



Research Paper

Medicinal application of Mushrooms in treatment and management of communicable or non-communicable disease

Accepted 27th May, 2022

ABSTRACT

Medicinal mushrooms is characterized as macroscopic fungi, mostly higher Basidiomycetes, which are used in the form of extracts or powder for prevention, alleviation, or healing of diseases and/or for nutritional reasons. Specific biochemical compounds in mushrooms are accountable for ameliorating human health in many ways. There are bioactive compounds present in mushrooms involve polysaccharides, tri-terpenoids, low molecular weight proteins, glycoproteins and immunomodulating compounds. Mushrooms have the capability to lower low density lipoprotein and they contain compounds that prevent the absorption and generation of cholesterol in the liver. These nifty shrooms also contain phytonutrients, which help in inhibiting plaque buildup and maintain health blood pressure. The edible mushrooms have little fat with higher proportion of unsaturated fatty acids and absence of cholesterol and consequently it is the relevant choice for heart patients and treatment of cardiovascular diseases. Minimal sodium with rich potassium in mushroom enhances salt balance and maintains blood circulation in human.

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Keywords: Communicable and non-communicable disease, mushrooms, prevention, treatment.

INTRODUCTION

Mushrooms can be described as ingredient of gourmet cuisine across the globe; particularly for their unique flavor and have been valued by humankind as a culinary wonder (Venturella et al., 2021). Mushrooms are known from centuries to be used as food and medicine. Mushrooms are a group of macrofungi belonging to ascomycetes and basidiomycetes, and they acquire their nutrition through being saprotrophs, parasites, or symbiotic as mycorrhiza. Mushrooms have a reproductive phase (fruiting bodies) and a vegetative phase (mycelia). Mushrooms have a high nutritional value due to their contents of proteins, fats, volatile oils, carotenoids, phenolic compounds, flavonoids, and vitamins such as vitamins B1, B2, B3, C, and ergosterol that can be easily converted into vitamin D2 (Jeitler et al., 2020). Edible mushrooms frequently have low amount of lipid level with higher proportion of polyunsaturated fatty acids; means mushrooms do not have cholesterol; however they have ergosterol that acts as a precursor for Vitamin-D

secretion in human body. The protein content of edible mushrooms is often high, but greatly different. The crude protein content of mushrooms varied from 12 – 35% depending upon the species. The free amino acids composition differ widely but in general they are rich in threonine and valine but deficient in sulphur containing amino acids (methionine and cysteine) (Bulam et al., 2019).

Application of mushroom as medicine

Mushrooms are not only sources of nutrients but also as therapeutic foods, useful in inhibiting diseases such as hypertension, diabetes, hypercholesterolemia and cancer. The functional characteristics of mushrooms are chiefly due to the availability of dietary fiber and in especial chitin and beta-glucans. Specific biochemical compounds in mushrooms are accountable for ameliorating human health

in many ways. The bioactive compounds such as polysaccharides, tri-terpenoids, low molecular weight proteins, glycoproteins and immunomodulating compounds enhance the clinical activity of mushrooms (Alonso et al., 2017). Medicinal mushrooms are observed to have numerous pharmacological actions such as antimicrobial, anti-inflammatory, immunomodulatory, antidiabetic, cytotoxic, antioxidant, hepatoprotective, anticancer, antioxidant, antiallergic, antihyperlipidemic, and prebiotic properties, among others are discussed in turn:

Antimicrobial activity (antibacterial and antifungal activity)

Mushrooms extracts express a higher antimicrobial activity against gram positive bacteria. Mushroom known as *Osmoporus odoratus* produce petroleum ether, chloroform, acetone and water extracts that are helpful for their antibacterial activity against *Staphylococcus aureus*, *Streptococcus pyogenes*, *Bacillus subtilis*, *Escherichia coli* and *Pseudomonas aeruginosa*. The antimicrobial activity of many solvent extracts like methanol, ethanol, acetone and aqueous extract of *G. lucidum* mushroom is applied against six bacterial species *E. coli*, *S. aureus*, *K. pneumoniae*, *B. subtilis*, *S. typhi* and *P. aeruginosa*. The antibacterial and antifungal activity of methanol and aqueous extract of fruit bodies from *Phellinus* is applied against five bacterial pathogens such as *E. coli*, *P. aeruginosa*, *S. typhi*, *S. aureus* and *Streptococcus mutans* and five fungal strains *Penicillium* spp., *Aspergillus fumigatus*, *Aspergillus Niger*, *Aspergillus flavus* and *Mucor indicus* (Chen et al., 2019).

Antioxidant activity

Mushrooms have high amounts of ergothioneine and glutathione which are potent antioxidants. The oxygen molecule is a free radical, which lead to the secretion of the reactive oxygen species and can injure the cells. Ethyl acetate, methanol and aqueous extract of *G. lucidum* are highly prevent $O_2\cdot$ and $\cdot OH$ radicals, but aqueous extract cannot prevent ferrous ion induced lipid peroxidation whereas ethanol extracts of the mycelium of *G. lucidum* is high as antiperoxidative activity. Chaga mushroom are an oxidant powerhouse, making them excellent contenders for fighting free radicals and inflammation. These dark black mushrooms combats oxidative stress (which is linked to skin aging), perhaps inhibit or slow the growth of cancer, and has been found to low density lipoprotein, which is the bad cholesterol (Muszynska et al., 2018).

Management of arthritis

Mushrooms are good for individuals who have arthritis

because of its nutrients which are richest vegetarian source of vitamin D, which is significant in maintaining health bones, muscles and immunity and they retard inflammation (Hetland et al., 2020).

Treatment of Alzheimer's disease

Mushrooms are described as useful therapeutic agents in management and treatment neurodegenerative diseases. Lions mane mushroom contains a large number of bioactive components and secondary metabolites that have been promoted for healthy benefits ranging from antibiotic, anti-inflammatory, anti-carcinogenic and neuroprotective properties (Janardhanan et al., 2020).

Treatment of cardiovascular disease

Mushrooms has the capability to lower low density lipoprotein and they contain compounds that prevent the absorption and generation of cholesterol in the liver. These attractive mushrooms also contain phytonutrients, which aid in inhibiting plaque buildup and maintain health blood pressure. The edible mushrooms have little fat with higher proportion of unsaturated fatty acids and absence of cholesterol and consequently it is the relevant choice for heart patients and treating cardiovascular diseases. Minimal sodium with rich potassium in mushroom enhances salt balance and maintaining blood circulation in human (Sun and Niu, 2020).

Prevent fibromyalgia

The Ganoderma lucidum mushroom seems to be capable to ameliorate fibromyalgia symptoms, involving depression and pain. Reishi mushrooms are especially effective for fibromyalgia due to the fact that it helps decrease spasticity in muscles, irritable bowel syndrome, Colitis, ulcers, bronchial spasms and it helps the liver detoxify waste (Zeb and Lee, 2021).

Anti-aging activity

The polysaccharides from mushrooms are potent scavengers of super oxide free radicals; then these antioxidants inhibit the action of free radicals in the body, consequently decreasing the aging process. Ergothioneine is a specific antioxidant found in *Flammulina velutipes* and *Agaricus bisporus* which is necessary for healthy eyes, kidney, bone marrow, liver and skin (Blagodatski et al., 2018).

Control muscle loss

Cordyceps classes of mushrooms act as being very

stimulating for both energy and libido. Cordyceps can help the body utilize oxygen more efficiently and enhance blood flow and can also be useful for athletes or those who regularly work out and also speed up post-workout muscle recovery(Javed et al., 2019).

Lower weight gain

Mushrooms helps in weight loss. The antioxidants present in mushrooms decrease the risk of metabolic disorders. Mushrooms are rich in fibre and protein which fulfil the body nutritional requirements.

Regulate digestive system

The fermentable fiber as well as oligosaccharide from mushrooms acts as a prebiotics in intestine and therefore they anchor useful bacteria in the colon and its dietary fibre assists the digestion process and healthy functioning of bowel system.

Strengthen immunity

Mushrooms are capable of strengthening the immune system. A diverse collection of polysaccharides (beta-glucans) and minerals, isolated from mushroom is accountable for up-regulating the immune system and these compounds potentiate the host's innate (non-specific) and acquired (specific) immune responses and activate all kinds of immune cells. Fungal β -glucans are notably beneficial to humans; they markedly stimulate the human immune system and protect from pathogenic microbes and from harmful effects of environmental toxins and carcinogens that impaired immune systems and also protect from infectious diseases and cancer and aid patients recovery from chemotherapy and radiotherapy(Deo et al., 2019).

Improving kidney functions

The mechanism of kidney-enhancing activity of Cordyceps is owing to its capability to elevate 17- ketosteroid and 17-hydroxycorticosteroid levels in the body, protect sodium pump activity of tubular cells, accelerate tubular cells regeneration, and reduce calcium content in certain tissues(Roda et al., 2020).

Antitumoral activity

The antitumor polysaccharides isolated from mushrooms are acidic or neutral, with strong antitumor action and different, importantly in their chemical structures. A wide range of glycans extending from homopolymers to highly

complexheteropolymers exhibits antitumoral activity. Mushroom polysaccharides have antitumor action by activation of the immune response of the host organism, in other words, mushroom polysaccharides do not directly kill tumor cells(Barad et al., 2020).

CONCLUSION

Mushrooms can be expressed as ingredient of gourmet cuisine across the globe particularly for their unique flavor and have been valued by humankind as a culinary wonder. Medicinal mushrooms are demonstrated to have numerous pharmacological actions such as antimicrobial, anti-inflammatory, immunomodulatory, antidiabetic, cytotoxic, antioxidant, hepatoprotective, anticancer, antioxidant, antiallergic, antihyperlipidemic, and prebiotic properties. Mushrooms are characterized as useful therapeutic agents in management and treatment neurodegenerative diseases. Lions mane mushroom contains a large number of bioactive components and secondary metabolites that have been promoted for healthy benefits ranging from antibiotic, anti-inflammatory, anti-carcinogenic and neuroprotective properties.

ACKNOWLEDGMENT

The author is grateful to anonymous reviewers for the comments that increase the quality of this manuscript.

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Cite this article as:

Bereda G (2022). Medicinal application of Mushrooms in treatment and management of communicable or non-communicable disease. *Acad. J. Food. Res.* 10(3): 025-028.

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