



Review of Pharmacological Effects of Agaricus Blazei Murill and its Application in Dietotherapy

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Abstract

Agaricus blazei Murill (ABM) also known as Brazilian mushroom, originated in Brazil and Peru, is a kind of edible and medicinal fungus. It is neutral in nature and sweet in taste, distributed in heart, lung, liver and kidney channels. It has high nutritional value and medical efficacy and is rich in protein, polysaccharides, vitamins, minerals and unsaturated fatty acids. Its pharmacological ingredients mainly include nucleic acid, exogenous lectin, sterols, fatty acids and polysaccharides. It also has the effect of anti-cancer, anti-tumor, immune regulation, anti-inflammatory activity, protection of liver and kidney, treatment of diabetes, antioxidant activity, anti-fatigue effect, prevention and treatment of leukemia, asthma, and radiation injury. It can strengthen health and promote hematopoiesis. With the improvement of people's living standards and the advancement of science and technology, many diseases already have better treatments and the average life expectancy is greatly extended. With the development of food industry, medicine and other related industries, some foods with unique medicinal effects and values such as glossy ganoderma, cordyceps sinensis and Agaricus blazei Murill have been re-recognized and used. The use of these pharmacological foods for disease prevention and treatment has become a trend. For example, the nutrients of relevant foods are extracted to make health-care products and patients are given corresponding solution to assist their treatments. Some progress has been made in realizing the pharmacological effects and dietary applications of Agaricus blazei Murill. This paper will analyze and summarize the results of current researches of pharmacological effect and application in dietotherapy of Agaricus blazei Murill, which is helpful to improve people's understanding of its medicinal effects and to provide rich experience in dietary therapy and experimental basis. With the further research on the pharmacological effects of Agaricus blazei Murill, it will be more widely used in food therapy.

Keywords: Agaricus blazei Murill; Pharmacological effects; Dietotherapy; Present research.



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1. Introduction

Agaricus blazei Murill (ABM) also known as Brazilian mushroom, originated in Brazil and Peru, is a kind of edible and medicinal fungus. Because of its high nutritional value and medical efficacy, it has aroused wide concern and extensive research. It is neutral in nature and sweet in taste, distributed in heart, lung, liver and kidney channels. It is rich in protein, polysaccharides, vitamins, minerals and unsaturated fatty acids. It also has the effect of anti-tumor, protecting liver and kidney, strengthening health and promoting hematopoiesis. Its pharmacological ingredients mainly include nucleic acid, exogenous lectin, sterols, fatty acids and polysaccharides. Nowadays, many diseases already have better treatments and the average life expectancy is greatly extended. With the development of food industry, medicine and other related industries, some foods with unique medicinal effects and values have been re-recognized and used. The use of these pharmacological foods for disease prevention and treatment has become a trend.

This paper will analyze and summarize the results of the current research of pharmacological effects and application in dietotherapy of ABM, providing references and experimental basis for clinical application.

2. Current Researches on Pharmacological Effects of ABM

2.1. Protective Function of Liver and Kidney

ZHANG Qiang et al. found ABM had protective effect on alcoholic liver injury. Mice which were given fermentation solution and fermentation complex broth of ABM had lower levels of ALT and AST in serum. Zhang, et al. [1] ALT is sensitive markers of liver injury and AST is a sign of an increased degree of chronic liver injury. The polysaccharide of ABM had been found could protect renal function. The experiment showed the ABM

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polysaccharide solution could significantly reduce the levels of urea nitrogen and inosine in serum of mice which were negatively correlated with the degree of renal injury [2].

2.2. Enhancement of Immunity

The mouse aging model was established by injection of d-galactose solution. The polysaccharide of ABM could help mice to increase thymus index and spleen index and the high dose group was the most obvious. Li, *et al.* [3] CHEN Lan-fen also got the same results. Chen, *et al.* [4] Thymus has the function of regulating cellular immunity, which can act on the body by producing T lymphocytes and secreting thymosin. The spleen is rich in immune cells which are closely related to immunity. The thymus and spleen index can reflect the body's immune function. It can be seen that polysaccharide of ABM in high dose group can significantly improve viscera index and regulate immune function.

2.3. Antioxidant Activity

ABM has antioxidant activity and scavenging ability for different free radicals. The test showed that the scavenging ability of DPPH radical, OH radical and superoxide anion radical increased with the increase of ABM concentrations. Ren, *et al.* [5] WANG Hong-yu *et al.* also proved polysaccharide of ABM could scavenge DPPH and ABTS free radicals to some extent [6].

2.4. Anti-Fatigue Effect

It was found mice were given a certain proportion of ABM polysaccharide had stronger endurance and hypoxia tolerance and the lactic acid and urine nitrogen in blood did not increase significantly after high-intensity exercise. Liu, *et al.* [7] Therefore, the intracellular polysaccharide of ABM can relieve fatigue to some extent.

2.5. Anti-Tumor Effects

ABM has certain anti-tumor effect. The cancer cell Bel-7402 and CT-26 had been researched. The results showed a kind of ABM mycelium polysaccharide HWSP had obvious inhibitory effect on CT-26 in vitro and the effect was most obvious at the dose of 0.100 g/L. HWSP also had a higher inhibitory effect on the growth of Bel-7402 hepatocellular carcinoma (HCC) cells. Jiang and Gu [8] The dendritic cell (DC) derived from murine bone-marrow was studied. It was concluded that the polysaccharide solution of ABM could effectively improve the ability of antigen presentation of dendritic cells (DC) which could effectively resist malignant tumors and increase the killing rate of tumor cells [9].

2.6. Anti-Inflammatory Activity

ABM has anti-inflammatory effect. The murine macrophage RAW264.7 was studied. The results showed the secretion of TNF- α and NO decreased with the increase of ABD polysaccharide concentration extracted from ABM, especially among high-concentration groups (250, 500, 1000 μ g /m L). Since TNF- α and NO both were major inflammatory factors, them constructed the inflammatory model successfully. Liu, *et al.* [10] Different kinds of inflammatory models of mice were established, which showed polysaccharide solution of ABM could effectively inhibit inflammatory responses such as arthritis and acute ear inflammation [11].

3. Current application of ABM on Dietotherapy

3.1. Prevention and Treatment of Diabetes

Normal saline and different concentrations of ABM polysaccharide were given to adult rats. The tests showed that compared with control group, gain of body weight and decrease of blood glucose were more significant, spleen index and thymus index were higher, CD4+ and CD8+ were also significantly increased and inflammatory cytokines TNF- α , CRP and IL-6 significantly decreased with the increase of dose. Juan, *et al.* [12] The rat diabetes model was established, in which the rats were given normal saline and polysaccharide solution of ABM. The results showed that the body weight, cell counts of peripheral blood CD4+ and CD8+, spleen index and thymus index of the rats fed ABM were all increased, while fasting blood glucose, TNF- α and IL-6 all decreased [13].

Hyperglycemia is a major symptom of diabetes and immune dysfunction plays an important role in the occurrence and development of diabetes. High concentration of inflammatory cytokines will aggravate the course of diabetes and increase the risk of complications. Sheng and Xie [14] Polysaccharide of ABM can reduce blood glucose and enhance immune function and anti-inflammatory activity. It also can prevent and cure diabetes.

3.2. Prevention and Treatment of Leukemia

The leukemia cells at logarithmic growth phase were taken as research objects, which were given different concentrations of ABM polysaccharide. The experimental results showed that the ABM polysaccharide ABP- II - α and ABP- II - β had different inhibition abilities to leukemia cells and the abilities improved with the increase of dosage and duration. Shen, *et al.* [15] The THP-1 cells in acute monocytic leukemia were studied, which were found that the apoptosis rate of leucocyte was significantly increased after giving Low molecular weight polysaccharide of ABM which could enhance the expression of pro-mortal factors such as Bax and related proteases such as Caspase-3, which could enhance the apoptosis. Wang, *et al.* [16] Therefore, polysaccharide of ABM can prevent and treat leukemia to some extent by inhibiting leukemia cells.

3.3. Prevention and Treatment of Gastric Cancer

The clinical studies of gastric cancer were carried out, in which 50 patients with gastric cancer adopted chemotherapy regimens. The results demonstrated that the patients received polysaccharide of ABM had better physical condition, improvement and recovery than the control group. The natural killer cell activity (NKCA) in the treatment group was significantly increased, while the indexes of the patients received broken ganoderma lucidum spore powder were not significantly changed. Fan, *et al.* [17] The gastric cancer BGC823 cells were selected as research objects. The results showed that low molecular weight polysaccharide of ABM had strong inhibitory effect on gastric cancer cells and was strengthened with the increase of time and concentration. It also could reduce the number of cells penetrating the membrane and activate the expression of related proteins which could induce apoptosis. Chen, *et al.* [4] So, ABM has certain preventive and therapeutic effects on gastric cancer.

3.4. The Therapeutic Effect on Asthma

The female Balb/c mice were divided into groups. Mice in different groups were sensitized and then treated with polysaccharide solution of ABM. The results showed that polysaccharide solution of ABM could significantly reduce the number of inflammatory cells, the levels of inflammatory cytokines such as IL-4, IL-5 and IL-3 which could trigger and worsen bronchial asthma and the pathological changes of lung tissues in mice. Men, *et al.* [18] Therefore, polysaccharide of ABM has a certain effect on asthma.

3.5. Prevention and Treatment of Cancer

The lung cancer model of mice was established. The results showed that polysaccharide of ABM combined with selenium could increase the non-tumor body weight of mice, especially in the high-dose groups and effectively inhibit the levels of TNF- α , IL-1 and IL-6 in the serum of mice which played a key role in the occurrence and development of cancer cachexia. All the mice in the dose group survived and showed increased activity during the experiment, while three mice died in the model group. Zhou, *et al.* [19] It can be seen that polysaccharide of ABM combined with selenium has metabolic regulation effect on cancer cachexia and certain prevention and treatment effect on cancer.

3.6. Treatment of Radiation Injury

The radiation model of rats was established. After the radiation of X-ray, gave normal saline and polysaccharide solution of ABM to rats in different groups. Compared with control group, the weight, lymphocyte proliferation activity and erythrocyte solubility of the rats fed ABM all increased significantly, especially in the high dose group. Zhou, *et al.* [20] Lymphocyte proliferation activity is a measure of cellular immunity Zhang, *et al.* [21] and erythrocyte are closely related to the immune system. The drosophila melanogaster was radiated by ultraviolet. The results showed that the ultraviolet radiation had obvious damage to drosophila melanogaster, but those were fed polysaccharide solution of ABM had higher average body weight, significantly lower mutation rate and higher total antioxidant capacity. Sun, *et al.* [22] That means polysaccharide of ABM can improve the anti-ultraviolet ability and enhance the recuperative ability after radiation.

4. Conclusion

Above all, some progress has been made in understanding the pharmacological effects and dietary applications of ABM, such as anti-cancer, anti-tumor, immune regulation, anti-inflammatory activity, protection of liver and kidney, treatment of diabetes and so on. With the further research on the pharmacological effects of ABM, it will be more widely used in food therapy.

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