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THERAPEUTIC POTENTIALS OF PADDY STRAW MUSHROOM *Volvariella volvacea*

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ABSTRACT

Mushrooms have been used as nutritious healthy foods throughout the world. In modern medicine, mushrooms represent an important source that has high proportion of phytochemicals showing considerable antitumor and immunomodulation properties. These polysaccharides are mostly glucans with different glycosidic linkages. These are also used as food additives and dietary supplements. Some of the commonly available edible mushrooms of the genus *Volvariella,* namely *Volvariella volvacea* are commonly known as straw mushroom. These possess excellent nutritional value any other vegetables. They exhibit different medicinal properties. This paper studies the therapeutic potentials of paddy straw mushroom *Volvariella volvacea*.

Keywords: *Volvariella volvacea,*Antioxidant, Anticancer, Fruitingbody

INTRODUCTION

Volvariella volvacea, commonly known as the straw mushroom, paddy straw mushroom orthe Chinese mushroom, belongs to the family Pluteaceae (Kotl. & Pouz) of the Basidiomycetes **[1]**. Paddy straw mushroom is an edible mushroom of the tropics and subtropics and first cultivated in China in 1822 **[2]**. It is presumed that cultivation of this mushroom begun before the 18th century, almost 300 years ago **[3]**. Around 1932 to 1935, this mushroom was introduced into the Philippines, Malaysia and other South Asian countries by overseas Chinese **[4, 5]**. In India, though Su and Seth were the first to cultivate this mushroom in 1940; but

first scientific cultivation of *Volvariella diplasia* using spawn was successfully done at Coimbatore. In India 19 edible species of *Volvariella* have been recorded but cultivation methods have been devised for three of them only viz *V. esculenta* (Mass) Sing.,*V. diplasia* (Berk and Br.) Sing. and *V. volvacea* (Bull ex Fr.) Sing.

V. volvacea is also known as "warm mushroom" as it grows at relatively high temperature. The optimum temperature and relative humidity for the growth of this mushroom are 30-35°C and 80-90%, respectively. It is a fast growing mushroom and under favorable growing conditions total crop cycle is completed within 3-4 weeks times. It can be cultivated in North-Indian plains from July to September and in peninsular India from March to November. However, in the hilly areas during the November to January months artificial heating is necessary to raise the environmental and bed temperature but in the plains, artificial heating can be minimized by the incorporation of Melia *Azadirachta indica* and *Tamarindus indicus*leaves in alternate layers. *Volvariella* comprises 5% of the total mushroom production of the world **[5]**.

Over the recent decades, *Volvariella volvacea* (paddystraw mushroom) has become one of the most preferable cultivated mushrooms which contributed to the top commercial mushrooms in the world with5% of total production **[6-8]**. *V. volvacea* is a popular mushroom variety because it produces aromatic and pleasant flavour and tastes, as well as shorter cropping period **[8-10]**. It is commonly known as paddy straw mushroom because it grows best on paddy straw. It was also called Chinese mushrooms it was believed that the Chinese were the first who cultivated it **[3]**. The fruiting body of *V.volvacea* appears white with large cap and short stipe underneath, and it is cultivated mainly in China, India and Southeast Asian countries. This paper studies the therapeutic potentials of paddy straw mushroom *Volvoria volvoca*.

Nutritional Composition

Mushrooms are important sources of carbohydrates, fiber, minerals and proteins **[11, 12]**, where the amino acids are comparable to animal proteins **[13]**. Proteins in mushrooms find its position in between animal proteins and vegetable proteins **[14, 15]**. Water is the main component of Mushrooms (90%). The remaining parts contain protein (10-40%), fat (2-8%), carbohydrate (3-28%), fiber (3-32%), ash (8- 10%) and minerals like calcium, magnesium, iron, potassium, phosphorous, copper, zinc etc. Edible mushrooms contain different bioactive molecules including nucleotides, terpenoids, glycoproteins and polysaccharides. Ergosterol **[16]**,

provitamin D2 is also present in mushroom. Nutritional composition **[17-19]** of *Volvariella volvacea* straw mushrooms is given in **Table 1**.

Table 1: Nutritional composition of edible straw mushrooms shown in percentage

Parameters	*V. volvacea*
Carbohydrate (%)	50.90
Protein (%)	30.10
Lipid/Fats (%)	6.40
Ash (%)	12.60
Fiber (%)	11.90

Data given: (g) per 100 g of sample

These mushrooms possess all nine amino acids (leucine, lysine, tryptophane, methionine, threonine, histidine, valine, Isoleucine, and phenylalanine) which are essential to make the proteins that operate different functions of our bodies **[20-23] (Table 2)**. The mushrooms contain crude fats, having all types of lipid compounds such as monoglycerides, diglycerides, triglycerides, sterol esters, phospholipids, sterols and free fatty acids. On account of possessing high amount of provitamin D_2 and ergosterol, *V.Volvacea* contains low percentage of saponifiable fat (58.8%) **[16]**, unsaturated fatty acids are present in high level due to high content of of linoleic acid (69.91%) in total fatty acids of *V.volvacea* (myristic acid 0.48%, palmitic acid 10.5%, palmitoleic acid 0.62%, stearic acid 3.47%, oleic acid 12.74% and linoleic acid 69.91%) **[24]**. Saturated fatty acids present in animal fats are harmful to our health, unsaturated fatty acids on the other hand are very much essential parts of our diet **[25]**. These mushrooms being rich in unsaturated fatty acids and linoleic acids are considered as healthy foods. A healthy and balanced diet should necessarily contain high proportion of fiber. It is well known that, foods rich in fiber can reduce a diabetic patient's daily requirement of insulin through stabilizing the blood sugar level **[26]**. The fiber content is 11.90% **Table 3**. Comparative vitamin and minerals composition (dry weight basis) of edible straw mushroom.

Table 2: Composition of essential amino acids of edible straw mushroom

Amino acids	*V. volvacea* [20]
Valine	5.4
Leucine	4.5
Isoleucine	3.4
Threonine	3.5
Methionine	1.1
Lysine	7.1
Phenylalanine	2.6
Tryptophan	1.5
Histidine	3.8

Data given: Amino acids (g) per 100 g of sample

Table 3: Comparative vitamin and minerals composition (dry weight basis) of edible straw mushroom

Parameters	*V. volvacea* [27]
Vitamin D (IU/g)	462.05
Thiamine(mg/Kg)	0.35
Niacin(mg/Kg)	64.88
Riboflavin(mg/Kg)	2.32
Vitamin C(mg/Kg)	1.40
Calcium (mg/100g)	39.74
Potassium (%)	4.16
Iron (mg/Kg)	72.51
Copper (mg/Kg)	42.55
Zinc (mg/Kg)	94.28
Sodium (mg/Kg)	345.34
Magnesium (%)	0.11

Therapeutic potential

Antioxidant activity

In recent years, the use of some synthetic antioxidants has been restricted because of their possible toxic and carcinogenic effects **[28, 29]**. This concern has resulted in an increased interest in the investigation of the effectiveness of naturally occurring compounds with antioxidant properties **[30]** foods rich in antioxidants have been shown to play an essential role in theprevention of cardiovascular diseases **[31]**, neurodegenerative diseases, Parkinson's and Ahlzeimer's diseases **[32]** inflammation and problems caused by cell and cutaneous aging **[33-35]**. Thus the natural antioxidants present infoods and other biological materials have attracted considerable interest because of their presumed safety and potential nutritional and therapeutic effects **[33]**. The antioxidant activity of *V.volvacea* reported by Sudha *et al*. **[36]**.

Anticancer activity

Thiribhuvanamala *et al.,* **[8]** studied the oil palm bunch waste with rice straw. *V. volvacea*was a good source of polypeptides, terpenes, steroids **[37]** and phenolic compounds such as flavonoids, phenolic acids and tannins which contributed to highantioxidant capacity **[8]**. The free phenolics were higher in this mushroom which is antioxidant activity. Methanol and water extracts of *volvacea* were found to have a rich antioxidative activities which helped in the prevention of cardiovascular diseases, cancer **[38]**, neuro-degenerative diseases **[32]**, inflammation and problems caused by celland cutaneous aging **[33]**. Muthusamy *et al*., **[39]** reported that the highest yield of *V. volvacea* was obtained from wheat grain with rice bran.

Antimicrobial activity

Extracts *Voluariella volvacea* showed effective antibacterial activity against *Staphylococcus aureus, Streptococcus, Pseudomonas aeruginosa, Escherichia coli* and *Klebsiella* **[40]**. Ethyl acetate, hexane extracts of *Volvariella*

volvacea showed good activity against MDR pathogens like *Escherichia coli, Salmonella* and *Shigella* like enteric pathogens **[19]**. Purified fraction of this mushroom exhibited better activity than crude extracts, which contains ergostoro peroxide. It produced best activity against *E. coli* **[41]**. Extracts of *Voluariella volvacea* also had a specific antibacterial activity against food borne bacterial strins like *Escherichia coli, salmonella* and toxigenic *staphylococcus aureus* **[42]**. One of the study from rain forest of Westbengal also illustrated the efficiency of *Voluariella volvacea* **[43]**. Alcoholic extracts also produced antifungal activity against *Fusarium, Aspergillus and Mucor.*

CONCLUSION

Straw mushrooms are considered as excellent natural food with a potential to maintain good health and improving human immune system and are recognized as rich sources of several bioactive components exhibiting antibacterial, anticancer, antioxidant, antitumor, cytotoxic, anti-HIV and hypocholesterolemic activities.

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