cardiovascular disease (CVD) hallmark, it has been intricately linked with an oversupply of food-based cholesterol. HMG-CoA reductase (3-hydroxy 3-methyl glutaryl Co-enzyme A reductase) is the rate-controlling enzyme of the mevalonate pathways, the metabolic pathways that produce cholesterol and other isoprenoids. *Lentinula edodes* possessing bioactive food components capable of conferring anti-oxidative defence and curtailing LDL oxidation (oxidative modification of low density lipo-protein) is one of the earliest event in atherosclerosis. Oxidized LDL (oxLDL) reports a variety of modification of both lipid & apolipoprotein B (APOB) compounds by lipid peroxidation, this promote atherosclerosis through inflammatory and immunologic mechanism that leads to formation of macrophage foam cell) as well as being potent in inhibiting the activity of rate limiting enzyme in cholesterol biosynthesis thus support as use in anti- atherosclerotic agent. Food bio component as vit E (tocopherol), Oleic acid, linolenic acid ergosterol & butyric acid present and these enabled this mushroom to act as anti- atherosclerotic agent.

F. ANTI-DIABETIC ACTIVITY. (Satoh et al. 1988) studied the effects of various biological response modifiers, including lentinan, on insulin dependent (Type I) diabetes mellitus in nonobese diabetic (NOD) mice. Lentinan inhibited development. So, it has anti-diabetic activity.

G. ANTI-HYPERTENSIVE AND ANTI-CHOLESTEREMIC COMPOSITIONS A germanium-rich beverage from *Lentinula edodes* is both anti-hypertensive and anti-cholesteremic (Iizuka, 1982). A health food preparation containing shiitake has an anti-cholesteremic effect (Y. Abe and Kaneda, 1986).

Conclusion

The shiitake mushroom, Lentinula edodes (Berkeley) Pegler is the most popular important and popular mushroom in the global market. It is full of the nutrients and having chemicals which can provide immunity against several health problems. It has been seen that shiitake mushroom having hypolipidemic, antibacterial, antiviral, anti-cancer, anti-tumour, anti-atherosclerosis, anti-diabetic, anti-hypertensive and anti-cholesteric activity.

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