

Review Article

Medicinal and Nutritional Importance of Mushrooms

Qays M. Issa^{1*}¹College of Pharmacy, Al-Nahrain University, Baghdad, Iraq***Corresponding Author:** Qays M. Issa

College of Pharmacy, Al-Nahrain University, Baghdad, Iraq

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Abstract: Mushrooms have been used as food for centuries because of their unique taste, in addition to their great nutritional value, as it was found that there are many nutritional and medical benefits due to human consumption of mushrooms, both wild and cultivated. Nutritionally, mushrooms are rich in proteins, carbohydrates and fibers and are also low in energy and fats. It also contains a large variety of nutrients and minerals such as potassium, copper and vitamins such as riboflavin, niacin and folate. Most types of mushrooms are an important source of active compounds with the potential for medicinal and therapeutic effects. Biologically of potential medical importance, as the results of studies showed that the bioactive components isolated from mushrooms have pharmacological effects such as antitumor, antioxidant, antiviral, cholesterol-lowering, as well as lowering blood sugar effects in patients. Consuming mushrooms or one of their products in our daily diet may provide many health benefits.

Keywords: Mushrooms, Nutritional component, Diseases, Medicinal.

INTRODUCTION

There are thousands types of mushrooms fungi that differ in their shapes, sizes and colors. Some of them are Edible, but others are Poisonous, and some of them are great therapeutical Mushrooms. Estimations vary on the number of edible mushrooms varieties from 300 to 2000, but only around 10 are grown commercially, according to Idaho University [1]. Due to the wide global consumption of mushrooms, it is a food rich in proteins, vitamins, minerals, amino acids, sugars, and fibers. It has also become important from the medical side, as scientific research has shown that mushrooms have different therapeutic activities, such as, Immunoregulatory, anti-cancer, antioxidant, anti-platelet, Anti-microbial, anti-inflammatory, Neuroprotective, Reduce Triglycerides, Blood Sugar Balancing, Anti-aging, Kidney/ Liver Protective, Hormone Balancing [2]. There are about 270 species of mushrooms known for their healing properties. In recent years, the commercial production of these species has increased due to the increased demand for mushrooms due to the characteristics it possesses. Now days, Mushroom and its ingredients are used to treat many incurable diseases, as well as to prevent some health problems [3].

Medicinal Mushrooms have been used for hundreds of years, especially in Asian countries, to treat infections. More recently, it has also been used in the treatment of lung diseases and cancer. Medicinal mushrooms have been approved as an adjunct to approved cancer treatments in Japan and China for more than 30 years, and have an extensive clinical history of safe use as single agents or in combination with radiotherapy or chemotherapy [4]. Today, more than 100 types of medicinal mushrooms are used in Asia. The most famous of them are currently four types in the fields of scientific research. Studies have examined the effects of mushrooms on immune response pathways and on direct antineoplastic mechanisms. The immune effects are interfered with by the fungus' stimulation of innate immune cells, such as monocytes, natural killer cells and dendritic cells. This activity is generally considered to be due to the presence of high molecular weight polysaccharides (beta-glucans) in mushrooms, although other components may also be involved. Clinical trials in cancer patients have shown that some of these compounds are generally well tolerated by the body [5].

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In the June 2018, the medical journal Oncotarget, a group of Russian and Swiss researchers presented their scientific review entitled: "Medical mushrooms as a new and attractive source of natural compounds for future cancer treatment." They said: "Mushrooms have been used medicinally throughout human history to treat many diseases including cancer [4]. Nowadays it has been extensively studied in order to reveal the chemical nature and mechanisms of action of its biomedical potential. Targeted treatment of cancer, which is not harmful to healthy tissue, has become a desirable goal in recent decades. Compounds of fungal origin provide a large pool of potential innovative medicines. We have shown that some of the aspects of fungal treatment for tumors that have been studied are relatively good [6].

Chemical Compositions of Mushrooms

In a study conducted by [7] to determine the chemical composition of edible mushrooms, 7 wild samples of Mushrooms were taken (*Agaricusbisporus*, *Chlorophyllumrhacodes*, *Agaricuslutosus*, *Volvariellavolvacea*, *Agaricusimpudicus*, *Agaricusarvensis*, *Agaricussilvensis*). The search results showed that all samples taken had moisture content ranging between (5.26% - 11.11%), fat content (0.94% - 2.99%), protein content (19.41% - 34.14%), ash content (0.22% - 1.47%), Fiber Content (5.25% - 23.86%), Carbohydrate Content (26.76% - 77.91%), Calcium Content (5.80-8.60mg/kg), Magnesium Content (3.07- 5.50mg/kg), Phosphorous Content (2.15-2.50mg/kg), potassium content (21.20-21.50 mg/kg), iron content (1.30-1.55 mg/ 100 g), zinc content (0.51-0.52 mg/100 g), copper content (0.10 - 0.11 mg/100 g), The manganese content (0.10- 0.12 mg/100g), while the study showed that the content of essential amino acids (mg/100g) for mushroom samples was: arginine (6.30-6.40), histidine (1.90 - 2.20), lysine (5.00 - 5.10), tryptophan (0.88 - 0.90), phenylalanine (2.00 - 2.10), methionine (1.00 - 1.15), threonine (4.05-4.10), leucine (3.90-4.10), isoleucine (5.56-5.70), valine (4.20-4.50).

Some types of mushrooms that used in ancient medicine

1. Shiitake (*Lentinulaedodes*)

Shiitake mushrooms have many medicinal properties due to the micronutrients they contain, such as selenium, phosphorous, and B vitamins. They also contain polysaccharide called entinan, which has unique antitumor and immune-regulating properties. Currently, one study showed that this sugar inhibited the gene expression of liver enzymes (CYP), which in turn reduces the risk of making carcinogenic substances [8].

2. Reishi (*Ganoderma lucidum*)

The Reishi mushroom is a fungus that grows in various hot and humid locations in Asia, is a large, hard mushroom that is used in traditional Chinese Medicine as an herbal medication, particularly for healthy immune function and liver function by reducing oxidative stress [9]. More than 400 bio-active compounds in this type of mushroom contain. Researchers believe that the main compounds responsible for the immune and liver protecting advantages of Reishi mushrooms are proteins and triterpenes, especially Ganoderma acids which have an inhibitory action on the release of histamine in mast cells [10]. It was demonstrated that Reishi mushroom inhibits tumor cell proliferation by stimulating immune factors, such as TNF- α , IFN- γ , and IL-1 β . In layman's terms, the Reishi mushroom is one of the most effective immune boosters known to humans and may assist in killing opportunistic bacteria and viruses [11].

3. Chaga (*Inonotus obliquus*)

Chaga mushrooms are a parasitic fungus that infects hardwood trees, mostly those from the genus *Betula*. This fungus used in traditional medicine to treat various health problems. Chaga really has the highest oxygen radical absorbance capacity of any natural food on the planet, with a huge score of 1104 units per gram. The Khanty people, an ethnic group from Siberia, used it in traditional medicine for different medicinal indications: as an anthelmintic, antitubercular, to cure digestive disorders, to prevent hepatic and cardiac illnesses [12]. The extracts of Chaga have been used in China, Korea, Japan, Russia, and the Baltics for their favorable effects on lipid metabolism and cardiac function, as well as for antibacterial, anti-inflammatory, antioxidant, and antitumor activities [13].

Chaga extracts were found to inhibit hepatitis C virus and human immunodeficiency virus and established strong antioxidant and immunostimulatory activities in vitro [14]. Animal studies showed that aqueous extracts of Chaga mushroom presented anti-inflammatory effects in experimental colitis and gave rise to lipid metabolism. Chaga mushroom has the capability to incensement peroxisome proliferator-activated receptors γ transcriptional activities, which are expected to be medicinal targets for dyslipidemia and type 2 diabetes [13].

4. Cordyceps (*Cordyceps militaris*)

Cordyceps is a fungus that lives on certain caterpillars in the high mountain regions of China. Supplement makers are able to get enough of the product to sell because cordyceps will reproduce in the laboratory of the more than 400 species of Cordyceps discovered, two have become the focus of health research: *Cordyceps sinensis* and *Cordyceps militaris* [15].

C. sinensis is a classic Chinese medication. Due to it is infrequent and costly, some other natural cordyceps, cultured mycelia, and fruiting bodies of cordyceps have get its primer alternatives to prepare of health foods. Cordyceps has several bioactivities, such as hypoglycemic, protective effect on the liver, antioxidant; reduce fatigue, antitumor, sexual and reproductive function enhancement, and immunomodulatory. Cordyceps is quite safe in the in vivo treatment of animals for up to 3 weeks. Fermented products of cordyceps, along with natural *C. sinensis*, could be functional foods for maintaining human health [16].

Some people use cordyceps as a stimulant to increase energy and enhance stamina. Cordyceps works to strengthen immunity by stimulating cells in the immune system, and has anti-cancer activity, as it leads to a decrease in the size of the tumor, especially in cases of skin cancer and lung cancer [17].

Mushrooms and heart health

A group of cardiology researchers from Houston, New York and Cleveland presented the results of their study titled "Mushroom consumption and Cardiovascular Health: A Systematic Review". The researchers said: "Our goal in this investigation is to systematically review existing studies and research regarding the potential cardiovascular benefits of edible mushroom consumption to assess mushroom intake in the management of modifiable cardiovascular risk factors". They added "Edible mushrooms have great nutritional value including protein, essential amino acids, fiber, vitamins D, C, B1, B2 and B-12, and the minerals calcium, potassium, magnesium, phosphorous, copper, Iron, manganese and selenium. It is a low-fat and low-sodium food Consumption of edible mushrooms may have positive effects on blood lipid levels, such as LDL cholesterol, HDL heavy cholesterol, triglycerides, and total cholesterol," they reported in their study. Furthermore, consumption of edible mushrooms is likely to be associated with a moderate decrease in blood pressure [18].

Reduce the risk of cancer

Researchers from Pennsylvania State University School of Medicine presented their scientific review entitled "Higher mushroom intake is associated with lower cancer risk". When analyzing the results of 17 scientific research published between the years 1966-2020 on the incidence of cancer diseases for twenty thousand cancer patients, it was found that there is a strong relationship between the consumption of mushrooms in various diets and the incidence of cancer diseases, as the people who ate mushrooms frequently were 45% less likely to be infected, and these results were explained on the basis that these fungi contain unusually high levels of the antioxidants glutathione and ergothioneine, and these scientists also indicated that mushrooms may protect the body from age-related diseases such as cancer, Alzheimer's, heart and coronary artery. According to a report published by the British newspaper The Guardian, Robert Pillman, professor emeritus of food sciences and director of the Pennsylvania Center for Plant Products and Mushrooms for Health, explained, "Without a doubt, mushrooms are a tremendous nutritional source for these two types of antioxidants, and some types contain both"[19]. In a study it was found that 373 people with precancerous tumors were 27% more likely to respond positively to chemotherapy or radiation while taking reishi mushroom extract than those who did not consume the mushroom as part of their treatment [20].

Immunity Booster

American and Italian researchers published a medical review study entitled "Mushrooms and Immunity ", the researchers said:"In the broad field of nutrients, the effects of mushrooms on immunity and cancer, including autoimmunity, have been argued for centuries. But in recent years, increased scientific interest has led to the elucidation of a number of specific compounds that have properties of biologically active mechanisms." They explained, "The glucans and a certain number of proteins are responsible for most of the biological effects of the Mushroom fungus, especially in terms of modulating the activity of immune cells and resisting tumors. In addition to the types of fats, which constitute a small part of mushrooms, but have a role in reducing cholesterol levels in the blood, and also phenols as antioxidants [21].

The researchers from Michigan presented their detailed study of the feasibility of adding mushrooms to daily nutrition, and it was titled "The Nutritional Effect of Adding a Share of Mushrooms to Food Patterns of the US Department of Agriculture". The researchers said: "Mushrooms are part of the vegetable and are an important source of nutrients and bioactive compounds. Adding 84 grams of sliced mushrooms of the two common types, Crimini Mushrooms and White Mushrooms, results in a 1 percent increase in calories, 3 percent in fiber, 12 percent in potassium, 18 percent in riboflavin (vitamin B-2), 26 percent in niacin (vitamin B-3), 23 percent in selenium, 26 percent in copper. Exposing the mushrooms to UV rays increases vitamin D levels to 200 international units per serving, which results in an 80 percent increase in vitamin D. Adding mushrooms had little effect on sodium (a 1 percent increase or less) and no effect on saturated fat or cholesterol [22].

Overcooking mushrooms can completely deplete the nutritional components of mushrooms, by destroying their bioactive compounds. Therefore, cooking mushrooms requires a delicate balance. A 2016 study published in the

International Journal of Food Science and Nutrition found that the best way to preserve the nutrients in mushrooms when cooking is to grill or microwave. In it, the researchers compared the extent of nutritional changes in the components of mushrooms after they were either boiled, fried, grilled, or microwaved. The study noted that roasted and microwave mushrooms retained the highest levels of antioxidants and beta-glucan [23].

Different vital capabilities of mushroom

The Harvard School of Public Health Bulletin states, in 2022, that the following summary “All mushrooms are low in calories and fat. Perhaps the most interesting properties of Mushrooms are the non-nutritive plant substances, such as the chemical compounds of the polysaccharides, indoles, polyphenols, and carotenoids, which cellular and animal studies have shown. It has antioxidant, anti-inflammatory and anti-cancer effects. But the exact mechanism of these health effects remains unclear and a fertile area for active research. Several polysaccharides found in Mushrooms, including beta-glucans, are believed to have anti-cancer properties. They are chemical compounds in the form of water-soluble fibers. Mushrooms are neither a plant nor an animal food, but rather a type of fungus that contains a substance called ergosterol, which turns into vitamin D when the Mushrooms are exposed to ultraviolet rays.

Mushrooms also contain a variety of B vitamins, phosphorous, selenium, copper and potassium. Mushrooms also contain chemical compounds of polysaccharides that act as prebiotics that feed beneficial prebiotic gut bacteria. Studies show that these sugars stimulate the growth and survival of beneficial strains of friendly bacteria in the colon, because they cannot be digested, and thus can reach the colon where these bacteria live [24].

CONCLUSION

Natural products have historically built a main contribution to drug therapy and are expanding the confidence of people for the therapy of several diseases. Mushroom, as functional foods and pharmanutrients are truly considered as next-generation that corroborating of the health. However, in spite of their very long history of usage, the differences amongst fresh mushrooms, their extracts, and biomass dietary supplements effects on human health are still unknown and still needed more valuation to identification of the responsible biomolecules beside the dose response. A toxicological study is also needed to ensure its safety and to enhance clinical studies.

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