Review Article

Pharmacological activities of mushroom- A short review

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ABSTRACT

There is a common saying, "medicines and foods have a common origin." Mushrooms are an ideal example of this in constituting both a nutritionally functional food and a source of physiologically beneficial medicine. There are many varieties of mushroom, which are nutraceuticals such as cordyceps mushroom and *Prosopis cineraria*. Some varieties of mushroom are for treatment of cancer such as extract of Chaga (Inonotus obliquus) is used as anti-tumors medicine. The general biochemical compounds which are obtained in mushrooms are triterpenes, polysaccharides, germanium, adenosine, ganoderic essence, amino acids, vitamins, minerals, proteins and fibers, beta-glycan, heteroglycan, proteoglycan, and nucleotides. This review focuses on various types of mushrooms and their biochemical extracts, which have greater nutraceutical value. Mushroom is an unlimited source of compound with anti-tumor and immunostimulants. Mushroom intake has been shown to reduce the risk of cancer, especially in the breast cancer.

KEY WORDS: Antitumor, Breast cancer, Immunostimulant, Nutraceutical

INTRODUCTION

Humankind has benefited from green plants as a source of drugs and herbal remedies for many years. Fungi, on the other hand, have not been considered in any significant way. However, this has been changing very rapidly, and fungi are considered as a major source of pharmaceuticals and medicinal food. The platform for fungi as a source of pharmaceuticals and health food will be very important, and their economic potential will be extremely important in coming years.[1] The Mexican Indians seem to regard the psychotropic plants as mediators with God. Nahuatl dialect speaking people named mushrooms as teohanotact, which means flesh of God. Classical religious scriptures like Vedas have mentioned their medicinal value. The Greeks regarded mushrooms as providing strength to soldiers in war. The Romans considered them as Food of the Gods, and the Chinese treated them as the Elixir of life.[2] There are approximately 14,000 described species of mushrooms. However, there are an estimated 1.5 million species of fungi, of which it is likely that there are approximately 140,000 species that qualify as mushrooms; suggesting that only 10% have been reported so far in science. Medicinal mushrooms had a long tradition in Asian countries, whereas their use in Western nations has only increased slightly during the past decade.[3] They have been used in folk medicine throughout the world. Attempts have been made in many parts of the world to explore the use of mushrooms and their metabolites for the treatment of a variety of human ailments.[4] A variety of mushrooms have been used to maintenance of health and for prevention and treatment of diseases such as cancer, inflammation, viral diseases, hypercholesterolemia, blood platelet aggregation, and hypertension in the traditional way.[5] Nutraceuticals were defined as a food or part of food, which provides medical or health benefits, including the prevention and treatment of disease.[6] Historically, Linnaeus classified mushrooms among lower plants in the Division Thallophyta, largely due to their relatively simple, anatomically structural attributes. The medicinal properties of mushrooms than in their basic value as a source of food had been an interest among early herbalist. Mushrooms were first cited as early as in 100 B.C., in the Shen Nong's Herbal classic due to their medical effects. At present, mushrooms have been good source of biologically active antioxidants.[7] A mushroom nutraceutical is partially defined extract from either the mycelium or the fruiting body of a mushroom, which is consumed in the form of

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capsules or tablets as a dietary supplement and which has potential health-care effects.[8] Mushroom of the genus *Coprinus* is commonly known as asinky cap mushrooms due to their deliquescence nature forming a black mass as they mature. The genus is well known for harboring edible medicinal mushroom distributed almost in all continents of the world. They usually grow on rotting plant materials such as sisal wastes; sugar cane filter mud and some decaying tree logs. *Coprinus* mushroom is widely eaten and known for their antioxidant properties and used in the formulation of nutraceuticals and functional foods.[9]

Anticancer Activity of Mushrooms

The evidence suggests that efficacy of *Cordyceps sinensis* is as anti-neoplastic therapeutic agents due to its role inactivator of immune responses. Extracts from mycelium and fruiting bodies from *C. sinensis* is influence the immune system in different ways. In a study, water extract from dried *C. sinensis* increased the survival time of the allogeneic mice inoculated with Ehrlich ascites carcinoma cells (EAC) to 316% and syngeneic mice inoculated with Meth a fibrosarcoma (Meth A) to 312% of the control with no cytotoxic activity on either EAC or Meth A *in vitro*.[10] The water extract of this mushroom also proved beneficial in the prevention of tumor metastasis in mice as an adjuvant agent in cancer chemotherapy.[11] Another effect on breast cancer is the most common type of cancer among women worldwide, and its rate is increasing in different countries. Among different country, the burden is not evenly distributed, and there are large variations in the incidence rates of breast cancer.[12] Most breast cancers (about 95%), whether in pre- and post-menopausal women, are initially hormone-dependent.[13] The breast cancers occur during the post-menopausal period when the ovaries have ceased to be functional. Despite the low levels of circulating estrogens, the tissue concentrations of estrone (E1), estradiol (E2) and their sulfates (E1S, E2S) in breast tumors are many times higher than those which is found in the plasma or in the area of the breast considered as normal tissue, suggesting a specific tumoral biosynthesis and accumulation of these hormones.[14] The ethyl acetate extract of *C. sinensis* mycelium was found to have strong anti-tumor activity on four cancer cell lines, MCF-7 breast cancer, B16 mouse melanoma, HL-60 human promyelocytic leukemia, and HepG2 human hepatocellular carcinoma.[15] Antibody neutralization studies revealed that the tumoricidal and differentiating effects of PSCS-MNC-CM were mainly derived from the elevated cytokines, especially interferon-gamma and tumor necrosis factor-alpha.[16]

Antioxidant Activity of Mushroom

Many free radicals play major roles in many physiological and pathological conditions.[17] Excess of free radicals, which is present, in general, caused by the imbalance between free radical generations and scavenging may contribute to disease development. They also can damage membranes, proteins, enzymes and DNA, increasing the risk of diseases such as cancer, Alzheimer's, Parkinson's, angiocardiopathy, arthritis, asthma, diabetes, and degenerative eye disease.[18] Mushrooms had become attractive functional foods and a source of physiologically beneficial compounds including antioxidants.[19] Different wild mushroom species had reported to have antioxidant activity, which is related to their phenolic content.[20] Nevertheless, none of the available reports present a quantitative study to obtain a predict model for antioxidant potential. In addition, other chemical substances found in mushrooms including proteins, carbohydrates, vitamins, and fibers contribute to the antioxidant capacity.[21] The scavenging effect on α,α-diphenyl-β-picrylhydrazyl (DPPH) free radical has been measured by the method of *Shimadae*.[22] 2,2'-azino-bis(3-ethylbenzothiazoline-6-sulphonic acid) (ABTS) radical-scavenging activity (RSA) hydrophilic fractions were determined by a procedure reported by Re *et al*.[23] Antioxidant activities of the *Coprinus cinereus* was calculated in terms of the scavenging ability on DPPH radicals, total flavonoid, total phenolic content, ascorbic acid (Vitamin C), and crude protein according to Adefegha and Oboh.[24] For antioxidant activity data, they had used the results of two *in vitro* chemical assays, which are reducing power (measures the conversion of a Fe3+/ferricyanide complex to the ferrous form) and scavenging activity on DPPH radicals-RSA (measures the decrease in DPPH radical absorption after exposure to radical scavengers). This is the most commonly used method for assessment of the antioxidant properties of natural products. Both assays are suitable for solvent extracts and as rapid assays; it can be used for monitoring the activity of many samples over a short period of time.[25] Polysaccharide is one of the active components in mushrooms that have many pharmacological activities, and between this are the activities of antioxidation. ABTS+based assay system is a method for measuring the free radical scavenging activities of mushroom extracts. In this assay, the absorbance decreases as a result of a color change from blue-violet to colorless as the radical is scavenged by antioxidants.[26] Among the reactive oxygen species, the hydroxyl radical is the most reactive one and can induce severe damage to their adjacent biomolecules. Hydrogen peroxide and superoxide molecules can lead to oxidative injury in the biomolecules indirectly by producing hydroxyl radicals through Fenton reaction or iron-catalyzed Haber-Weiss reaction, which can be prevented by antioxidants. The antioxidant activities of the polysaccharides vary with different radical-scavenging methods, which depend on the polysaccharide contents or constituents. However,

the monosaccharide compositions of glycosidic bond of connection and active groups also related to the antioxidant activities of the crude polysaccharides. Wang and others reported that polysaccharides with different molecular weights and monosaccharide compositions possessed different antioxidant effects.[27-29]

DISCUSSION

The review demonstrates that mushrooms, similar to plants, have a great potential for the production of useful bioactive metabolites and those they are a prolific resource for drugs. Prerequisite for a use as drug, nutraceutical or other purpose is the continuous production of mushrooms (fruiting bodies or mycelium) in high amounts and in a standardized quality. The mycelial products are the "wave of the future" because they ensure standardized quality and year around production. A further necessity is the establishment of suitable quality parameters and of analytical methods to control these parameters. Nevertheless, the legal regulations for authorization as drug or as dietary supplements or as food should get more attention. Control of possible side effects (i.e., Allergies) during broad use is necessary.

CONCLUSION

Mushrooms had become attractive functional and a source of drug and nutraceuticals due to their anticancer, antioxidant, antifungal, and antimicrobial activities. Besides their pharmacology use, mushroom posses more high nutrients value. More research is required to study the toxicity of mushrooms to evaluate the usefulness of mushrooms in health and disease.

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