

# Study on Antihypertensive Effect of Ginseng, Pueraria Lobata and Other Medicinal and Edible Chinese Herbal Medicines

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**Abstract:** Hypertension is now recognized as one of the major public health problems in the world, and it is also one of the most important risk factors of cardiovascular and cerebrovascular diseases. Hypertension has seriously endangered people's life and health, so it is particularly important to prevent and treat hypertension. Although the homology food of medicine and food in China has an early origin and many kinds, few of them can form a scale and go abroad. According to statistics, there are more than 400 kinds of food in China, which are based on traditional Chinese medicine with the same origin as medicine and food. We use modern biotechnology to study ginseng, pueraria lobata and other Chinese herbal medicines, obtain active substances with antihypertensive components, and develop related products with antihypertensive function.

**Keywords:** ginseng; Pueraria lobata; Hawthorn; Corn silk; Coix seed; Medicine and food are homologous; lower blood pressure

**DOI:** 10.33142/cmn.v1i1.8870

Hypertension is one of the most common cardiovascular diseases, and it is also the main risk factor leading to congestive heart failure, stroke, coronary heart disease, renal failure and aortic aneurysm. According to the World Health Organization's global disease burden research report, hypertension has become the second largest risk factor affecting global mortality. With the aging of the population in China, the number of patients with hypertension may continue to increase, and the situation of prevention and treatment is grim. The prevalence of hypertension in China is increasing year by year, and it is close to 20% at present. Every year, 2 million people in China die from diseases related to hypertension. Moreover, more than 60% of patients with coronary heart disease, more than 70% of patients with cerebral infarction and 90% of patients with cerebral hemorrhage have a history of hypertension. If the adult's blood pressure is  $\geq 140$ mmHg and/or 90mmHg, it is hypertension. Common risk factors of hypertension lurk in our daily life, including: high-salt diet, overweight or obesity, long-term excessive smoking and drinking, heavy work pressure, mental stress, irregular work and rest time, etc <sup>[1]</sup>.

From diuretics in the 1960s to  $\beta$ -blockers in the 1970s, to calcium channel antagonists and angiotensin converting enzyme inhibitors in the 1980s. Through years of clinical application, the therapeutic effect of these drugs has been affirmed by clinicians and patients. However, in the process of clinical application, the side effects of these drugs are becoming more and more obvious. With the deepening of people's understanding of the pathogenesis of hypertension, new drugs aimed at new and more effective targets have been developed one after another. This product is a kind of antihypertensive health food, based on the concept of homology of medicine and food, using the effective antihypertensive components in Chinese herbal

medicines, making precise proportions, and adopting modern biotechnology to independently develop. It has no toxic side effects and high safety <sup>[2]</sup>.

## 1 Homology of Medicine and Food and Antihypertensive Market

### 1.1 Development status of homology of medicine and food

With the development of society, the increasing number of sub-healthy people and the strategy of "healthy China", the traditional Chinese medicine health preservation of "medicine comes from food, tableware is effective, and medicine is edible" is becoming increasingly prosperous. Both food and traditional Chinese medicine come from nature, and human beings know about food earlier than drugs. In the process of foraging, people gradually realize that some substances can harm people's health or cause death, which is poison. Some substances can make sick people better, that is, drugs. The homology of medicine and food refers to those traditional Chinese medicines that can be used for clinical use and animals, plants and fungi that can be eaten daily. The modern definition of "homology of medicine and food" refers to a kind of long-term harmless Chinese herbal medicines which are classified as edible and medicinal by the relevant state departments and have a long tradition of eating habits, including edible animals and plants, fungi and spices. Since the Zhou Dynasty, there have been records of medicinal and edible plants, such as the descriptions of Lycium barbarum, pueraria lobata, Zanthoxylum bungeanum and mulberry in the Book of Songs. It was not until the appearance of Shennong Herbal Classic in Han Dynasty that people gradually got to know about edible plants <sup>[3]</sup>. "Five grains,

five animals, five fruits and five vegetables are described in Huangdi Neijing Tai Su. If they are used to satisfy hunger, they are called food, and if they are used to treat diseases, they are called medicine". This is the most clear record about the definition of dual-use medicine and food, and it is also the first documentary record of homology description of medicine and food. Studies on the dual-use of medicine and food in the treatment of diseases show that the homologous foods of medicine and food have obvious advantages in lowering blood pressure, relieving fatigue, lowering blood sugar, resisting oxidation and losing weight, and they also play an important role in the prevention and treatment of epidemic situation in COVID-19. At present, the dual-purpose food for medicine and food is favored by middle-aged and elderly people and even young people because of its safety, universality, treatment and health preservation and certain physiological effects, and it has become a hot topic for people. In addition, people's requirements for health preservation and health are increasing day by day, and the application of medicine and food homologous resources has attracted much attention and attention, and has been widely used in food and health care industry, which can improve people's sub-health and promote the development of Chinese medicine and economy <sup>[4]</sup>.

## 1.2 Development Status of the Step-down Market

In China, hypertension, as the most common cardiovascular disease, has a low treatment rate, which poses a great threat to people's health. Long-term use of antihypertensive drugs is an effective medical means to control and treat hypertension at present. In the future, with the aging of the population, the rapid increase in the number of hypertensive patients and the enhancement of people's awareness of preventing hypertension, the market size of antihypertensive drugs will continue to expand, but the expansion rate will slow down day by day, and the growth rate of compound antihypertensive drugs with better treatment effect will gradually accelerate <sup>[5]</sup>.

Although the market size of antihypertensive drugs is increasing year by year, it may not increase too much market space with the release of new guidelines. On the one hand, according to the clinical guidance of the new guidelines, all the patients newly added after adjusting the standards in the new guidelines do not necessarily need to take medicine; On the other hand, after intensive collection, the price of antihypertensive drugs has been as low as a few cents. For example, after the commonly used antihypertensive drug valsartan is collected, each tablet is only 0.1 yuan, and amlodipine tablets are as low as 0.07 yuan per tablet. Obviously, it is hard to say how much performance increase this favorable situation can bring to many generic drug companies due to extremely low drug prices. For innovative drugs, the reduction of diagnostic criteria may bring new growth space. But the premise is that truly innovative drugs have significant advantages in terms of efficacy or safety <sup>[6]</sup>.

## 1.3 Development status of homology of medicine and food

As a traditional, long-standing and systematic discipline in China, Chinese medicine pays attention to the whole and dialectical treatment in the treatment of diseases, and it also pays attention to "preventing diseases". However, the treatment of disease is to prevent it first, and the prevention of disease is to keep in good health at ordinary times. The ancients paid more attention to the changes and development of natural laws and the methods of keeping in good health by diet, such as supplementing qi and nourishing kidney with black food and supplementing iron and nourishing blood with red food. With the improvement of people's material living standard and the development and application of medicine and food homologous herbs, modern people gradually tend to keep in good health by diet, which makes people pay more attention to the choice of this kind of food in their daily life, and achieve the purpose of strengthening their physical function and preventing diseases by adopting the method of medicinal diet therapy in their daily diet <sup>[7]</sup>.

When developing medicinal and edible homologous herbs, we should interpret the safety and supplement of medicinal herbs, develop and utilize medicinal and edible homologous products with safety, tonic and flavor, and at the same time, develop new processing methods. However, in the development and application, we should also pay attention to summarizing the nature, taste, meridian tropism and efficacy recorded in ancient materia medica and medical books, follow the principles of application compatibility and conditioning, understand the true meaning of ancient prescriptions and their unique formula rules, and make full use of the essence of Chinese medicine prescriptions. It is also necessary to establish a relationship with modern physiological effects, and to combine modern technical means to analyze the components-targets-pathways of the developed medicinal materials to develop new therapeutic effects while eating them daily. With the improvement of people's material living standards, accelerating the development and application of medicinal materials with the same origin of medicine and food can also promote the development of traditional Chinese medicine tourism, promote the modernization of traditional Chinese medicine and promote the development of "healthy China" <sup>[8]</sup>.

## 2 Study on Antihypertensive Components of Ginseng, Pueraria Lobata and Other Medicinal and Edible Chinese Herbal Medicines

### 2.1 Research and extraction of antihypertensive components from ginseng

#### 2.1.1 Study on Ginseng-Ginsenoside

Different ginsenosides have different effects on

blood pressure, and have two-way regulating effects of boosting and lowering blood pressure. Some ginsenosides can reduce blood pressure by regulating the expression of nitric oxide synthase in endothelial cells, stimulating vasodilation and blocking calcium channels at the same time. At the same time, some studies have shown that ginseng also contains components that raise blood pressure. In general, ginsenoside Rb1, Rb2, Rb3, Rc, Rd, Rg3, Rh2 and glycosyl PD are the main antihypertensive components in ginseng. In general, ginsenoside Re, Rg1, Rg2, Rh1, glycosyl PT and other protopanaxatriols are the main components with antihypertensive effect in ginseng.

### 2.1.2 Extraction of Ginsenoside

The yield of water extraction is low, water-soluble impurities become more, and water is not easy to store, which is prone to mildew. The main solvents extracted by organic solvent extraction are methanol, ethanol and n-butanol, which leads to more organic impurities in the extract, darker color of the product and lower purity of total ginsenoside. The ultrasonic extraction method has the advantages of less solvent consumption, high extraction efficiency and no influence on the activity of ginsenoside. Ultrasonic extraction is a normal temperature extraction method, which does not need heating. Ultrasonic extraction is a physical process, and there is no chemical reaction in the whole soaking extraction process, which effectively avoids the inactivation and loss of effective components of ginsenoside due to high temperature or chemical reaction in the extraction process. At the same time, the ultrasonic soaking extraction time is short, only 30-60min is needed, which saves the extraction time and improves the extraction efficiency. Ultrasonic extraction was carried out under the conditions of ethanol concentration 60%, solid-liquid ratio 1 : 35, temperature 70°C and extraction time 45min<sup>[9]</sup>.

## 2.2 Research and extraction of antihypertensive components from *Pueraria lobata*

### 2.2.1 Study on *Pueraria lobata*-Flavonoids and Puerarin

The main components of *pueraria lobata* for lowering blood pressure are *pueraria lobata* total flavonoids and puerarin. After intravenous injection of *pueraria* total flavonoids and puerarin, it can dilate peripheral blood vessels to a certain extent, reduce blood pressure, slow down heart rate and reduce myocardial oxygen consumption. Huang Wei and others found in clinical and basic research that puerarin can reduce plasma endothelin (ET) and platelet surface activity, enhance myocardial contractility, inhibit platelet aggregation and adhesion, reduce blood lipid, cholesterol and blood viscosity, and prevent thrombosis. It can dilate peripheral blood vessels, improve microcirculation and vascular endothelial cell function, reduce the ratio of thromboxane to prostacyclin, dilate cerebral vessels, increase cerebral blood flow and improve cerebral oxygen supply<sup>[10]</sup>.

### 2.2.2 Extraction of Flavonoids and Puerarin from *Pueraria lobata*

The main methods of extracting effective components from *pueraria lobata* are heating reflux method, percolation method, alkali liquor method, leaching method, etc., but there are many problems such as high energy consumption, long time and low efficiency. Ultrasonic-assisted extraction is a new extraction technology, which uses the mechanical effect, cavitation effect and thermal effect of ultrasonic wave to accelerate the diffusion and release of plant effective components in solvent and promote the full mixing of plant effective components with solvent. Using ultrasonic wave to extract *pueraria* flavonoids and puerarin has obvious auxiliary effect, which can effectively improve the extraction rate, shorten the extraction time and save the cost. Weigh the coarse powder of *Radix Puerariae*, put it into a triangular bottle with a stopper, add 95% ethanol by volume, pre-soak it for 100Wmin, ultrasonic extract it twice, each time for 30min, combine the two extracts, and concentrate the extracts<sup>[11]</sup>.

## 2.3 Research and extraction of antihypertensive components from hawthorn

### 2.3.1 Study on hawthorn-flavone

*Crataegus pinnatifida*, a dry and mature fruit of Rosaceae, is a traditional Chinese medicine for invigorating stomach and promoting digestion. It is rich in flavonoids, organic acids, triterpenoids, polysaccharides and other chemical components, and has many pharmacological effects such as antioxidation, blood lipid regulation, blood sugar reduction and anti-inflammation. Hawthorn was selected into the list of medicinal and edible medicinal materials issued by the former Ministry of Health in 2002, which is widely used in the fields of medicine and food. The main chemical components of hawthorn are flavonoids, flavans and their polymers, organic acids and so on. The antihypertensive effect of hawthorn is mainly composed of flavonoids and triterpenoid acid hydrolysates contained in hawthorn.

### 2.3.2 Extraction of flavonoids from hawthorn

There are two ways to extract hawthorn flavonoids by ultrasonic treatment technology. Ultrasonic-assisted ethanol extraction was used to extract flavonoids from hawthorn fruit, and ultrasonic-assisted extraction was used to extract flavonoids from hawthorn peel. Both of them are pretreatment of raw materials, material-liquid ratio mixing, ultrasonic extraction technology, centrifugation, determination of absorbance of supernatant, rotary evaporation, concentration and drying, and finally the crude flavonoids are obtained<sup>[12]</sup>.

The extraction rate of total flavonoids in hawthorn fruit was 11.31% when the ethanol concentration was 70%, the ratio of material to liquid was 1:30(g/ml), the ultrasonic power was 400W, the temperature was 55°C and the extraction time was 40min.

Ultrasonic power 100W, ethanol concentration 60%,

solid-liquid ratio 1:10 (g/mL), extraction time 30min, extraction temperature 80°C and extraction times 4 times, the extraction rate of total flavonoids in hawthorn peel residue can reach 4.41%.

## 2.4 Research and extraction of antihypertensive components from corn silk

### 2.4.1 Study on stigma maydis-flavonoids and polysaccharides

There are many kinds of chemical constituents in corn stigma. At present, there are 153 chemical constituents isolated from corn stigma, including flavonoids, terpenoids, sterols, saponins, polysaccharides, amino acids and organic acids. Based on the clinical function of corn stigma, scholars at home and abroad have started a lot of research on its chemical constituents since the 1920s, and found that corn stigma contains many chemical constituents such as phytosterol, flavonoids, allantoin, inositol, polysaccharides, volatile alkaloids, saponins and so on. Polysaccharides have hypoglycemic, diuretic and weight-reducing effects, while flavonoids have cardiotonic, coronary artery dilating and antihypertensive effects. The hypotensive effect of corn stigma is the result of the complementary and mutual cooperation of various chemical components<sup>[13]</sup>.

### 2.4.2 Extraction of flavonoids and polysaccharides from corn stigma

Extraction of total flavonoids: corn must be dried in an oven, crushed and sieved. Take corn stigma powder, add a little water to mix, adjust pH to 10 with NaOH, soak for 1 h, ultrasonic for 30 min at 30°C, filter, cool, adjust pH to 4 with HCl, stand overnight, remove supernatant, add water to recrystallize the precipitate, and filter to obtain total flavonoids.

Extraction of polysaccharide: Weigh the defatted corn stigma powder in a beaker, add distilled water according to the ratio of liquid to material of 20:1(mL/g), mix well, soak at 60°C for 1 hour, and then use ultrasonic power. 450 W extraction for 1h (ultrasonic instrument works intermittently, ultrasonic for 2s, and stops for 4s). After the extraction, centrifuge at 4000r/min for 10min, separate the residue, collect the extract, filter the extract under reduced pressure, dialyze the clear liquid for 24 hours, and determine the quality of polysaccharide in the solution by anthrone-sulfuric acid method with glucose as standard.

## 2.5 Research and extraction of hypotensive components from coix seed

### 2.5.1 Study on coix seed-coix seed oil

Coix seed contains coix seed fat, coix seed oil, sitosterol and alkaloids with high medicinal value, which have the effects of regulating blood lipid and lowering blood pressure. It has the function of dilating blood vessels, and can dilate peripheral blood vessels, especially pulmonary capillaries. It can dilate blood vessels and lower blood sugar, and has certain antihypertensive and hypoglycemic effects.

### 2.5.2 Extraction of coix seed oil

Solvent extraction (low temperature extraction): Generally, some soluble substances in the complex carrier are transferred from solid to liquid, which is essentially a mass transfer process from solid phase to liquid phase. The organic solvents for volatile oil extraction are usually petroleum ether, ethanol, dichloromethane, acetone, cyclohexane ethyl acetate, etc., which are continuously refluxed, distilled, impregnated, etc., then separated, and the solvent in the extract is evaporated at low temperature to obtain volatile oil. Coix lachryma-jobi seed oil was extracted from Coix lachryma-jobi seed by ethanol distillation, the ethanol concentration was 95%, the extraction temperature was 50 °C and the extraction time was 60min. Under these conditions, the extraction rate of Coix lachryma-jobi seed oil was 4.2%.

Ultrasonic-assisted extraction: the cavitation effect, thermal effect and mechanical effect generated by ultrasonic wave are used in the extraction process of traditional Chinese medicine components. By destroying the cell wall and increasing the solvent penetration, the extraction rate is improved and the extraction time is shortened, so as to achieve the purpose of extracting cell contents efficiently and quickly.

## 3 End and Future Outlook

Hypertension is one of the main diseases that threaten people's health in our country, and it is also a stubborn disease. It obviously increases the damage of target organs such as heart, brain, kidney and blood vessels, and it needs to take drugs continuously to maintain the normal blood pressure. Although the antihypertensive effect of traditional Chinese medicine compound is not as fast as that of western medicine, its function is multi-link, multi-channel and multi-target. While lowering blood pressure, it also takes into account other pathological links of hypertension, and has the functions of improving microcirculation, reducing blood lipid and antioxidation, protecting endothelium and regulating vasoactive substances. Therefore, traditional Chinese medicine compound can obviously improve the clinical symptoms of hypertension and improve the quality of life of patients, and it also has unique advantages in the protection of target organs.

This product uses Chinese herbal medicines with the same origin of medicine and food as raw materials. In the process of traditional Chinese herbal medicines, it is usually used by steaming, boiling and cooking. However, the use of effective active ingredients in Chinese herbal medicines such as ginseng and pueraria after cooking will lead to the inactivation, degradation and pharmacological effects of some substances at high temperature.

We adopt a brand-new independent research and development method, based on the study of edible Chinese herbal medicines in Compendium of Materia Medica, carry out compatibility of Chinese herbal



medicines, and follow the "four qi and five flavors" method, the five elements of Chinese herbal medicines are mutually compatible, and the Chinese herbal medicines are eighteen evils and nineteen fears. Based on the secret recipe and the theory of homology of medicine and food, the traditional Chinese medicine "boiling in water" was improved. In order to effectively ensure the activity of antihypertensive effective components in raw materials, we independently developed and compared the experimental data, and finally decided to use ultrasonic extraction technology and low-temperature extraction technology for extraction. Modern extraction technology is used instead of ancient method to extract the essence and make it according to the proportion, thus reducing the cost on the basis of the same amount of raw materials. The core technology that we use to replace the ancient method is ultrasonic extraction and low temperature extraction technology to improve the utilization rate of effective components in raw materials.

## References

- [1] Zhang Huien, Xu Deping. Study on the Flavonoids in *Stigma Maydis* [J]. Chinese Herbal Medicine, 2007, 30 (2):164-166.
- [2] Zhao Mian, Liu Chuanshui, Yin Tianpeng. Studies on the chemical constituents of corn silk from Yunnan [J]. Chemical Research and Application, 2013, 25 (6):846-850.
- [3] Liu Chuanshui, Tai Zhigang, Aimei Li. Studies on the chemical constituents of corn silk produced in Yunnan [J]. Research and development of natural products, 2011, 23(6):1041-1044.
- [4] Shan Xichen, Guan Hong, Wang Jinlan. Studies on the chemical constituents of corn silk [J]. Journal of Qiqihar University: Natural Science Edition, 2012, 28 (6): 33-34.
- [5] Qi Hang, Hu Guanyue, Xi Jing. Study on the Adjuvant Therapeutic Effect of Herbal and Edible Tea on Hypertension [J]. Chinese medicine guides, 2020, 17(4):189-192.
- [6] Liu Jianing, Guo Xuqi, Li Mingzhe. Evaluation of anti-fatigue effect of compound preparation based on homology of medicine and food [J]. Journal of Nutrition, 2022, 44(4):326-331.
- [7] Tan Minhua, Li Xiaoni, Yu Limei. Study on bifunctional activity and beverage technology of 20 medicinal and edible homologous materials [J]. Food Science and Technology, 2021,46(5):93-98.
- [8] Liu Haiyu, Zhang Qinghe, Liu Jinping. Progress in structural modification of dammarane triterpenoid saponins [J]. chinese journal of experimental traditional medical formulae, 2011,17(22):269-273.
- [9] Yang Ping, Cui Yunqiu, Yu Ting. Research progress of ginsenoside Rg3 dosage form [J]. International Journal of Pharmaceutical Research, 2017,44(6):514-517.
- [10] Liu Beilin, Dong Jisheng, Huo Hong. Discussion on the optimum extraction technology of hawthorn flavonoids [J]. Technology, 2007, 28(6):167-170.
- [11] Liang Dan, Zhang Baodong. Research progress on extraction and separation methods of flavonoids [J]. Journal of zhoukou normal university, 2007, 24(5):88-89.
- [12] Luo Qiong, Hao Jinda, Yang Hua. Textual research of *Pueraria lobata* [J]. Impurities of Traditional Chinese Medicine in China, 2007, 32(12):1141-1144.
- [13] Zhou Yonggang, wu si. UHPLC-QTOFMS analysis of flavonoids in *pueraria lobata* [J]. Journal of pharmaceutical practice, 2013,31(2):116-119.