VOLVARIELLA VOLVACEA: A PADDY STRAW MUSHROOM HAVING SOME THERAPEUTIC AND HEALTH PROSPECTIVE IMPORTANCE

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ABSTRACT
Mushrooms have been used as therapeutic properties as evident from ancient literature. In the present day world, they are known for culinary values due to their chemical nature of the bioactive compounds present in this mushroom includes: polysaccharides, lipopolysaccharides, proteins, peptides, glycoprotein's, nucleosides, triterpenoids, lectins, lipids and their derivatives. In this review were comprehensively searched, composed and organized with an aim to update the present status and to future prospects of Volvariella volvacea for their therapeutic and health prospective significance. The presented information will give a new perception to researchers for upgrading Volvariella volvacea species from functional food to holistic mushroom medicine.

KEYWORDS: Therapeutic Properties, Bioactive Compounds, Volvariella volvacea.

INTRODUCTION
Mushroom mycelia are perfect source for developing innovative pharmaceutical agents derived from mushrooms. Several novel therapeutic substances have been developed from mushroom mycelium produced by biotechnological processes. Paddy Straw mushroom is an excellently edible mushroom extensively cultivated in Asia. The genus Volvariella (paddy straw mushroom) 59 comprised a group of several species, which can be found growing on a variety of substrates in tropical and sub-tropical regions. Volvariella volvacea (Bull.) Singer is probably the best known species, as it has been traditionally cultivated in Southeast Asia since the 18th century (Chang, 1977).
The repetition of using fungi as treatments are found in the traditions of many cultures, past and present. The first Chinese book on medicinal substance, ‘The Shen Nung’s Herbal’, 2000 years ago, documented the beneficial effect of various fungi. It was not until this century, when antibiotic was obtained from Pencillium, that the therapeutic value of fungi extended worldwide attention. It is now well documented that many fungi produce antibiotic substances and a number of them have been shown to possess antitumor activities and other pharmaceutical properties (Jong et. al 1992).

In traditional Chinese medicine, Volvariella volvacea has been used to relieve heat stroke, bring down body temperature, enhance milk of women in childbirth, support baby’s health and make healthy liver and stomach. The V. volvacea mycelium is the most favorite mycelium in South Asian countries because of its excellent delicacy, high protein, amino acid, vitamin and minerals contents. Several research reveal that Volvariella volvacea contains isomerization protein that could improve the function of immunity, reduce cholesterol and prevent atherosclerosis (Thakur et. al 2006).

Since the available information on the therapeutic properties and uses of Volvariella volvacea is scanty, studies on the therapeutic potential of this mushroom was considered important. Hence, the therapeutic importance’s of Volvariella volvacea was selected in the various investigations. The current presentation was undertaken to collect the information of therapeutic properties of Volvariella volvacea mycelium and its health prospective importance’s are presented in this paper.

MATERIAL AND METHODS
In the late 19th and early 20th, extensive study was enthusiastic to the uses of therapeutic importance of paddy straw mushroom (Volvariella volvacea). So we searched, composed and systematized the knowledge about the therapeutic importance of paddy straw mushroom from different sources. 14 therapeutic importance’s have been enumerated in this study.

RESULT AND DISCUSSION
There are Basidiomycetes mushrooms are known to contain a number of biologically active components that show promising different uses of therapeutic importance of paddy straw mushroom (Volvariella volvacea). Based on the collection and record of the present work different uses of therapeutic importance have been enumerated.
[1] Antimicrobial
Mushrooms have been discovered to combat simple and multiple drug resistant isolates of *Staphylococcus aureus, Staphylococcus epidermidis, Escherichia coli* (Akyuz, et.al. 2010). Activity against the Gram-positive bacteria *Staphylococcus aureus*, has been validated in *Volvariella volvacea* strain R83, while *Volvariella volvacea* strain ATCC62890 showed considerably less antimicrobial activity, but it was reported to be a source of antioxidants (da Silva et. al 2010).

[2] Antiviral
Mushroom contains constituents that exert direct or indirect antiviral effects as a result of immune-stimulatory activity (Brandt, et. al. 2000). The anti-viral activity was due to binding of sulphated $\beta$-glucans to viral particles thus inhibiting them from contaminating the host cells (Gregori, et. al. 2007). Basidiomycetes mushrooms are known to contain a number of naturally active components that show propitious antiviral effects (Didukh, 2001).

Ribonucleases (RNases: mol. wt. 10.7 k Da) have the potentiality to neutralize HIV through degradation of viral genetic material. On the other hand, RNases (mol. wt. 14.5 k Da) is demonstrated very stable nuclease activity at 100°C for 30 min. with a higher ribonucleolytic activity toward Poly-G (Wang, et. al. 1998). Later in the fruiting bodies of mushroom an advanced ubiquitin-like protein having HIV-1 reverse transcriptase inhibitor activity (Wang, et. al. 2004).

In 1969, Wantanabe noticed antineoplastic accomplishments of polysaccharide extracted from the maturing body of mushroom. These polysaccharides extracted inserted intra-peritoneal (*i. p.*) in the female Swiss albino mice and caused 76% reduction in the number of neoplastic cells were also shown to have antineoplastic accomplishments (Wolff, et. al. 2008). Extracts from different species of mushrooms may modulate the response of host immune system; in particular, various mushroom polysaccharides are likely to affect raise and development stages towards cancer (Chatterjee, et.al. 2011).

Exposure of DNA to UV radiation or free radical’s intensification oxidative nucleotide as glycol, dTG and 8- hydroxy-2-dexoy-guanosine, due to the oxidative destruction to DNA.
Also that mitochondrial DNA is vulnerable to oxidative damage that plays an important role in many diseases including cancer (Wao et al., 1998). The oxidative destruction of DNA results in permanent modification of the genetic material which represents the first step involved in mutagenesis, carcinogenesis and ageing (Halliwell & Gutteridge, 1999). In 2001, Didukh studied the antitumor properties of *Volvariella volvacea* mushroom. Many more reports are available indicating that mushroom possesses antitumor activity [Sarangi, et. al.2006, Gu, et. al. 2006.].

[6] **Antimutagenic**
The antigenotoxic and bio-antimutagenic accomplishments on *Escherichia coli* and *Staphylococcus typhimurium* was established by extracts of different mushrooms species (Filipic, et. al.2002). This type similar outcome was found in methanolic extract of culinary-medicinal oyster mushroom (*Pleurotus ostreatus*) and paddy straw mushroom (*Volvariella volvacea*) (Lakshmi, et. al. 2004).

[7] **Antioxidant**
Several antioxidant compounds naturally occurring in mushroom sources (Ishikawa et al., 1984; Mau et al., 2002). Methanol and water extracts from paddy straw mushroom (*Volvariella volvacea*) have been shown to have antioxidant accomplishments against lipid peroxidation of rat brain homogenate. The ethyl acetate sub-fraction of the methanol extract of *Volvariella volvacea* was found to have same antioxidant activity to caffeic acid against the oxidation of human low-density lipoprotein (LDL). The antioxidant accomplishments against lipid peroxidation were found to compare with the phenolic content in different sub-fractions of the mushroom extracts (Cheung and Cheung, 2005).

[8] **Antilipidemic**
Hyper lipidemia is the notable risk factor for atherosclerosis. Feeding of mushroom powder intensifications, the excretion of total lipids and cholesterol through fecal matter. Recent report produced by Alam states that when hyper cholesterolemic rat feeding of diet comprehending mushroom so that reduced total lipid, phospholipids and LDL/HDL correspondingly (Alam, et. al. 2011).

[9] **Hyperglycemic**
Guanide, a compound related to the bi-guanide class of oral anti-diabetic drugs and they show anti-hypoglycemic result (Windholz, et. al. 1983). High fiber and proteins content and
low fat content of edible mushrooms make it perfect food for diabetic patient (Yuan, et.al.1998). Basidiomycetes mushrooms are recognized to contain a number of naturally vigorous constituents that show auspicious antidiabetic properties (Didukh, 2001).

[10] Hypotensive
The level of antihypertensive property diverges with mushroom species and their amalgamations possess blood pressure lowering performance (Miyazawa, et.al. 2008). Recently shown that protein segments from some mushroom possessed the highest ACE (Angiotensin-I converting enzyme) inhibitory activity that cause the shrinkage of blood vessels thereby raising the blood pressure; however, effect was lower compared to captopril, an ACE inhibitor used for the treatment of hypertension and some other types of congestive heart failure (Ching et. al. 2011). *Volvariella volvacea* has been reported to produce a hypotensive response in animals. An aqueous extract of the mushroom (SME) was prepared and given through intravenous injections to normotensive rats. An intravenous injection of SME produced a hypotensive effect in rats with an ED50 of 25mg dry weight/kg body weight. SME did not increase urinary excretion or sodium diuresis. It produced positive chronotropic and inotropic effects on isolated right atria and induced contraction of isolated tail artery strips. This latter contractile response was inhibited by opponents of serotonin and alpha-adrenoceptor, ketanserin and phentolamine correspondingly. Partial purification using dialysis and liquid chromatography revealed that the hypotensive active substances had molecular weights between 8,000 and 12,000 Daltons. These substances were heat stable and resistant to trypsin digestion (Chiu et al., 1995). Basidiomycetes mushrooms are known to contain a number of naturally active components that show auspicious hypotensive properties (Didukh, 2001).

Liver destruction by hepatotoxic agents is of vital consequence because chronic liver injury leads to fibrosis, end stage cirrhosis and hepatic-carcinoma. Hence, there is an increasing need to search of an agent which could protect the liver from such damages. Many species of mushrooms contain some active compounds like $\beta$-glucan, phenol and vitamin C that increase the activity of antioxidant-enzymes viz. catalase, superoxide dismutase; these enzymes are responsible for decline of hepatic cell necrosis (Bobek, et. al.1997: Fu,et.al. 2009). Basidiomycetes mushrooms are known to contain a number of naturally active components that show auspicious hepatoprotective properties (Didukh, 2001).
[12] Hypocholesterolemic
Lovastatin, a drug, used in the lowering blood cholesterol level, and it was accepted by FDA in 1987. Introductory reports indicated that diet containing 4-10 % dried mushrooms species show more reduction in the arterial pressure and blood cholesterol level when compared to normal diet in rabbits and rats (Bobek, et.al.1993; Bobek, et.al.1997; Ooi, et. al. 2000). *Volvariella volvacea* has also been shown to have hypo-cholesterolemic properties (Cheung, 1996: Cheung, 1998). Basidiomycetes mushrooms are known to contain a number of naturally active components that show promising hypocholesterolemic properties (Didukh, 2001).

[13] Immunomodulatory
Some polysaccharide ranging from mol. wt. 500- 2000 k Daltons, are the most effective mushroom-derived constituents stimulating immunomodulation activity (Wasser, et. al. 2002). The antiplatelet-aggregating activity, along with the anti-inflammatory accomplishments, suggests its latent therapeutic use against vascular disorders (Jose, et.al.2004). Recently some groups of workers reported the purification of fungal immunomodulatory protein designated FIP-VVO from *Volvariella volvacea* (Hsu et al., 1997). Basidiomycetes mushrooms are known to contain a number of naturally active components that show auspicious immunomodulation properties (Didukh, 2001).

[14] Anti-Ageing
It is a process of tolerant decline of physiological functions (Denham Herman et al., 1956). The free radical damage to cells is thought to lead to the pathological changes related with ageing (Ashok et al., 1999). Thus, it is known that ageing process is associated with the amplified oxidative stress. Ageing is thus credited to the accumulation of DNA and cellular damages (Cantuti et al., 2000). So that decrease of free radicals or decreasing their rate of production may stay ageing. mushroom raised levels of vitamins like ascorbic acid and tocopherol, increased activities of superoxide dismutase, glutathione peroxidase and catalase in aged rats. These enzymes are known effective antioxidant enzymes (Bobek, et.al. 2001: Keyhani, et. al.2007). The levels of malondialdehyde, a polyunsaturated lipid and an electrophilic mutagen, was lowered on administration of mushroom extract to elderly rats (Buddi, et.al. 2002).
CONCLUSIONS
The up dated comprehensive validation shows that mushroom holds many promising therapeutic properties that requires more high-tech approaches for deeper investigation. As such, the mushroom fruiting body, its mycelium and their extracts or concentrates have been considered a functional food as it has the potentiality to control many human diseases. It is loyally supposed that comprehensive information as presented in this review on many promising therapeutic properties of Volvariella volvacea might provide detailed evidence for its use in different medicines. But the therapeutic properties yet known as per its biochemical components are not satisfactory and thus, more clinical and pathological studies must be conducted to investigate the vacant potential of this mushroom.

REFERENCE


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