Analysis on Nutritional and Functional Components of Different *Pueraria lobata* Roots

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Abstract This paper made analysis and evaluation of nutritional components and functional components of different *Pueraria lobata* roots. Nutritional components mainly include water, ash content, fat, reducing sugar, starch and cellulose; functional components mainly include flavone and polyphenol. *Pueraria lobata* root No. 1 has highest ash content, flavone, and polyphenol but lowest fat, so it is suitable for using as medical Pueraria lobata root resource. Pueraria lobata root No. 5 has starch content as high as 64.43%, and is recommended using as vegetable and processing into *Pueraria lobata* powder. *Pueraria lobata* root No. 5 has cellulose content as high as 17.79% and is recommended processing into Pueraria lobata tablets. Through comparison of nutritional and functional components of different *Pueraria lobata* roots, it is intended to provide reference for variety selection, breeding, production and processing of *Pueraria lobata* roots.

Key words *Pueraria lobata* roots, Nutritional components, Functional components, Analysis

1 Introduction

Pueraria lobata belongs to *Pueraria* DC. of *Leguminosae*. The plant is a member of the pea family, with reddish-purple flower clusters. It is perennial deciduous liana. Its big roots are rich in starch and essential nutritional components for human body and also active components for physiological functions. In China, there are 9 varieties and 2 variants of *Pueraria lobata*[1]. Except Xinjiang and Tibet, most provinces and regions of China have distribution of *Pueraria lobata*. *Pueraria lobata* food functions as improving memory, suppressing postnatal diseases, and beauty care[3]. Starch and flavone separated from Pueraria lobata roots can be processed into foods clearing heat, removing toxin, preventing and curing high blood pressure, high fat of blood, coronary heart disease, and diabetes, etc[4]. In March of 1998, the Ministry of Public Health of China listed *Pueraria lobata* into Catalogue of Food and Medicine Homology. With development of China's foreign trade, especially increase in demands of international market for *Pueraria lobata* root powder and Pueraria lobata root flavone, the area of cultivating wild *Pueraria lobata* is gradually expanding. However, because Pueraria lobata roots have high ability of survival and rich wild resources, all areas input little to variety selection of Pueraria lobata roots, local Pueraria lobata roots are mainly domesticated germplasm resources, the nutritional and functional components are not well known. In order to better use and develop *Pueraria lobata* roots and provide reference for variety selection of *Pueraria lobata* roots, we made an analysis on major nutritional and functional components of *Pueraria lobata* roots.

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2 Materials and methods

2.1 Materials Samples we used are Pueraria lobata roots obtained from two years of growing Pueraria lobata roots in experimental base of Hubei Gewa Food Co. Ltd. We cleaned them with tap water, chopped and put them into 105℃ baking oven for 20 minutes, dried at 80105℃ to constant weight, and ground samples to powder with pulverizer and screened with 50 mesh sieve, put into reagent bottles and affixed with labels for experiment.

2.2 Methods Water content was measured by direct drying method with reference to methods stated in GB/T5009.3 -2003. Ash content was measured by methods specified in GB/T 5009.4 -2003. Starch was measured by enzymic hydrolysis method with reference to methods stated in GB/T5009.9 - 2003. Fat was measured with acid hydrolysis method with reference to methods stated in GB/T 5009.6 -2003. Total dietary fiber was measured by methods stated in GB/T 5009.10 -2003. Reducing sugar was measured by direct titration with reference to methods stated in GB/T5009.7 -2003. Flavone was measured by sodium nitrite - aluminum nitrate - sodium hydroxide colorimetric method. Polyphenol was measured using Folin-Ciocalten method.

3 Results

3.1 Nutritional components of *Pueraria lobata* roots Ash content is mainly mineral salts or inorganic salts, including essential inorganic salts or minerals for human body, such as calcium (Ca), magnesium (Mg), potassium (K), sodium (Na), and sulfur (S), accounting for 80% of ash content weight, as well as trace elements such as iron (Fe), copper (Cu), zinc (Zn), manganese (Mn), selenium (Se). From Table 1, we can see that *Pueraria lobata* root No. 1 has the highest ash content, next is

Pueraria lobata root No. 2. With constant deepening of nutrition research and constant upgrade of diet concept, it is generally acknowledged that cardiovascular disease, high fat of blood, hypertension, obesity and cancer are connected with high intake of fat. Table 1 indicates that *Pueraria lobata* root No. 1 has the lowest fat content, next is *Pueraria lobata* root No. 2. Starch of *Pueraria lobata* roots has a series of unique features, such as transparency of starch paste, high viscosity, starch gel not easy to syneresis, and as well as unique fragrance of *Pueraria lobata* roots[4]. Therefore, foods made of starch of *Pueraria lobata* roots are characterized by special nutrition and can be used as foods and medicine. From Table 1, we know that *Pueraria lobata* root No. 5 has starch content as high as 64.43%, followed by *Pueraria lobata* root No. 8 and *Pueraria lobata* root No. 7, respectively 54.37% and 53.93%. Cellulose features high water holding capacity and chelation and can be exchanged with anion, improve bacteria microenvironment of digestive system, so it plays extremely important role in human health. Its functions include easing constipation and preventing intestinal cancer, preventing diabetes and controlling obesity, reducing blood pressure and preventing and curing coronary heart disease, preventing cancer, preventing dental caries, and protecting oral health[5]. Besides, cellulose can be used as excellent food additives[6-7]. From Table 1, it can be seen that *Pueraria lobata* root No. 4 has cellulose as high as 17.97%, next is *Pueraria lobata* root No. 2 and *Pueraria lobata* root No. 1.

Table 1 Nutritional components of *Pueraria lobata* roots (Unit: %)

Number of *Pueraria lobata* roots	1	2	3	4	5	6	7	8
Water content	69.06	57.95	68.12	62.24	60.56	73.79	58.37	57.85
Ash content	8.29	6.28	4.50	5.08	4.72	5.46	3.35	4.25
Fat content	2.80	3.62	6.71	5.45	5.65	4.80	5.92	4.77
Reducing sugar	16.00	9.22	12.71	7.37	19.39	14.31	17.74	17.81
Starch	43.92	14.58	27.67	9.32	64.43	35.12	53.93	54.37
Cellulose	14.03	14.16	5.30	17.97	4.44	7.15	1.37	2.74

3.2 Functional components of *Pueraria lobata* roots With constant development of modern medical and food science and technologies, use value of *Pueraria lobata* roots receives higher and higher concern[8]. Major functional components of *Pueraria lobata* roots are flavonoids, aromatics, triterpenoids, polyphenol, etc. Flavone functions as expanding coronary artery and cerebral blood vessels, improving cardiovascular and cerebrovascular circulation, reducing myocardial consumption of oxygen, strengthening body immunity, reducing blood sugar and anti-oxidation[9-10]. Polyphenol has high anti-oxidation and ability of removing free radical. In addition, polyphenol has high ability of absorbing ultraviolet and far-ultraviolet, thus, it can reduce the incidence of such diseases as cancer, cardiovascular diseases, arthritis, and chronic diseases[11]. Table 2 lists polyphenol and flavone content of 8 samples of *Pueraria lobata* roots. From Fig. 1, we can see that polyphenol content is directly proportional with flavone content. *Pueraria lobata* root No. 1 has the highest polyphenol and flavone, next is *Pueraria lobata* root No. 4, followed by *Pueraria lobata* root No. 3.

Table 2 Functional components of *Pueraria lobata* roots (Unit: %)

Number of *Pueraria lobata* roots	1	2	3	4	5	6	7	8
Polyphenol content	1.49	1.24	1.09	1.30	0.54	0.53	0.18	0.27
Flavone content	2.78	1.91	1.69	2.55	0.43	0.49	0.02	0.09

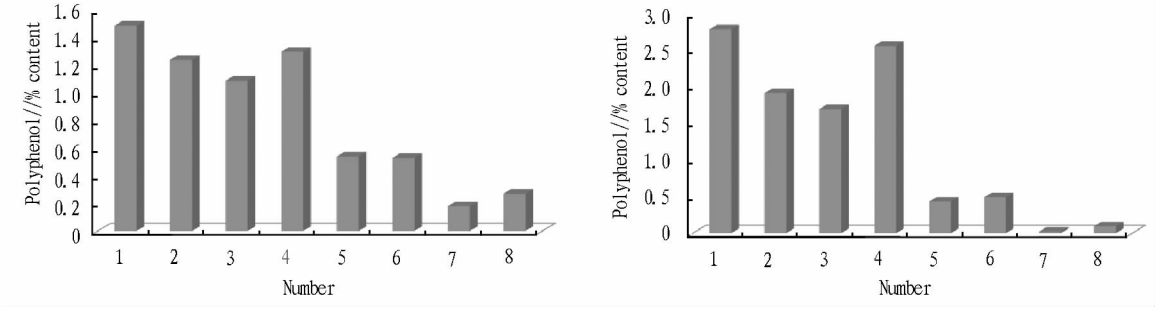

Fig. 1 Diagram for polyphenol and flavone content of *Pueraria lobata* roots

4 Conclusions

In the selective breeding of *Pueraria lobata* varieties, it is recommended to select varieties with high yield, high resistance of disease and suitability according to different purposes of use. For ex-

ample, it is recommended to select varieties with high starch content to process powder of *Pueraria lobata* roots. For medical purpose, it is recommended to select varieties with high content of polyphenol and flavone. For processing into tablets of *Pueraria lobata* roots, it is recommended to select varieties with high content of cellulose. For fresh eating or making dishes, it is recommended to select varieties with low content of cellulose and few sclerotic cells. *Pueraria lobata* root is a wild natural plant resource still not developed fully. With constant deepening of extraction, separation, and detection technologies of effective components of *Pueraria lobata* roots, as well as in-depth understanding of pharmacological functions, application value of *Pueraria lobata* roots receives higher and higher concern. As a type of easily cultivated cash crop, *Pueraria lobata* has wide suitability for soil, including sandy and clay soil. In intense sunshine and high temperature, *Pueraria lobata* still can grow. Besides, resistance to aridity and barren land is also a special characteristic. Therefore, *Pueraria lobata* is suitable for planting in mountain areas, especially for economic development of poor mountain areas, it is of realistic significance for farmers shaking off poverty and setting out on the road to prosperity. For example, if planting 66700 hectare *Pueraria lobata* using standardized cultivation technologies, it is able to harvest 2 million tons of fresh *Pueraria lobata* roots, which can replace 0.652 million tons of grain. Calculating at 9000 kg/ha grain, it is equivalent to increasing 72000 hectare farmland and providing grain for 2 million people for one year[12]. Therefore, planting and developing *Pueraria lobata* roots have prominent economic benefits and important social significance.

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4 Discussions and conclusions

From this experiment, it can be concluded that planting density has significant effect on the yield of *Coix Lachryrma-jobi* L, while the effect of fertilizer level and number of seedlings per hole is no significant on the yield of *Coix Lachryrma-jobi L.* This indicates that in the planting of *Coix Lachryrma-jobi* L, planting density is a major factor influencing yield of *Coix Lachryrma-jobi L.* In the actual planting, it is recommended to select appropriate planting density to ensure high yield of *Coix Lachryrma-jobi L.* The plant height of *Coix Lachryrma-jobi* L is as high as 1.5 -2.0 m, mutual shading situation is serious. With increase of planting density, the tillering rate, number of grains per plant and weight of thousand grains decrease. Therefore, properly sparse planting is favorable for increasing high yield of *Coix Lachryrma-jobi L.* Besides, the planting density is mutually influenced with the basic number of seedlings[6]. When the planting density increases, although the tillering rate, number of ears per hole, and number of grains per ear decrease, since the basic number of seedlings is high, it still can realize high yield. Therefore, in the planting of *Coix Lachryrma-jobi* L, it is recommended to coordinate the relationship between planting density and basic number of seedlings and select an appropriate planting density and basic number of seedlings to ensure high yield of *Coix Lachryrma-jobi L.*

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