

THE EFFECTS OF CORDYCEP MILITARIS ON HUMAN HEALTH: A REVIEW

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ABSTRACT

Cordyceps militaris - a valuable herb, is used as a medication to enhance health and wellbeing in many nations, particularly in Vietnam. Therefore, many research were carried out to examine how *C. militaris* affects some specific health problems. Our literature reviewed 168 research published worldwide and in Vietnam and revealed that: (1) *C. militaris* may promote immunity; (2) *C. militaris* has antioxidants properties; and (3) *C. militaris* could improve lung function. Product CordySen used *C. militaris* as main ingredients so that it also has the potential to bring benefits to human health.

Keywords: *Cordyceps militaris*, *cordyceps*, *immune booster*, *antioxidant*, *lung function*.

I. INTRODUCTION

The medicinal herb cordyceps has long been regarded as a rare, nutrient-rich, and useful herb. Numerous studies have shown that Cordyceps can be used to boost health as well as improve a wide range of medical issues. Among the cultivated varieties of Cordyceps, *Cordyceps militaris* is the most successful and popular cultivated variety. The most productive and well-liked Cordyceps cultivar is *C. militaris*, which is also the most widely grown. As a result, it is crucial to conduct studies to fully comprehend the effects of *C. militaris* in general and the product CordySen in

particular, and to determine the possible applications of this medicinal herb as well as the health benefits of this product. Our literature review focused on 3 main objectives:

- 1) To evaluate the ability of *C. militaris* to support immunity,
- 2) To evaluate the properties of antioxidant of *C. militaris*,
- 3) To evaluate the ability of *C. militaris* protect and enhance lung function.

II. METHODOLOGY

A literature review: all the studies based on a combination of keywords, from websites, medical literature, and medical journals were included. In summary, there were 168 references, including 5 documents on traditional medicine and 163 documents on modern medicine.

III. RESULTS AND DISCUSSION

3.1. *Cordyceps militaris* and immunity

Research on Cordyceps in traditional medicine from countries as United States, Japan, Korea, and Thailand have all recognized its nourishing effects, treating tuberculosis, bronchitis, strengthening the immune system and stabilize blood sugar. In terms of strengthening the immune system, the *Ben cao cong xin* (Wu Yiluo) noted: Cordyceps has a sweet taste and neutral; influences on the lungs, kidneys, and the whole body. Cordyceps has ability to increase vitality, improve physical health

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during convalescence, slow down the aging process...

According to modern medicine, the effects of *C. militaris* on the immune system include effects on prolonging the life of the lymphatic system, natural killer (NK) and phytohaemagglutinin (PHA) cell activities affecting interleukin 2 (IL-2), tumor necrosis factor alpha (TNF-alpha) on monocytes. As a result of these processes, more cytokines are produced, which can be used in the treatment of autoimmune diseases or allergies.

The bioactive components in *C. militaris* such as cordycepin, polysaccharide, cordycepic acid and superoxide dismutase [1] had been reported to have different biological properties, with the ability to enhance and inhibit the immune system through the regulation of innate and adaptive immunity. Acidic polysaccharide (APS) extracted from *C. militaris* contributed to the regulation of the activity of macrophages and had potential applications in the treatment of influenza type A [2].

Cordycepin in *C. militaris* had the ability to suppress the expression of the T2D gene, which is responsible for diabetes regulation by inhibiting NF- κ B dependent inflammatory responses. Therefore, it is hoped for applications as an immunomodulator used in the treatment of immune diseases.

Cordymin - a peptide isolated from *C. militaris* - had anti-fungal and anti-viral activity in in vitro study. Cordymin could inhibit the growth of various fungi, and inhibited HIV reverse transcriptase. In vitro studies have demonstrated the antiviral activity of cordycepin and its derivatives. The antiviral activity was confirmed for the influenza virus, Epstein-Barr virus (EBV), herpes simplex virus (HSV) and HIV. The mechanism of antiviral activity of cordycepin

is related to the inhibition of reverse transcriptase and RNA polymerase of the virus [3].

An experiment analyzed the effect of a 12-week supplementation of *C. militaris* on the course of upper respiratory tract infection and the immune response in a group of 100 patients aged 20-70 years. The study showed that the use of *C. militaris* did not have a significant effect on frequency and symptoms of colds. However, an increase in NK cell activity and an increase in IgA concentration were observed, which indicated the immunostimulatory effect of *C. militaris*

3.2. Cordyceps militaris and antioxidant properties

The antioxidant capacity of *C. militaris* comes from polysaccharides, cordycepin, ergothioneine, phenolic compounds, carotenoids, and selenium. Animal experiments with *C. militaris* containing polysaccharides showed increased activity of antioxidant enzymes, specifically superoxide dismutase (SOD), catalase and GPX, and/or decreased levels malondialdehyde (MDA) [4]. In many in vitro experiments, many polysaccharide fragments also showed antioxidant activity, for example WCBP50, CMP, CMP-1 and SeCSP-I. The addition of selenium to the medium of *C. militaris* was found to increase the antioxidant activity of the polysaccharide fractions.

The use of *C. militaris* as a remedy for weakness and fatigue because of its ability to provide energy by increasing cellular ATP has been used for centuries by people living in the high mountains of Tibet. Nowadays, *C. militaris* is used by athletes to overcome weakness and fatigue, while increasing endurance and increasing energy. Furthermore, clinical trials about chronic

fatigue in the elderly showed that using *C. militaris* helped to improve fatigue, dizziness, increase cold tolerance and improved the forgetfulness.

Cordycepin and adenosine in *C. militaris* were shown superior antioxidant activities [5]. These bioactive compounds when taken as dietary supplements played an important role in preventing oxidative damage in the body. The generation of reactive oxygen species (ROS), including O₂ - and H₂O₂, induced by platelet-derived growth factor can be eliminated using cordycepin. Administration of cordycepin protected cells from oxidative damage by decreasing in AST and ALT activity, as well as BUN and creatinine levels in experimental mice. This may be due to cordycepin mediated free radical scavenging activities. Adenosine is activated in energy transfer reactions in the form of adenosine triphosphate (ATP) and adenosine diphosphate (ADP) as well as in signal transduction pathways in the form of cyclic AMP (cAMP). Adenosine promoted the rapid activation of antioxidant enzymes by 2-3 times by activating an AAR subtype that is conjugated to phospholipase C.

3.3. *Cordyceps militaris* and lung function

According to traditional medicine, Cordyceps is a medicine with many nourishing effects for the lungs. The *Ben cao cong xin* (Wu Yiluo) states that Cordyceps has a sweet and warm taste; It has the medicinal properties of nourishing lung, replenishing negative elements, reducing phlegm. According to Traditional Chinese Medicine, Cordyceps mainly used to treat tuberculosis, bloody coughs, laxatives, and expectoration [6] It is also used to relieve fatigue, cough, and body weakness after serious illness. Traditional Chinese medicine

has long believed that Cordyceps has a pulmonary tonic effect, due to its ability to promote oxygen utilization. Traditional medicine believes that the phlegm of the lungs is a viscous, sticky fluid, produced during the activity of the internal organs. When the phlegm condenses in any part, it causes diseases. When phlegm condenses in the lungs, it is difficult for air to move, making it difficult to breathe and creating a good environment for the growth of bacteria and viruses. Therefore, eliminating phlegm is an important step in the treatment of lung diseases, especially with asthma. According to author Dai Duy Ban, Cordyceps in general has many effects on lung diseases such as bronchial stenosis, bronchitis, tuberculosis, asthma. Particularly, Cordyceps has anti-inflammatory and special treatment for bronchial asthma, and when used Cordyceps helps to increase air circulation in the lungs and thereby reduce asthma attacks. In the book Vietnamese Medicinal Plants and Medicines by author Do Tat Loi [7], Cordyceps is a tonic, although it is different from Cordyceps imported from China, but the method of use and usage are similar. With its capacity to treat cough, reduce phlegm and bloody cough, Cordyceps is beneficial for the lungs. The effect of Cordyceps soaked in alcohol is even evaluated as ginseng.

From a modern medical perspective, the active ingredient cordycepin isolated from *C. militaris* was especially beneficial for patients with influenza A because of the ability to reduce symptoms of chronic bronchitis. In 2016, a systematic review of 15 high-quality studies conducted by the university Guangzhou Medical Center (China) collected data from 1238 patients with chronic obstructive pulmonary disease

(COPD) demonstrated that, *C. militaris* could significantly improve lung function, exercise endurance, and quality of life without any side effects. This is because Cordyceps has ability to dilate and open the airways. One of the issues that numerous research had examined is the efficiency of *C. militaris* in treating persistent inflammatory diseases of the lungs. Han et al. (1995) found that using 3g *C. militaris* per day for 2-12 weeks significantly reduced the symptoms of 92% of patients with chronic bronchitis, bronchial asthma, and pulmonary hypertension. Additionally, according to Qu et al (1995), administering 3g of *C. militaris* per day with or without an antibiotic helped to improve the health status of 87% of patients with respiratory disorders.

For chronic obstructive pulmonary disease (COPD), the predictive value of FEV1% and the FEV1/FVC ratio are not only the most important diagnostic and classification criteria, but also important indicators for the progression of COPD. sick. Research using *C. militaris* in combination with modern medicine had increased both the predictive value of FEV1% and the ratio of FEV1/FVC [8].

C. militaris not only contained a high amount of polysaccharide (3-8% of total dry weight) but also a large amount of cordycepic acid (2.4% of total dry weight). Cordycepic acid (D-mannitol) was a useful therapeutic agent for patients with cystic fibrosis and bronchiectasis. Mannitol inhalation powder increased mucosal clearance by rehydrating the airways. These pharmacological effects of cordycepic acid might be one of the important reasons why Cordyceps was used in several respiratory diseases such as asthma and chronic bronchitis, renal dysfunction and renal failure, hypertension.

The pharmacological action of *C. militaris* was consistent with the distribution and physiological role of adenosine receptors. Adenosine receptors such as A1, A2A, A2B and A3 distributed in the brain, lung, heart, liver, and kidneys, were involved in central nervous system-processed events such as sleep, immune response, respiratory regulation, cardiovascular function, and liver and kidney function. These pharmacological effects include antithrombotic, antiarrhythmic, and hypotensive effects; immunomodulatory activity; and protective effects on kidney, liver, and lung.

The product CordySen of Sen Healthcare Joint Stock Company with the main ingredient is *C. militaris* originating from Japan, with higher Cordycepin and Adenosine content than other products on the market, might bring many health benefits for users such as boosting immunity, antioxidant and improving lung function.

IV. CONCLUSION

C. militaris, which has been used in traditional and modern medicine, can support the following effects:

- *C. militaris* has ability to support immunity by acting on components of the immune system such as natural killer (NK) cells, interleukin (IL) cells, and leukocyte tumor necrosis factor alpha of mononuclear, immune cytokines, immunoglobulins.

- *C. militaris* has ability to supplement antioxidants to the body, including nucleosides, sterols, polysaccharides, phenolic compounds.

- *C. militaris* has ability to support protection and enhance lung function through improving lung damage, reducing inflammation, inhibiting tracheal

contractions, increasing lung ventilation, especially in COPD, asthma, bronchitis.

- The product CordySen used *C. militaris* as the main ingredient, so it also has the potential to bring health benefits.

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