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Research Progress of Agaricus blazei Polysaccharide on Blood Sugar in Diabetic Patients

Zibing Wei *

School of Food science and Nutrition, University of Leeds, Leeds, LS3 1HX, The United Kingdom
*** Corresponding author Email:** weizibingapp2023@163.com

Abstract: Diabetes is a metabolic infection portrayed by hyperglycemia, including type 1 diabetes and type 2 diabetes, as well as extraordinary twofold diabetes and gestational diabetes, and it will be accompanied by a variety of complications, which will bring great pain to patients. As of now, there are an enormous number of diabetic patients on the planet, and the quantity of diabetic patients is developing quickly, and it has gradually become younger, which has become a very serious public health problem, so how to work on the counteraction and treatment of diabetes is a vital issue. However, one of the major difficulties in the treatment of diabetes is that it can only control the disease, but it cannot be completely cured. Agaricus blazei Murill is a kind of medicinal mushroom. At present, it is found to be rich in many bioactive substances, and it can be used for adjuvant treatment of many diseases. It is also a potential drug to improve the adjuvant treatment of diabetes. If it can stably produce beneficial glucose metabolism such as lowering blood sugar, it will greatly improve the situation of diabetic patients. Therefore, this paper aims to analyze the pathogenesis of diabetes and the existing literature research on Agaricus blazei polysaccharide, and to clarify the specific role of Agaricus blazei polysaccharide in diabetic blood sugar and the related mechanism of Agaricus blazei polysaccharide in improving blood sugar in diabetic patients.

Keywords: Diabetes; Agaricus Blazei Polysaccharide; Hpyerglycemic; Mechanism of Action.

1. Introduction

Diabetes is a metabolic and endocrine disease [1], which influences individuals all around the world and causes serious wellbeing and monetary issues. The survey found that approximately 400 million adults have diabetes, and by 2045, this number is expected to exceed 700 million. Additionally, diabetes was the cause of nearly 4.2 million deaths worldwide in 2019 and at least 760 billion dollars in health care costs, accounting for 10% of the total adult expenditure. Therefore, the current situation of diabetes is very serious.

However, after people's research, it has been found that Agaricus blazei polysaccharide has anti-diabetic properties. At present, the research status of the application of Agaricus blazei in the adjuvant treatment of diabetes is not rich. Therefore, it is the main research direction in the future to discuss the research significance and background of Agaricus blazei in the direction of diabetes by studying diabetes and its pathogenesis, complications and pathogenesis, and its nutritional value, function and influence.

2. Classification, Diagnosis and Pathogenesis of Diabetes Mellitus

Diabetes mellitus is a metabolic sickness portrayed by hyperglycemia, and it is the general name of metabolic irregularity. The reason for diabetes is impeded insulin discharge or disabled insulin activity or both. Additionally, diabetes comes in four forms: type 1 diabetes, type 2 diabetes, two diabetes all exist and gestational diabetes [2-5]. Type 1 diabetes is the annihilation of immune system cells, prompting insulin inadequacy. Type 2 diabetes is impaired insulin secretion, resistance to insulin tissue action or a mixture of the two. A new type of diabetes known as double or mixed diabetes has emerged as a result of the difficulty in defining and diagnosing type 1 and type 2 diabetes. Twofold diabetes, which has the side effects of two kinds of diabetes simultaneously, and Gestational diabetes which is a unique sort of diabetes.

In addition, in the face of more and more diabetic patients around the world, how to diagnose diabetes first is a major focus.

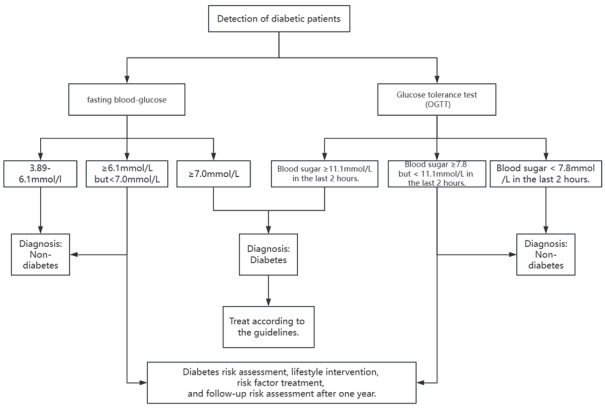

Figure 1. Diagnostic process of diabetes mellitus.

The pathogenesis of diabetes is also very complicated [6]. According to the current research, the pathogenesis of type 1 diabetes is known to involve six factors, while the pathogenesis of type 2 diabetes is known to involve three.

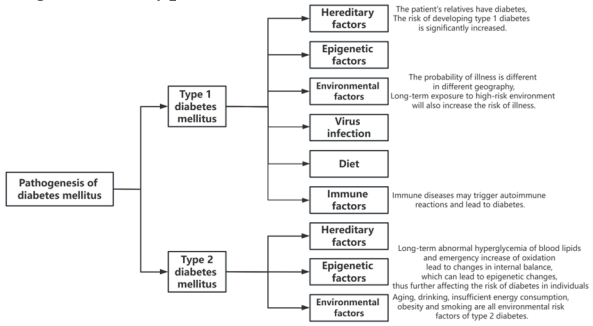

Figure 2. Pathogenesis of diabetes mellitus.

3. Diabetic Complications

The complications of diabetes are very serious, and bring considerable economic burden to millions of diabetic patients and their families [7]. Both macrovascular diseases and microvascular diseases have traditionally been associated with complications associated with diabetes. However, recent research shows that with the extension of life span of diabetic patients, they become not only affected by traditional complications, but also by other emerging complications.

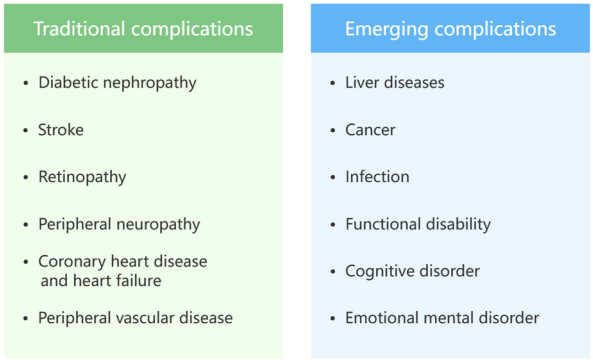

Figure 3. Diabetic complications.

4. Nutritional Value and Function of Agaricus blazei Murill

An edible basidiomycete mushroom is Agaricus blazei Murill (AbM)[8]. Due to its excellent biochemical properties and medical value, it has a strong reputation. As of now, AbM has been demonstrated by many examinations and utilized in adjuvant therapy of different illnesses, including diabetes, arteriosclerosis, chronic hepatitis, hyperlipidemia and other disease. What's more, AbM can likewise assist in controling cell immunity, cell reinforcements, antibacterial and so on.

Figure 4. Agaricus blazei Murill[8].

The nutritional value of Agaricus blazei Murill is very rich, including many bioactive substances, and it also has many medical functions and influences.

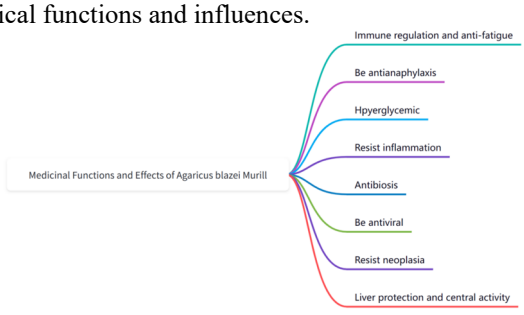

Figure 5. Function and influence of Agaricus blazei Murill.

5. Nutritional Value and Function of Agaricus blazei Murill

Agaricus blazei polysaccharide is one of the main bioactive components of Agaricus blazei[9], which contains many different kinds of polysaccharides. And several common Agaricus blazei polysaccharides are introduced below.

Table 1. Several Common Polysaccharides from Agaricus blazei Murill.

polysaccharide	Function and influence
β-glucan	β -glucan is one of the most important core components of Agaricus blazei polysaccharide, which can enhance the immune function of the body.
Acid polysaccharide	Acidic polysaccharide has antibacterial and antiviral effects.
Protein-binding polysaccharide	Protein-bound polysaccharides can enhance the antioxidant capacity of human body.
Other active ingredients	Such as polypeptide, flavonoids, etc. These ingredients have many other health-care functions.

6. Current Situation

Research shows that about 500 million adults in the world suffered from diabetes in 2021, with China and India as the two major epicentres. According to the survey, there are 140 million diabetics in China, which is equivalent to 13% of adults in China had diabetes. It is anticipated that by 2045, the overall number of diabetic patients on the planet will increment to 784 million, and the prevalence rate of adults will soon reach one eighth. At present, diabetes is not only the patent of the elderly, but also tends to be younger. Especially in Europe, the situation of children and adolescents suffering from diabetes is very serious. Diabetes has turned into a serious problems of public health and medical condition in the world[10].

The effect of Agaricus blazei polysaccharide extract on blood sugar of diabetic patients has been reported at home and abroad, but it is not rich. It is more about Agaricus blazei itself and some ingredients with different infections. There also have some research on other different diseases. In addition, more research is willing to focus on the future application of Agaricus blazei, and also attempt to apply Agaricus blazei to the treatment of COVID-19[11]. It can be seen that the research of Agaricus blazei polysaccharide on diabetes blood sugar is rare at present, and it still has strong development potential.

7. Study on Mechanism of Action

At present, diabetes is a very hot topic in the medical field, and because of the bioactive substances in Agaricus blazei polysaccharide, it is a very promising research to use Agaricus blazei polysaccharide to help improve diabetes and lower blood sugar, so many researchers have adopted different methods to analyze it at present. Wei et al. gave diabetic rats the ethanol extract and the ethyl acetate extract of Agaricus blazei Murill [12]. The results showed that the ethanol extract of Agaricus blazei Murill had the potential to lower the fasting blood glucose value of diabetic rats, especially the ethyl acetate extract can significantly lower the fasting blood

glucose value. Jeong et al. fed the diabetic rats with Agaricus blazei Mushroom Powder (ABP), and found that in the direction of blood sugar concentration [13]. In this way, the experiment found that ABP intake can reduce the food consumption of diabetic rats, thus significantly reducing blood sugar. Niwa et al. found that Agaricus blazei Murill added to the recuperation of islet β-cells by inhibiting oxidative stress and multiplying the creation of pro-inflammatory cytokine TNF-α in diabetes, and by shielding islet cells from harm and adding insulin discharge [14]. MASCARO et al. observed that signal mediation was the conceivable mechanism of β-glucan bringing down glucose [15]. In addition, the PI3K/Akt pathway regulates numerous cell functions, including apoptosis, cell growth, insulin-stimulated metabolism, and inflammatory processes, so human body could through the approach of PI3K/Akt pathway to lower blood sugar.

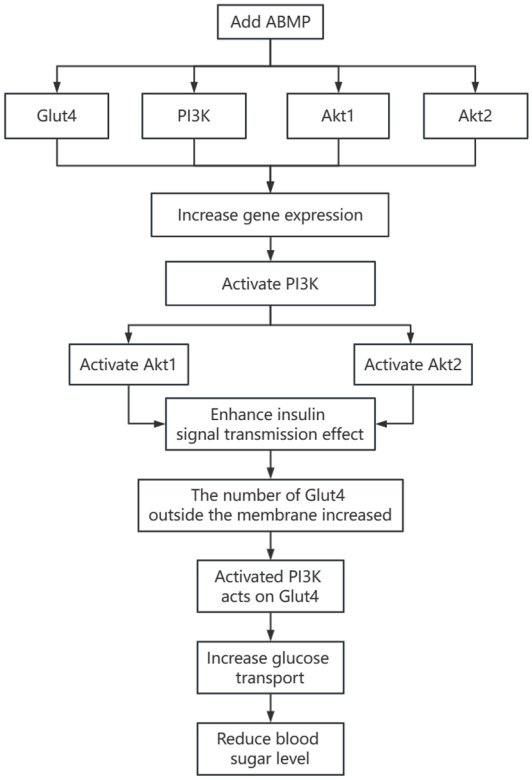

Figure 6. PI3K/Akt pathway.

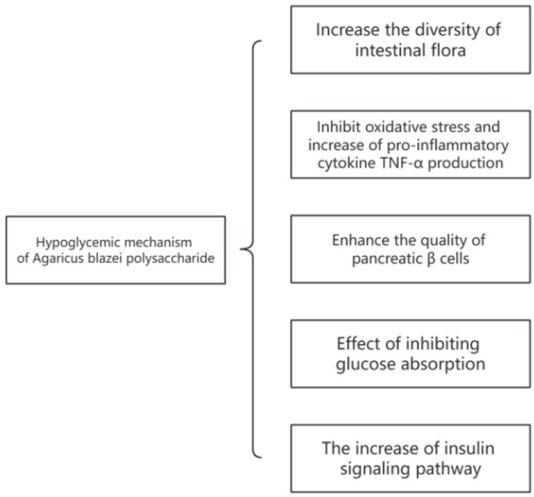

Figure 7. Hypoglycemic mechanism of Agaricus blazei polysaccharide

Through the previous experimental studies, we can find that Agaricus blazei does have the effect of lowering blood sugar in diabetes, and Agaricus blazei lowers blood sugar through various mechanisms. Specifically, the hypoglycemic mechanism of Agaricus blazei polysaccharide can be summarized into the following five aspects.

8. Prospect and Deficiency

As we all know, diabetes is as yet one of the principal issues prompting human demise, so we can predict the medicinal mushroom Agaricus blazei polysaccharide, which has a very strong future development prospect:

Firstly, whether Agaricus blazei polysaccharide can be combined with nano-technology and micro-technology, so that Agaricus blazei polysaccharide can improve blood sugar more efficiently and assist in the treatment of diabetes through targeted action pathway and micro-technology.

Second, maybe Agaricus blazei polysaccharide and other active ingredients can be combined to play a synergistic role to improve the utilization rate and efficacy of Agaricus blazei polysaccharide.

However, there are still many problems need to be solved in the future:

First of all, it is rare to apply Agaricus blazei polysaccharide to the real diabetic population at present and is necessary to extrapolate it from animal experiments to population clinical experiments.

In addition, although Agaricus blazei polysaccharide can improve diabetes and lower its blood sugar, it should be evaluated more comprehensively because of the possible pollution during mushroom cultivation.

9. Summary

This paper summarizes the application of Agaricus blazei polysaccharide (ABP) in lowering blood sugar and improving the adjuvant treatment of diabetes and its complications, and summarizes its various mechanisms in lowering blood sugar. It is beneficial to the further adjuvant therapy of Agaricus blazei polysaccharide for diabetes in the future. Overall, the vast majority of studies are conducted in test tubes or on animals, and there are only a small number of universal clinical trials testing the efficacy in humans. However, due to its rich nutritional value, health promotion activity and various functions, humans will seek a wide application prospect of future natural therapeutic alternatives based on AbM extracts or raw materials.

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