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MYCOMEDICATION

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Mycomedication means “use of fungus as medicine” which is also known as myco medicine. Mycomedicine is a special class of medicine, which is used mainly in Asian countries for many years. It is composed of spores, fruiting bodies, or other tissues as well as biochemical compounds like polysaccharides, and triterpenoids extracted from medicinal fungi.

In the late 19th century, the discovery of penicillin by Alexander Fleming from *Penicillium notatum* focused on the use of fungi and their extracts as a medicinal value in front of the world. There is a huge potential in medicinal fungi to enhance the immune responses of an individual with various mechanisms like inducing apoptosis, autophagy, and reduction of metastatic potential.

There are lots of fungi that are used for medicinal properties such as *Auricularia delicata*, *Ganoderma sp.*, *Pleurotus tuber-region*, *Lentinus velutinus*, *Pycnoporus sanguineus*, *Schizophyllum commune*, *Daldinia eschscholtzii*, *Inonotus obliquus*, *Piptoporus betulinus*, *Trametes versicolor*, *Fomes fomentarius*, *Fomitopsis pinicola*, *Trichaptum pergamenum*, *Stereum subtomentosum*, *Grifola frondosa*, etc., possess wide range bioactivities, e.g., antiviral, antifungal, antibiotic, anticancerous, anti bacterial, anti-inflammatory, and in cardiovascular disorders.

Antiviral Activities by Medicinal Mushrooms

- Laccase (LAC) is a low molecular substance extracted from the medicinal mushroom *Tricholoma giganteum* which inhibits the RT activity of HIV-1. LAC is


Fig1:-Ganoderma lucida

extracted from lots of other mushrooms like the dried fruiting body of *Hericium erinaceus*, and the fruiting body of *Pleurotus eryngii*, *Ganoderma lucidum*, and *Lentinus edods*.

- The lectin extracted from the toxic *Pholiota adiposa* and *Inocybe umbrinella*, The *Schizolysin*, a hemolysin extracted from *Schizophyllum commune*, and hemagglutinin extracts from *Cordyceps militaris*, are known to inhibit the inhibitory activity of HIV-RT.



Fig2:-Fomes fomentarius

- Lake Sinaivirus (LSV) and Deformed Wing Virus are the diseases of honey bees and these diseases are controlled by the use of extracts from both medicinal mushrooms like *Fomes fomentarius* and *Ganoderma lucida*.

Anti Bacterial Activity of Medicinal Mushrooms

Ganoderma mushroom species show antibacterial effects on both Gram Positive as well as Gram Negative bacteria. The mycelial extracts of this fungi possess antibiotic activity against different strains of bacteria such as *Bacillus subtilis*, *Bacillus cereus*, *Staphylococcus aureus*, *E. coli*, *Salmonella spp.* The extracts of *Ganoderma lucidum* in combination with 4 Antibiotics i.e. ampicillin, cefazolin, chloramphenicol, and oxytetracycline shows combine effects on bacteria and are found more effective to decrease the growth of bacterial cells.

Anti protozoal Activities of Medicinal Mushroom

Protozoa are unicellular, nucleated organisms generally associated with animal cells. It is responsible for causing Malaria disease in human beings. It has many species (*P. vivax*, *P. falciparum*, and *P. malariae*) which affects the animal cells and leads to sickness. Interestingly, extracts from *Ganoderma lucidum* show inhibitory effects against *Plasmodium falciparum* as well.



Fig3:- Cordyceps mortierella

Anti-Inflammatory Activities of Medicinal Mushrooms

Inflammation is the complex biological response of the immune system to harmful stimuli, from infection, damaged cells, or irritation. Macrophages play a crucial role



Fig4:-Armillaria mellea

during the inflammatory process by engulfing apoptotic cells and pathogens and secreting immune effector molecules. The control of the overproduction of inflammatory molecules by macrophages should greatly facilitate the treatment of inflammatory diseases such as rheumatoid arthritis, septic shock, and autoimmune diabetes. There has recently been increased interest globally in identifying anti-inflammatory components/compounds that are pharmacologically potent and have few or no side effects for use in preventive medicine. Medicinal mushrooms, most of which belong to higher Basidiomycetes, are species used or studied as possible treatments for disease. The anti-inflammatory compounds like chloroform, ethyl acetate, methanol, and n-hexane are extracted from the mycelium of five important medicinal mushrooms *Cordyceps mortierella*, *Armillaria mellea*, *Cephalosporium sinensis*, *Ganoderma lucidum*, and *Hericium erinaceus* are being used widely. The chloroform extracted from *H. erinaceus* and *Armillaria mellea*, Ethyl acetate extracted from *A. mellea*, n-hexane, ethyl acetate, chloroform, and methanol extract from *C. sinensis*, *G. lucidum*, and *Cordyceps mortierella*. The chloroform among all is the most effective inhibitor of inflammatory substances.

Antioxidant Activity of Medicinal Mushrooms

Nowadays, biologically active substance is a major issue in the pharmaceutical industry. Although higher fungi have a wide range of secondary metabolic pathways, they have been less studied as a potential source of BAS than plants. The Chaga mushroom (*Inonotus obliquus*), is traditionally used as medicine in Russia. It has been used for a long as an anti-inflammatory and anti tumor agent and has also proven pronounced anti cancer and immunomodulatory effects. In China and Japan, the reishi (also known as lingzhi) mushroom (*Ganoderma lucidum* (Curtis) P. Karst) is widely used for medical treatment. It has been shown that



Fig5:-*Inonotus obliquus*



Fig 6:-*Piptoporus betulinus*

fruiting bodies of *Ganoderma* contain high concentrations of steroids and triterpenes (triterpenic acids and alcohols), which have a pronounced anticancer effect. A report from Japan shows that extracts of glycoprotein from biotechnologically cultivated *Trametes versicolor* (L.) Lloyd has got anticancerous properties. Extracts from *P. betulinus* fruiting bodies were rich in free amino acids and showed high antiradical and antioxidant activity.

The xylotrophic fungi species growing on birch are potential natural sources of antioxidants and free amino acids.

Anticancer Activity of Medicinal Mushrooms

Naturally obtained products are playing a major role not only in health promotion and disease treatment but also in drug discovery and development these days, especially in the area of cancer and infectious diseases. Medicinal mushrooms are a large group of organisms that are extensively used as antiviral, antimicrobial, anti-inflammatory, antihyperglycemic, and anti cancer compounds. *Ganoderma lucidum*, as already been discussed in the last section, has been used in traditional Chinese medicine as a medicinal mushroom for many years for the prevention and treatment of various human diseases, including chronic bronchitis, hepatitis, hypertension, hypercholesterolemia, immunological disorders, and cancers. The major bioactive ingredients in *Ganoderma lucidum* are polysaccharides, ganoderic acid (triterpene), and adenosine. *Ganoderma lucidum* possesses biological activity and is of therapeutic application, while ganoderic acid possesses anti-tumor and anti-HIV-1 activities, in addition to other biological activities including facilitating histamine release, cytokine production, and immunomodulatory activity. *Ganoderma lucidum* is the most well-studied member of the Ganodermataceae family. *Amauroderma* is another member of the same family, widespread in tropical areas, and contains about 30 species. Among them, *Amauroderma rude* is a newly described fungus in 2007. This mushroom is brown with concentric zones of varying shades on the cap and possessed the highest activity in inducing cancer cell death.

Conclusion

Medicinal uses of traditional and natural products have long been applied in Asian countries but have been primarily dependent on ancient experience and evidence. Ever since the development of the famous fungal extract, penicillin, and the notable 2015 Nobel Prize for the discovery of artemisinin from traditional Chinese herbs, a growing body of research has acknowledged the potential pharmacological and beneficial effects of these natural-based products. Mycomedicine, which consists of all macroscopic fungi, medicinal mushrooms, and their extracts or powders, contributes an enormous source of food and health supplements for humans, with presents numerous benefits, including anti-cancer, antibacterial, and anti-inflammatory properties. Despite promising advantages, several obvious limitations need to be resolved. First, aside from the widely documented anti-cancer components of myco

medicine, the exact structures and anti-neoplastic functions of numerous bioactive have not been extensively explored. More importantly, the amount of these pharmaceutically active compounds isolated from Mycomedicine is usually extremely low, with extraction procedures being costly and time-consuming. Thus, in this regard, improving the extraction methods and purification protocols could be a practical strategy to enhance production. Lastly, although medicinal mushrooms are superior in terms of their safe application and less severe side effects to humans, their efficacy is usually lower than that of synthetic agents. This vital weakness leads to the phenomenon that Mycomedicine is consistently regarded as an adjuvant rather than a main therapeutic approach for treating diseases, including cancers. Having a tremendous reservoir of pharmacologically active chemical compounds, Mycomedicine deserves further development, and in-depth studies should be conducted to reveal the mechanisms of action of this "superfood" in treating various diseases.

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