



Review on Medicinal Application of Mushroom: *Cordyceps Militaris*

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ABSTRACT

The medicinal mushroom *Cordyceps militaris* is rare and precious, and it has long been utilised in traditional drug. Due to its colorful physiological conditioning and several active constituents (including cordycepin, polysaccharides, ergosterol, mannitol, etc.), it's now employed for a variety of remedial purposes. Antibiotic, anti-inflammatory, anti-tumor, anti-metastatic, hypoglycemic, immunomodulatory, antioxidant, steroidogenic, and hypolipidamic conduct are all displayed by *C. militaris* multitudinous clinical trials have demonstrated the salutary goods of the new *C. militaris* factors on mortal health.

KEYWORDS: *Cordyceps militaris*, cordycepin, polysaccharides, antioxidant, anti-inflammatory, anticancer, immunomodulation

INTRODUCTION

Today medical herbs are increasingly popular and important in the public and scientific communities. The study of medicinal mushrooms' biology and chemistry as well as their practical operations in the field of Pharmacology is demanded in order to produce new medications using biotechnological methods. *Cordyceps* species is a useful natural product source with a wide range of natural processes. *Cordyceps militaris* is a unique and precious medical mushroom in china which has been extensively used as a conventional drug. *Cordyceps militaris*, belonging to the *Clavicipitaceae* family, a member of the *Clavicipitaceae* class. *C.militaris* is a common insect endoparasitoid that generally grows on pupae and less frequently on larvae and is wide across North and South America, Europe and Asia. It grows into a tiny, 3- to 4- centimeter (about 1-3 inch) fruiting structure that resembles a mushroom and has an orange head, or cap. It has numerous types active factors (similar as cordycepin, polysaccharides, ergosterol, mannitol, etc.), and because of its different physiological conditioning, it's now used for multiple medicinal purpose. *C.militaris* polysaccharide molecular weights vary from 1.273×10^3 to 4.36×10^4 Da and these polysaccharide have shown immunomodulatory activity. *C.sinensis* is an another member of genus cordyceps which has high molecular weight polysaccharide, strong resemblance to *C.militaris*.



Cordyceps militaris

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BIOACTIVE COMPONENTS OF *C.militaris*

From northern *Cordyceps* (*C.militaris*), various biologically active substances have been discovered. Aside from cordycepin and adenosine, *C.militaris* also contains γ -aminobutyric acid (GABA), ergothioneine, ergosterol, cerebrosides, lectins, D- mannitol, xanthophylls and carotenoids similar as lutein and zeaxanthin, lovastatin, phenolic compounds, flavonoids, vitamins, and biominerals similar as magnesium, potassium, selenium, and sulfur.

Table 1 Concentration of bioactive components in *C.militaris*

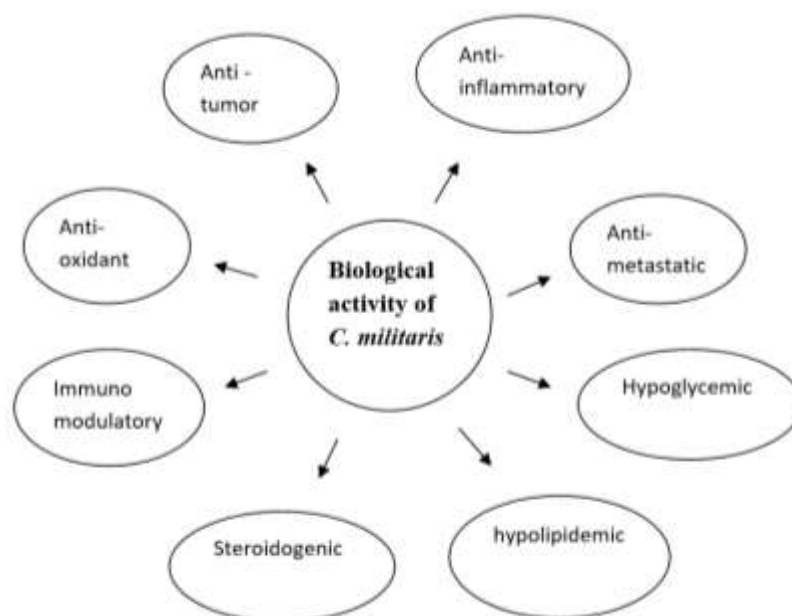
Bioactive components	Fruit body	Mycelium body
cordycepin	0.11%	0.182%
D-mannitol (cordycepic acid)	4.7 mg/100g	5.2 mg/g
ergothioneine	782.37 mg/kg	130.65 mg/kg

Table 2: Concentration of bio minerals in *C.militaris*

Bio minerals	Fruit body	Mycelium body
Magnesium	4227 mg/kg	3414 mg/kg
Sulfur	5088 mg/kg	2558 mg/kg
Potassium	15938 mg/kg	12183 mg/kg
Selenium	0.4 mg/kg	<0.5 mg/kg

BIOLOGICAL ACTIVITY

Cordycepin (3'-deoxyadenosine, C₁₀H₁₃N₅O₃), is a main active part of *C.militaris* which exhibits an antibiotic nature that might inhibit canceration of cells. Other compounds such as Polysaccharides and ergosterol give antiinflammatory, anti-tumor, anti-metastatic, hypoglycaemic, immunomodulatory, antioxidants, steroidogenic and hypolipidemic conditioning. *C.militaris* used as a folk alcohol to help and control various conditions. Silver nanoparticles (AgNPs) biosynthesized from *C.militaris* mycelium extract due to its antibacterial activity.

Fig 1: Various biological activities of *C.militaris*

MOTIFS IN MEDICINE

C.militaris are used to treat various conditions including lung and order malfunction, habitual inflammation, night sweat, pale lips, buzzing in the cognizance, wakefulness and thirsty, cold or hot branches, nervous exhaustion, toothache and loose teeth, pain in knees, diabetes, sexual incompetence, anemia and slow, recovery from illness respiratory diseases, hyperglycemia, cancer, and cardiac arrhythmias.

1. FIBRIN CLOT

Fibrin clot is formed when fibrin protein is accumulated in a blood vessel which leads to thrombosis and heart conditions. Fibrinolytic enzymes derived from *C.militaris* have an anti-coagulant activity which is used to dissolve fibrin clots. Since huge numbers can be manufactured easily and effectively, this enzyme may be a supplement to the precious fibrinolytic enzymes that are now employed for treating aging heart complaint.

2. INFLAMMATION

An important part of natural processes that are triggered by a variety of stimuli and unpleasant elements, similar as UV radiation, irritants, infections, and cell damage, is inflammation. The primary signs of inflammation are redness, a high body temperature, discomfort, and changes in the physiological processes at the infected locales. Inflammation is typically thought of as a protective mechanism against pathogen-induced tissue damage, and it can be

either acute or habitual. Due to their capability to suppress both acute and habitual seditious responses, medicinal fungi like, *C.militaris* or their element cordycepin are presently being researched as anti-inflammatory therapeutic medicines. iNOS and COX- 2 gene expressions related to inflammation were reduced by cordycepin, a major element of the *C. militaris*.

3. CANCER THERAPY

The mushroom *C.militaris* has long been utilised in traditional Chinese drug and as a nutraceutical in eastern Asia as a cancer treatment. One of the most significant bioactive anticancer medicines found in the *Cordyceps* species (summer grass- winter worm) is cordycepin (3'-deoxyadenosine), which has antibacterial, anticancer, antimetastatic, immunomodulatory, and insecticidal properties. Human sarcoma cell line HT1080, and human umbilical vein endothelial cells (HUVEC) proliferation were both suppressed by a water extract of *C. militaris*. Additionally, this mushroom extract decreased the expression of the genes for metalloproteinase 2 (mmp2) in HT1080 and introductory fibroblast growth factor (bFGF) in HUVECs. The dried regenerating bodies of *C. militaris* lately contained a cytotoxic protease that showed cytotoxicity against mortal bone and bladder cancer cells.

4. ANTIOXIDANT ACTIVITY

After the identification of a wide range of bioactive factors, including flavonoids, polyphenols, sterols, peptides, and polysaccharides, it was demonstrated that *C. militaris* extracts were a rich source of antioxidants. To find an antioxidant that would be beneficial for the biological system, a wide range of in vitro experiments have been examined for antioxidant activity. The anti-oxidant rates of the *C.militaris* extract showed that free radical scavengers can guard against oxidative damage to DNA, proteins, and other macromolecules. Also, *C.militaris* extract has the capacity to reduce reactive oxygen species (ROS), which can affect in aging- related ails including cancer.

5. HYPOLIPODEMIC ACTIVITY

Atherosclerosis has been linked to hyperlipidemia as a contributing factor. It is thought that several lipids are linked to rotundity, heart complaint, stroke, and order failure. Strong unproductive connections between lipid parameters and hyperlipidemia have been shown by epidemiological examinations. Due to its high fibre, protein, and microelement content and low fat content, several comestible mushrooms have been demonstrated to be an essential natural authority for treating hyperlipidemia. The metabolism of adipose acids is affected by the use of nucleotides and polysaccharides from *C.militaris*, which reduces cholesterol content.

6. HYPOGLYCEMIC ACTIVITY

Diabetes mellitus (DM) is a condition that, if left untreated, can lead to serious side effects like blindness, myocardial infarction, kidney illness, and nervous system complaint. Because of the elevated blood glucose situations associated with DM, haemoglobin, lens proteins, and other tissue proteins are more likely to glycate, which cause glucotoxicity. The patient problems in DM may be brought on by protein glycation, which damages tissue. As a result, natural hypoglycemic products may be useful in the treatment of diabetes. According to a 2004 study by Choi et al., *C.militaris* water extract enhanced insulin production and reduced insulin resistance in rats who had 90 of their pancreas removed.

7. IMMUNOSTIMULATORY ACTIVITY

An organism's capacity to defend itself against diseases by recognising and eliminating outside dangerous chemicals is known as immunity. In a living organism, the host immune response consists of both in innate immunity and adaptive immunity, and it depends on a many crucial vulnerable organs. Orally consumed polysaccharides have been set up in several trials to stimulate the small intestine's vulnerable system. By connecting to the projecting ends of dendritic cells (DCs) in the follicle- associated epithelium(FAE) of Peyer's patches, orally ingested polysaccharides can either be absorbed through M cells or by binding to the FAE's dectin- 1 and risk- suchlike receptor 2 (TLR2) to stimulate immunological response. Alkali-answerable polysaccharides derived from *C.militaris* have vulnerable nonsupervisory conditioning Low- molecular- weight polysaccharide (CMPB90-1) is a homogeneous polysaccharide that's primarily composed of D- glucose, D- mannose, and D- galactose and was insulated by alkaline extraction from *C.militaris* dressed regenerating bodies. Splenic lymphocytes and NK cells demonstrated immunostimulatory activity in response to CMPB90- 1. When we drink herbal tea, it gives stimulating, and relief to head ache. Add a minimal amount of *C.militaris* excerpt to herbal tea. It stimulates hormonal balance and stress relief.

CONCLUSION

In the history, *C.militaris*, an antiquated medical fungus, was employed as a tonic medicine, but it's now allowed to be a implicit source of numerous enigmatic possibilities being explored. Multitudinous clinical studies have shown that the new factors derived from *C.militaris* have positive impacts on mortal health. The primary bioactive element of *C.militaris* is cordycepin, shown strong anti-inflammatory, anti-cancer, anti-metastatic, and immunomodulator properties. *C.militaris* works as pharmacological agents to treat conditions including cancer, heart illness, lung and renal dysfunction, among others. It requires further exploration, pharmacological analysis, clinical trials, and public education to completely understand this new remedial fungus, *Cordyceps militaris*.

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