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AGARICUS BISPORUS (FUNGI): CHEMICAL CONSTITUENTS AND PHARMACOLOGICAL ACTIVITIES-A REVIEW

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ABSTRACT

Mushrooms (*Agaricus bisporus*) have been used from many years as a conventional source of natural bioactive compounds and have many potential components which is used to prepare lot of cosmetics products. The ingredients present in *Agaricus bisporus* are beneficial to the skin and hair. The ingredients presents in *Agaricus bisporus* are as follows: Polysaccharides, Vitamins, Phenolics, Polyphenolics, Terpenoids, Selenium and Volatile organic compounds. *Agaricus bisporus* show excellent Pharmacological activities such as antidiabetic, antioxidant, anti-aging, anti-wrinkle, skin whitening, and moisturizing effects, which make them ideal candidates for cosmetics products. Lectins participate crucial role in biological processes such as cellular signaling, scavenging of glycoproteins from the circulatory system, cell–cell interactions in the immune system, differentiation and protein targeting to cellular compartments, as well as in host defence mechanisms, inflammation, and cancer. Along with all the sources of lectins, plants have been most extensively studied. However, more recently fungal lectins have attracted considerable attention due to their antitum or, antiproliferative and immunomodulatory activities. Only 10% of mushroom species have been taxonomically classified, mushrooms represent an enormous unexplored source of potentially useful and novel lectins.

KEYWORDS

Mushrooms (*Agaricus bisporus*), Antidiabetic, Anti-aging, Antioxidant and Skin whitening.

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INTRODUCTION

Mushrooms (*Agaricus bisporus*) are an assemblage of fleshy macroscopic fungi. They have a distinctive fruiting stiff that could by hypogenous, large adequate to be seen by naked eyes and to be touch by hands. Edible mushrooms (*Agaricus bisporus*), are ideal small calorie foods for diabetic patients since they contain very small amounts of fats cholesterol low levels of carbohydrates,

elevated content of protein, vitamins and minerals. Mushrooms (*Agaricus bisporus*) compounds are suitable functioning of the liver, Pancreas and other endocrinal gland thereby promoting creation of insulin and related hormones which ensure healthy metabolic functioning. Beta glucans (Polysaccharides), contained in mushrooms have the capacity to restore the function of pancreatic tissues by causing increased insulin output by β-cells which leads to lowering of glucose levels in the blood. It has also been shown to develop the sensitivity of peripheral tissues to insulin. Mushrooms consumption markedly decreases the lipid levels including total cholesterol, total triglyceride and low- density lipoproteins and increase the level of high- density lipoproteins[1]. The chemical constituents of mushrooms have been described to have been used in many diseases including cancer, hypertension, metabolic syndrome and cardiovascular diseases. Many studies have focused on their immunomodulatory and anti-tumor effects because mushrooms may contain a diverse array of biologically active metabolites (β-D-glucans, immunomodulatory proteins, secondary metabolites) with well-known immune enhancing capabilities. Some drugs are also hypoglycemic agents (anti-diabetes agents), like insulin, Metformin, tolbutamide, gliclazide, phenformin, troglitazone and Rosiglitazone, exenatide are the mainstay in the treatment of diabetes and are effective in controlling hyperglycemia. Because, these anti-diabetec agents may have harmful side-effects, fail to significantly alter the course of diabetic complications and there is insufficient knowledge on the pharmacological condition of the disease. Therefore, natural antidiabetic drugs from medicinal plants have involved a large deal of attention. Admittedly, diabetes mellitus is a hormonal disorder which should have no treatment, only it can be controlled or prevented with appropriate lifestyle adaptations including exercise, appropriate food and health relevant environments. Certainly healthy foods rich in various components of medicinal properties which provide a means to good health. Edible and medicinal mushrooms are included under functional foods and therefore a good solution to controlling diabetes and a potent source of biologically active compounds with anti-diabetic effects. Many mushroom species appear to be effective for both the control of blood glucose levels and the modification of the course of diabetic complications. *Agaricus bisporus* is a popular edible mushroom worldwide. The mushroom has prospective anti-inflammatory, hypoglycemic and hypocholesterolemic effects due to presence of high amounts of acidic polysaccharides, dietary fibre, and antioxidants, such as vitamins C, B12, and D; folate, ergothioneine; and polyphenol. White button mushrooms may provide innate immunity against tumors and viruses, and can reduce high concentrations of blood cholesterol levels, hypercholesterolemia, can lead to a progression of hyperglycemia/ type 2 diabetes in humans and animals, if intake is high. Cholesterol directly effects β-cell metabolism and that may contribute to β-cell dysfunction and the onset of diabetes. Epidemiological studies put forward that higher levels of dietary fibre intake play a significant protective role with respect to diabetes, in lowering the dietary glycemic load and shows potent hypocholesterolemic effects. Diabetic rats fed *Agaricus bisporus* fruiting bodies have significant anti-glycemic and anti-hypercholesterolemic effects. Furthermore, *Agaricus bisporus* have a positive response on lipid metabolism and liver function. While soluble dietary fibre is the most likely candidate in lowering blood glucose levels and cholesterol levels, other constituents, such as anti-oxidants (polyphenol, vitamin C, and ergothioneine), proteins, and polysaccharides may also play an important role[2].

Phytochemical compounds

Literature indicates that mushrooms have phytochemicals compound such as Alkaloid, Carbohydrates, steroids, glycosides, flavonoids, protein, amino acids, phenols, Saponins, triterpenoids presented[3,4] Pantothenic acid[5], Riboflavin[5], Niacin[5], Vitamin C[5], Chitin[6], Beta glucan[6], Vitamin D[7].

Nutritional Value

The nutritional value of the Agaricus bisporus originates from its chemical composition. The crude protein, Carbohydrates, fat, Dietary fiber, Sugars, Fat, Protein, Water, Pantothenic acid (B5), Riboflavin (Vit. B2), Niacin (Vit. B3), Vitamin C, Iron and ash contents as well as the amino acid composition are favourable[8]. The remarkable level of phosphorus and the very low Na are present in the Agaricus sp. contains 85-90% water of its dry matter. However, quantity of water is greatly influenced by ratio and temperature throughout growth and storage. Protein is that the most important part that contributes to a great deal of organic process price of food. Protein varies from 34% to 44% of total dry weight in Agaricus sp[9]. The crude fat content ranges from 1-20% of total dry weight. Besides protein, a large variety of free and combined fatty acids are present in A.bisporus with high concentration of palmic acid, stearic acid and oleic acid[10]. The major active compound found in the ethyl acetate fraction is unsaturated fatty acids such as linoleic acid, linolenic acid and conjugated linoleic acid. Fresh mushroom contains comparatively great amount of carbohydrates i.e.3-28%, significantly pentoses, hexoses, disaccharides and trehlose (a mushroom sugar)[11]. They appear as a decent supply of many vitamins (thiamin, riboflavin, niacin, biotin, ascorbic acid, vitamin A, B, C, D, and minerals (sodium, potassium, calcium, iron, etc), essential amino acids (methionin, citralline, ornithin)[12]. Lectins are a diverse group of carbohydrate-binding proteins commonly present in animals, plants, and microorganisms. Lectins can act as mediators of cellular and molecular recognition in a wide range of biological systems[13].

PHARMACOLOGICAL ACTIVITIES

Antibacterial and Antifungal Activity

The antimicrobial effect of extracts of A.bisporus was tested against Gram-positive and Gram negative bacteria and one species of yeast. The Gram-positive bacterium is more prominent. This can be because of the influence of temperature that disturbed the compound that is accountable for the activity. The ethanol extracts of A.bisporus exhibited anti-candidal activity against C.albicanc[14,15].

Anticancer activity

The glycoprotein from the common mushroom fungus genus bisporus, the most popular edible species in western countries, has potent antiproliferative effects on human epithelial cancer cells, without any apparent cytotoxicity. The lectin from Agaricus bisporus (ABL) has antiproliferative effects on a range of cell types. ABL caused a dose-dependent inhibition of proliferation and lattice contraction without significant toxicity. ABL might be especially useful where subtle modification of healing is needed, as in eye surgery for glaucoma[16,12]. Selenium is a necessary element for humans and animals. The work of Clark, *et al*[17]. involving the role of selenium in cancer chemoprevention. Mushrooms provide more selenium than other foods in the fruit and vegetables food group and can be a source of this essential mineral for vegetarians[17]. Selenium has a possible role to prevention of cancer through antioxidant protection and /or increased immune function. There is evidence from human studies to suggest that selenium may reduce the incidence of cancer when taken in higher doses. Intervention trials have also show benefit with selenium in reducing cancer, specifically in the liver, prostate, colon, and lung, with the greatest benefits in those with lowest selenium status[18]. The study was shown that white button mushrooms has suggested that they may be a useful chemo preventive agent against breast cancer, as they suppress aromatas/oestrogen biosynthesis. Aromatase is an enzyme that converts androgen to oestrogen. Increased expression of aromatase in breast tissue is considered to be a risk factor for breast cancer. Chen and colleagues found that of the seven vegetable extract tested, mushroom extract was the most effective in inhibiting the activity of this enzyme[19]. Maturation of Bone Marrow-Derived Dendritic Cells (Dc) White button mushroom (WBM) promotes DC maturation and these mushroom –treated DC are more effective in

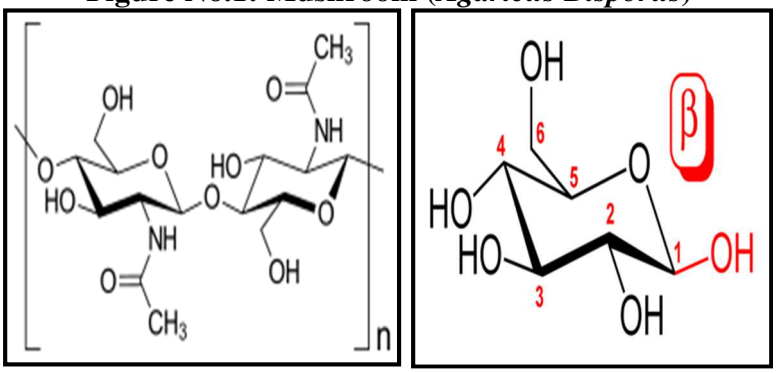
activating specific T cell responses through an improvement in their antigen-presenting function. This effect of mushroom could have significant implications in inducing both innate and adaptive immunity against tumor development and microbial infection[20].

The genoprotective effect

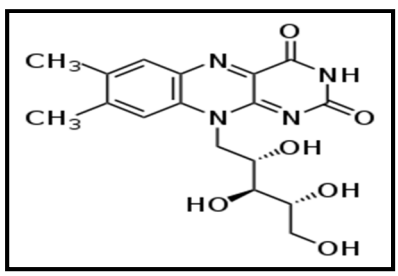
A.bisporus is the most widely cultivated and consumed edible mushroom. A. bisporus fruit bodies prevented H_2O_2-induced oxidative damage to cellular DNA A. bisporus is associated with a heat-labile protein, designated FIIb-1, present in the fruit body and which has been identified as tyrosinase. The genoprotective effect associated with cold water extracts of the edible mushroom, Agaricus bisporus, is correlated with tyrosinase activity found in the mushroom fruit bodies. The genoprotective effect of A. bisporus tyrosinase is dependent upon the enzymic hydroxylation of tyrosine to L-DOPA and subsequent conversion of this metabolite to dopaquinone[21].

Adverse effects Some studies have revealed that raw A. bisporus - along with some other edible mushrooms contains small amounts of carcinogenic hydrazine derivatives, including agaritine and gyromitrin. However, the research also noted when cooked, these compounds were reduced significantly. Consumption of the Agaricus species mushrooms has increased considerably in Japan as the Japanese have become accustomed to Western cooking[22]. The fungus genus species mushroom contains reducing agent derivatives called Agaritine. Bladder implantation was performed to check the cancer potential of the fungus genus species mushroom that contains massive quantities of Agaritine. The wood alcohol extract of contemporary mushrooms (Agaricus bisporus) and synthesized Agaritine were found to be considerably cancer on the mouse bladder epithelial tissue by the bladder implantation check with a probability of less than 0.01[23].

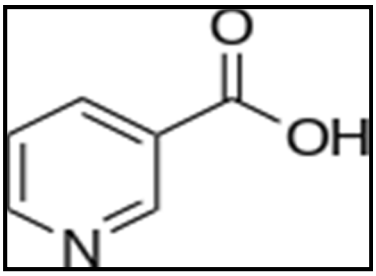
Figure No.1: Mushroom (*Agaricus Bisporus*)



Chitin **Beta-glucan**



Riboflavin



Niacin

CONCLUSION

The review demonstrates that agaricus bisporus have a great potential for the production of useful bioactive metabolites and those they are a prolific resources for drugs. The accountable bioactive compounds belong to many chemical teams. Agaricus bisporus possess a high variety of bioactive compounds, and therefore of pharmacological effects. The market opened up recently in the USA and Europe to higher fungi providing good health. Hundreds of papers discuss Basidiomycota therapeutic indications chiefly growth, antidiabetic, antimicrobial, immune-stimulating, anti-inflammatory and antioxidant effects as well as in cardiovascular. Mushroom metabolites process new generations of pharmacologically active compounds, ought to positively facilitate fill a number of the weaknesses of current therapeutic arsenal and develop it against gift and future therapeutic challenges.

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CONFLICT OF INTEREST

We declare that we have no conflict of interest.

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