

Phytochemical Study of Jerusalem Artichoke Tubers and Creation of Therapeutic and Prophylactic Agents Based on It

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ABSTRACT

Pharmaceutical science is faced with the task of providing the population with effective medicines in the most complete way, for which it is necessary to improve existing and create new drugs with high pharmaceutical activity and low toxicity. Traditionally, plants are one of the main sources of obtaining medicines with such advantages as low toxicity, low frequency of side effects, high efficiency, availability, etc.

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Introduction. In folk medicine, Jerusalem artichoke has long been used for diabetes, atherosclerosis, cardiovascular diseases, and gastrointestinal tract diseases. In recent years, Jerusalem artichoke tubers have been used to produce biologically active additives.

In Uzbekistan, within the framework of the food security project prepared by the FAO (Food and Agriculture Organization of the United Nations), one of the recommended ones, among others, Jerusalem artichoke is considered as a strategic raw material for the food and pharmaceutical industries.

Unfortunately, no medicinal preparations from Jerusalem artichoke tubers have been created to date either in Uzbekistan or in the CIS countries. The reason for this is the lack of regulatory documentation on Jerusalem artichoke raw materials due to the poor study of the chemical composition.

The above allows us to conclude that in-depth phytochemical research of this type of plant material and the creation of therapeutic and prophylactic agents based on it is an urgent task.

The aim of the study was to investigate the anatomical and diagnostic features of Jerusalem artichoke tubers, phytochemical study of Jerusalem artichoke tubers and the creation of therapeutic and prophylactic agents based on them.

To achieve the stated goal, it was necessary to solve the following tasks:

- to study scientific publications on pharmacognostic properties, pharmacology, chemical composition, methods of analysis of the main active substances of Jerusalem artichoke tubers, to assess its prospects as a medicinal plant raw material;
- to study the anatomical and diagnostic features of Jerusalem artichoke tubers;
- using modern physicochemical methods, conduct a phytochemical analysis of Jerusalem artichoke tubers, namely, study the composition of free and bound carbohydrates, amino acids, ascorbic acid, and also develop methods for the identification and quantitative determination of polysaccharides,

saponins and tannins in Jerusalem artichoke tubers;

- develop a technology for obtaining a dry extract from Jerusalem artichoke tubers, evaluate the quality of the extract obtained;
- obtain capsules with granulated dry extract of Jerusalem artichoke, evaluate the quality and stability of the dosage form.

Main part.

Jerusalem artichoke, or earth pear (*Helianthus tuberosus* L.) belongs to the (Asteraceae) family and is an annual plant. It is considered perennial because it usually grows in one place without annual transplantation for several years. In terms of the structure of the above-ground organs, it is similar to sunflower. The stem is straight, well-leaved. Depending on the variety and growing conditions, the stems are from 1 to 5 meters high. The number of branches on the main stem varies among different varieties of Jerusalem artichoke and ranges from 1 to 5 stems. The color of the stems is green, but some may have a purple tint. The general shape of the leaf, in the middle part of the plant, is predominantly ovoid. The inflorescence of Jerusalem artichoke is a multi-flowered basket with bright yellow flowers, similar in structure to the inflorescence of a sunflower. The diameter of the basket, taking into account the ligulate flowers, is from 7 to 11 cm. Early and mid-season varieties are distinguished by a larger number of inflorescences than late-season varieties. The fruit is a small achene, similar to a sunflower, the weight of 1000 seeds is 7 - 9 g. The seeds ripen only in Central Asia, Crimea and Transcaucasia. Unlike sunflower, Jerusalem artichoke stems form numerous underground shoots - stolons, at the ends of which are tubers.

Tubers of wild Jerusalem artichokes are randomly located in the soil, while cultivated varieties are characterized by a large cluster. The color of the tuber in varieties is white, purple-red, light brown. The predominant tuber shape is pear-shaped, but can be oblong-oval, spindle-shaped. Tubers of some varieties have an uneven surface, due to the very large number of babies (growths). The average weight of tubers, depending on the variety and growing region, ranges from 10 to 90 g, most often 30-50 g.

Jerusalem artichoke is undemanding to soil, grows well without fertilizers. It has no pests or diseases, and therefore, there is no need for pesticide treatment. Jerusalem artichoke has the ability to accumulate low levels of nitrates, heavy metals and radionuclides.

Chemical composition of Jerusalem artichoke.

The following biologically active substances have been isolated and identified from Jerusalem artichoke tubers: chlorophyll, carotenoids, carbohydrates, polysaccharides, tannins, nitrogenous bases, amino acids, organic acids, coumarins, iridoids and microelements.

The tubers contain a large number of protein compounds. Jerusalem artichoke tubers contain 18 amino acids, valine, leucine, tryptophan, phenylalanine, arginine, lysine, threonine, histidine, tyrosine, etc. The organic acids in the tubers are contained within 6-9% of dry weight. Of this amount, 35-50% is accounted for by di- and tricarboxylic acids: malic, citric, fumaric, succinic, glutamic, lactic, quinic, among which malic and citric acids predominate (27% and 55%, respectively).

The tubers contain B vitamins and vitamin C. The tubers contain 12-42 mg/1 kg of carotene, vitamin C: 42-124 mg/% in spring, 318 mg/% in autumn, vitamin B1 - 7.6 mg/%, vitamin B2 - 0.8-3 mg/%, PP - 10.7-27.2 mg/%, choline - 1936-3100 mg/%.

The main component of the hydrocarbon complex of Jerusalem artichoke tubers are fructosans. Low-molecular fructosans predominate in small tubers; as the tuber develops, polymerization of low-molecular fructosans into high-molecular ones occurs. The carbohydrate complex of tubers equal in weight but formed at different times is different. The most valuable component of the carbohydrate complex is inulin. The inulin content in Jerusalem artichoke tubers ranges from 11 to 36%.

Jerusalem artichoke tubers contain a large amount of inulids. The large differences in the content of inulin in Jerusalem artichoke tubers according to different authors can be explained by the fact that some of them took into account only pure inulin under inulin, while others - a mixture of inulin with inuloids. The composition of the carbon complex of Jerusalem artichoke tubers, in addition to inulin, oligosaccharides of the inulin type, includes fructose, glucose, sucrose, as well as pectin substances, hemicellulose and

cellulose. The amount of pectin substances in Jerusalem artichoke tubers, depending on the variety and conditions of the year, ranges from 5.7% to 11.7% (dry weight). Most of these high-polymer carbohydrates are pectin substances.

The radioprotective properties of Jerusalem artichoke tubers are associated with pectin substances. The most valuable component of the carbohydrate complex is inulin. The inulin content in Jerusalem artichoke tubers ranges from 11 to 36%.

Grass and tubers contain micro and macroelements: Ca, Mg, Na, Cl, Fe, Cu, Mn, Zn. There is a high content of phosphorus (3.7% of total ash), potassium - 42.7%, iron - 3.7%, silicon 10.0%, sodium - 10.2%, calcium - 3.3% and chlorine - 3.9%.

Jerusalem artichoke grass is also a valuable raw material containing significant amounts of biologically active compounds. The spectrophotometric method established the content of carotenoids, which fluctuates in Jerusalem artichoke grass from 51.8 to 52.2 mg/%; the chlorophyll content is 0.90 - 0.95%. The content of tannins, determined by the permanganometric method in terms of tannin, was from 3.81 to 3.86%.

Jerusalem artichoke grass has different nitrogen content in stems and leaves. Leaves contain 16.1 - 19.32% nitrogen, stems - 6.22 - 9.13% in terms of dry matter.

Jerusalem artichoke is widely used in the national economy and industry. The vegetative part of Jerusalem artichoke is the raw material for obtaining ethyl alcohol and is widely used in agriculture. Jerusalem artichoke tubers are used as a food product.

As a result of medical-biological and clinical trials of Jerusalem artichoke and therapeutic and prophylactic products based on it, a pronounced sugar- and cholesterol-lowering effect was established. The results of studies indicating an improvement in the condition of patients with diabetes mellitus and diabetes insipidus and with liver diseases when consuming Jerusalem artichoke syrups containing fructose for six months are described. Normalization of metabolism, liver and kidney functions is noted. The use of biologically active food supplements is one of the ways to correct nutrition.

Conclusion:

Jerusalem artichoke concentrate (dried), soluble powder and cryopowder from Jerusalem artichoke tubers have been developed as a dietary supplement. Experimental pharmacological studies have confirmed a wide range of biological activity of the obtained products: adaptogenic, anti-stress, and immunoactive. According to Hungarian scientists, the anti-cancer effect and immunostimulating action of Jerusalem artichoke is provided by the high content of magnesium, zinc, and selenium ions, while inulin promotes the absorption of calcium and iron by the body, activates the pancreas, and affects sugar metabolism in the liver. Pectin contained in Jerusalem artichoke has antiulcer, hemostatic, antifibrinolytic, hypocholesterolemic activity, etc. It has been experimentally determined that pectin reduces cholesterol and sugar levels in the blood, normalizes intracellular metabolic processes, and increases resistance to allergic reactions.

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