Study on Chemical Components and Hypoglycemic Effect of Dendrobium Nobile Lindl

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Abstract: Dendrobium nobile Lindl is a perennial herb. It is a traditional Chinese medicine commonly used in China. It has the functions of nourishing the stomach and promoting energy, nourishing yin and clearing heat, and has a long history of medication. Therefore, the research on the composition and drug mechanism of Dendrobium candidum has been extensive. In recent years, the research on Dendrobium candidum has focused on the analysis of chemical composition, and its pharmacological effects have mostly focused on the cardiovascular system, hypoglycemia, blood lipids, nervous system, Antioxidant and other aspects. In this article, the chemical constituents of Dendrobium nobile Lindlum were used as the starting point to explore its hypoglycemic effect and discuss its clinical application value.

1. Introduction

The stems of Dendrobium nobile Lindl are clustered, and the upper part is slightly flat and slightly curved and rises[1]. It is 10~ 60 cm high and 1~3 cm thick. It is grooved, with thick nodes and narrow base. The leaves are nearly leathery, oblong or oblong, 6~12 cm long, 1 ~3 cm wide, apex 2 round-lobed, with or without leaves during flowering. The raceme of Dendrobium nobile Lindl has 1 ~ 4 flowers; the flower is large, drooping, up to 8cm in diameter, the perianth is white with light purple, and the apex is purple-red. The lip is obovate and oblong, 4 ~ 4.5cm long, 3 ~ 3.5cm wide, apex round, 1 purple spot on the lip disc, 2 anthers, 4 pollen blocks, and the flowering period is generally 4 ~ 6 months. Dendrobium nobile Lindl has a cold taste, sweet, light, and slightly salty. The function of Dendrobium nobile Lindl is to nourish yin and clear heat, and to quench thirst. It is used for fever injury, thirst, dry tongue, post-ill heat, stomach disease, retching, and less tongue coating[2]. The growth environment of Dendrobium nobile Lindl is mainly distributed in trees and rocks in the forest, and the origins are Sichuan, Guangxi, Yunnan, Guizhou and other regions.

Fig.1 Dendrobium Nobile Lindl

2. Analysis of Chemical Constituents of Dendrobium Nobile Lindl

2.1 Alkaloids

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Alkaloids are the earliest compounds isolated and purified from Dendrobium, and they are also important active ingredients in Dendrobium nobile Lindl, which mainly have anti-tumor, antihypertensive and protective effects on the nervous system[3]. It has been reported that Dendrobium nobile Lindl is also a Chinese medicine Dendrobium species which contains the most Dendrobium in Dendrobium plants. The total alkaloid content in the stem of Dendrobium nobile Lindl is about 0.3%, and the content of Dendrobine in artificial cultivated products can reach 0.2%. The medicinal materials “the tip is the most bitter” are consistent. Structural identification of sesquiterpenoid alkaloids in extracts from Dendrobium nobile Lindl stems identified nine compounds, such as dendrobine and nobilin. In addition, some scholars have isolated Dendrobium type alkaloids, Dendrobium ether bases, organic amine alkaloids and other compounds from Dendrobium nobile Lindl. Some alkaloids are shown in Table 1.

Table 1 Composition of Alkaloids

Number	Chemical Name	Molecular formula
1	nordendrobin	$C_{15}H_{23}NO_2$
2	dendrobine	$C_{16}H_{25}NO_2$
3	adenosine	$C_{10}H_{13}N_5O_4$
4	dendrobine-methohydroxyd	$C_{17}H_{28}NO_2$
5	dendramine	$C_{16}H_{25}NO_3$
6	dendrobin-N-oxid	$C_{16}H_{25}NO_3$
7	nobilin	$C_{17}H_{27}NO_3$
8	4-hydroxy-dendroxin	$C_{17}H_{25}NO_4$
9	N-trans-cinnamoyltyra-mine	$C_{17}H_{17}NO_2$

2.2 Sesquiterpenes

Before 1978, four sesquiterpenoids were successively isolated from three Dendrobium species of Dendrobium nobile Lindl, Dendrobium nobile Lindl and Dendrobium candidum. In 2000, a researcher isolated two Dendrobium alkaloids from Dendrobium nobile Lindl Sesquiterpenoids fl akinins A, B. Since then, sesquiterpene glycosides with enhanced immune activity have been separated from Dendrobium nobile Lindl: dendroside A, dendronobilosides A, dendronobilosides B. In recent years, 10 sesquiterpenes have been isolated from Dendrobium nobile Lindl. Eight sesquiterpene compounds were isolated from Dendrobium nobile Lindl, and compounds 1~ 8 are shown in Table 2.

Table 2 Composition of Sesquiterpene Compounds

Number	Chemical Name	Molecular formula
1	1R,2R,4S,5S,6S,8S,9R- 2,8- dihydroxycopacamphan- 15- one	$C_{15}H_{24}O_3$
2	2β,3β,4β,5β- 2,4,11- trihydroxypicrotoxano- 3(15)- lactone	$C_{14}H_{25}O_5$
3	2β,3β,5β,9α,11β- 2,11- epoxy- 9,11,13- trihydroxypicrotoxano- 3(15)- lactone	$C_{15}H_{22}O_6$
4	2β,3β,5β,12R*- 2,11,13- trihydroxypicrotoxano- 3(15)- lactone	$C_{15}H_{24}O_5$
5	2β,3β,5β,9α- 9,10- cyclo- 2,11,13- trihydropicrotoxano- 3(15)lactone	$C_{16}H_{26}NO_5$
6	9β,10α- muurol- 4- ene- 9,10,11- triol	$C_{15}H_{26}NO_3$
7	5β- cyclocopacaphane- 5,12,15- triol	$C_{15}H_{24}NO_4$
8	δ- cadinen- 12,14- diol	$C_{15}H_{24}NO_2$

2.3 Polysaccharides

In analyzing the chemical composition of polysaccharides in Dendrobium nobile Lindl, its structure includes the arrangement order of monosaccharide residues, the composition of monosaccharide residues, adjacent sugar residues, etc., the connection method, the anomeric carbon configuration, the sugar chain branching, etc. The resulting spatial structure is the basis for the polysaccharide's pharmacological activity. Based on this, the researchers isolated four components from the crude polysaccharide of Dendrobium nobile Lindl, and the analysis results of the

monosaccharide composition showed that the components analyzed by this polysaccharide were mainly glucose, galactose, mannose, and a small amount of rhamnose, arabinose, Xylose, etc.

2.4 Phenolic Compounds

In recent years, researchers have also isolated phenolic compounds from Dendrobium-type plants, mainly including three types of phenolic compounds: bibenzyl, phenanthrene and fluorenone[4]. At present, a total of 13 phenolic compounds, 15 bibenzyl compounds, 8 phenanthrene compounds, and 2 fluorenone compounds have been obtained from D. officinale.

2.5 Tannins

Modern clinical pharmacological research shows that tannins have a variety of biological activities such as bacteriostatic, antiviral, antioxidant, antitumor, and inhibition of gastrointestinal movement, and are widely used in the fields of food and medicine. The researchers determined and compared the content of tannins in Dendrobium nobile Lindl, Dendrobium nobile Lindl, Dendrobium nobile Lindl and Dendrobium candidum, and found that Dendrobium nobile Lindl had the highest content of tannin compounds, and Dendrobium nobile Lindl and Dendrobium nobile Lindl Close.

2.6 Other Chemical Ingredients

In addition, the researchers also isolated eight sesquiterpenoids from Dendrobium nobile Lindl, Dendronobilin J, dendrobane A, dendro-densiflorol, bullatantirol, dendrobiumane A, 6α, 10,12-trihydroxypicrotoxane,10,12-dihydroxypicrotoxane and 10, 13,14-trihydro-xyalloaromadendrane etc. In addition, 2,4,7-trihydroxy-5-methylfluorenone was also isolated and identified from Dendrobium nobile Lindl for the first time. Dengibsin was detected and isolated from Dendrobium nobile Lindl. Ingredients, chemical compounds such as pyranones, parahydroxycinnamates, parahydroxybenzoic acid, stigmasterol, hexacosyl trans ferulate, sitosterol, emodin.

It is worth noting that, in different time periods, relevant researchers' research focuses on the chemical components of Dendrobium nobile Lindl have different focuses. Prior to 2008, the research on alkaloids of Dendrobium nobile Lindl was mainly focused on the field of pharmacological effects, and to explore the effects of different growth regulators on the chemical composition of Dendrobium nobile Lindl under different cultivation conditions; During the period of 2009-2011, with the advancement of new medical detection technology, the determination of the alkaloid content and accumulation of alkaloids of Dendrobium nobile Lindl with different detection methods has become the focus of its research, but the attention in this field is clearly significant. By the drop. Since the research in 2011, researchers have not made much progress in the study of alkaloids from Dendrobium nobile Lindl.

3. The Role of Dendrobium Nobile Lindl in Reducing Blood Glucose

3.1 Dendrobium Nobile Lindl Assisted Hypoglycemic Treatment

In recent years, many domestic researchers have conducted research on the pharmacological activity and clinical application of the effective chemical components of Dendrobium medicinal materials, as well as the chemical components isolated from various Dendrobium plants. Numerous research results have shown that Dendrobium plants, including Dendrobium nobile Lindl, have extremely high pharmacological value, and can be used in anti-tumor, anti-mutation, enhancement of the body's immune capacity, anti-aging, anti-oxidation, vasodilation, anti-platelet aggregation and hypoglycemia Play an active role. In the field of Chinese medicine, it is generally believed that the thirst disease is also the occurrence of diabetes in modern pharmacology. Its basic pathogenesis is mainly characterized by kidney yin deficiency, premature lung and stomach fever, and pathological characteristics are characterized by qi and yin deficiency. Plants have the effects of nourishing yin, clearing heat and moisturizing, and have been used as a special medicine for the treatment of diabetes since ancient times[5]. However, modern clinical studies have shown that

Dendrobium's properties of plants have not only enhanced insulin activity, but also significantly reduced blood glucose levels in the clinical treatment of diabetes. As a result, some researchers have gradually focused their research on the clinical effects of plant-assisted hypoglycemic treatment with Dendrobium properties. For example, Li Manman conducted an empirical study on the research on the treatment of hypoglycemic effect of Dendrobium nobile Lindl and obtained some remarkable research results to clarify the mechanism of its therapeutic effect.

3.2 The Mechanism of Dendrobium Nobile Lindl in the Treatment of Hypoglycemia

Through the Li Manman study, it was found that Dendrobium nobile Lindl has significant effects on the treatment of diabetes[6]. The research results were divided and found that the mechanism of hypoglycemic effect of Dendrobium nobile Lindl is mainly from the following ways:

First, Dendrobium nobile Lindlum lowers triglycerides and regulates lipid metabolism. Dyslipidemia is a major risk factor for chronic complications of diabetes (cardio-cerebral-renal-vascular disease), and disorders of lipid metabolism can aggravate insulin resistance, leading to further disease The deterioration of lipid metabolism may be the primary pathophysiological change of diabetes and its complications, and the increase of triglyceride concentration is a manifestation of lipid metabolism disorder during diabetes. Through network analysis, it was found that Dendrobium candidum can regulate lipid metabolism disorders by regulating fatty acid and triglyceride metabolism, lipid transport, and reducing the concentration of triglycerides, thereby achieving a therapeutic effect on diabetes mellitus to a certain extent.

Second, Dendrobium nobile Lindl can achieve the therapeutic effect on diabetes by regulating the islet cell size, growth regulation, and reducing insulin resistance.

Third, Dendrobium nobile Lindl protects islet cells and reduces insulin resistance: the onset of type 2 diabetes is related to insulin resistance and islet β-cell function defects.

Fourth, Dendrobium candidum regulates the secretion of glucose-dependent insulin-promoting peptide (GIP). Gut suppressor peptide (GIP), also known as glucose-dependent insulin-promoting peptide, is secreted by K cells distributed in the small intestine to adapt to nutrient digestion. It can promote insulin secretion, protect islet β cells, and play an important role in the pathogenesis of impaired glucose-dependent insulin secretion in diabetic patients. Dendrobium nobile Lindl can regulate the secretion of GIP and play a certain role in treating diabetes.

Fifth, Dendrobium nobile Lindl inhibits calcium ion channels. Diabetes causes myocardial microvascular disease and myocardial metabolism disorders, leading to extensive focal necrosis of the myocardium. Its pathogenesis includes disorders of glucose metabolism and abnormal calcium balance regulation. In the absence of ischemia, diabetes can directly cause cardiomyocyte damage and induce diabetic cardiomyopathy. And Dendrobium candidum can regulate Ca 2+ channels through multiple channels, and thus achieve the therapeutic effect on diabetic cardiomyopathy.

In addition, by analyzing the hypoglycemic biological network of D. officinale, it was found that D. officinale mainly plays a role in treating diabetes and its complications through the following channels. First, Dendrobium candidum regulates lipid metabolism by reducing triglycerides. Second, it can reduce insulin resistance. Third, Dendrobium candidum protects islet cells. Fourth, it promotes glucose-dependent insulin-promoting peptide (GIP). Secretion; Fifth, Dendrobium candidum can play a role in inhibiting calcium channels.

4. Conclusion

All in all, in recent years, due to changes in people ’s production and lifestyle, the quality of people ’s life has also improved significantly, and their nutritional diet has also changed. However, many people are still in a sub-healthy state, and various disease incidence groups There is also a clear trend of younger. As a traditional and valuable Chinese medicinal material, Dendrobium nobile Lindlum has historically proven to have significant curative effects in improving human body resistance, resistance to body fatigue, and resistance to bacterial infections. At present, the research fields for D. officinale mainly focus on chemical components and pharmacological effects. Although the alkaloids, polysaccharides and other components of D. officinale have good

physiological activity, no related preparations have been developed so far and they cannot be widely used in treatment. It is believed that with the development of separation technology and bioengineering technology, the continuous maturation of cultivation technology, and the completion of related planting bases, the current problem of insufficient raw materials of Dendrobium candidum can be solved to a certain extent. The emergence of Dendrobium can better play the medicinal and health care value of Dendrobium nobile Lindl, and has extremely broad application prospects.

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