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ANALYSIS OF THE CHEMICAL COMPOSITION OF THE LEAVES OF THE PLANT RAPHANUS SATIVUS L.

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Annotation
The article presents information on the distribution, species, varieties, chemical composition and medicinal properties of the plant Raphanus sativus L. Based on a literature review, the amount of macro- and microelements in the leaves of the plant Raphanus sativus L., common in Uzbekistan, Pakistan and Russia, was determined and analyzed. The results were compared and the therapeutic effect was analyzed.

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Introduction. Radish **(***Raphanus sativus L.*) is a biennial plant belonging to the cabbage family. It was cultivated in ancient Egypt, Greece and Rome 5 thousand years ago. It is currently cultivated in all countries of the world. In the first year, it forms a ball of dissected, hairy leaves and fruits. In the second year, after planting, it produces a flower stalk and blooms in 35-40 days. Flowering lasts up to a month. Radish is grown only in open ground. Its seeds germinate at 2-4° C. It develops well at 13-20° C, and temperatures above 20° C have a negative effect on fruit growth [1]. Radish is a moisture-loving plant. If there is a lack of moisture, the fruit does not grow well. The fruit is large, weighing from 200 g to 4-5 kg. It contains an average of 1.92% protein, 1.58% sugar, 1.55% fiber, 8-29 mg of vitamin C. It is mainly consumed fresh, sometimes as a medicine. Radish is sown in the Central regions of Uzbekistan in late July and early August, to a depth of 2-3 cm [2].

The focus of this crop in Uzbekistan is the Margilan and Oltiariq districts of the Fergana Valley, where radishes, onions and other vegetables are widely grown. 4 varieties of radish are grown in different regions of our country. These are the varieties “Andijan 9”, “Kuz Khadyasi (daikon)”, “Margilan” and “Sodik (daikon)”. In Uzbekistan, the early-ripening varieties of radish “Margilan” and “Andijan 9” are included in the state register. The “Margilan” variety yields 350-360 c / ha; The Andijan 9 variety yields 480-500 c/ha [3].



Figure 1. Appearance of the Raphanus sativus L. variety "Andijan 9" cultivated in Uzbekistan.

For several years, the roots and leaves of radish (Raphanus sativus L.) in particular have been recognized as having high medicinal and nutritional value worldwide. Thus, radish leaves have been proposed as an alternative treatment for various diseases, including hyperlipidemia, cardiovascular disease, and cancer [4].

Many scientists have conducted scientific research on radishes internationally. Dr. Hiroshi Iwata, a Japanese scientist, conducted research on the genetic diversity and selection of radishes [5]. Dr. John R. Stommel, a scientist at the United States Department of Agriculture, conducted research on the biochemical composition and health benefits of radishes [6]. Dr. Maria A. M. Reis, a Portuguese researcher, conducted scientific work on the anthocyanin pigments of radishes and their antioxidant properties. Dr. Klaus-Peter Winterhalter, a German scientist, conducted research on the phytochemical composition of radishes and their health benefits. Dr. Sung-Chul Kim, a South Korean researcher, conducted scientific research on the medicinal properties of radish and its use in traditional medicine [7].

X.A. Idrisov and S.M. Nazarova provided information on the biological properties of radish and other plants, as well as cultivation technologies in their textbook “Plant Science”. I.N. Rusanov conducted research on the study of plants imported from abroad, including radish, in the Botanical Garden. The Department of “Biotechnology” of the Tashkent Pharmaceutical Institute conducted research on the technology of phytopreparations, and the medicinal properties of plants such as radish were studied. Scientific work was also conducted to determine the amount of heavy metals in radish leaves [8].

Research results.

Table 1. The amount of macro and microelements in the leaves of Raphanus sativus L., distributed in Uzbekistan, Pakistan and Russia, mg / 1 kg.

№	Macro va microelements	Uzbekiston	Pokistan	Russia
Raphanus sativus L. leaf macro and microelement mass, mg /1 kg				
1	Ca	895.56±2.45	863.21±1.01	715.95±1.23
2	Fe	5.89±0.05	4.95±0.04	4.15±0.03
3	K	698.45±0.62	541.78±0.45	512.14±0.23
4	Mg	78.12±0.26	82.15±0.26	65.78±0.26
5	Na	326.45±0.43	415.48±0.78	345.85±0.56
6	P	45.23±0.03	56.26±0.09	47.89±0.07
7	Zn	0.45±0.01	0.38±0.01	0.29±0.01
8	Cu	0.36±0.01	0.27±0.01	0.15±0.01

9	Mn	0.69±0.01	0.52±0.01	0.49±0.01
10	Ag	0.26±0.01	0.19±0.01	0.12±0.01
11	Au	0.32±0.01	0.23±0.01	0.19±0.01
12	Se	0.62±0.01	0.55±0.01	0.59±0.01

The results in the table above were based on the results of studies of *Raphanus sativus L.* leaves grown in Pakistan by Rozina Shahadat Khan, Sunair Siddique Khan, Romaisa Siddique, and of *Raphanus sativus L.* leaves grown in Russia by Pivovarov V. F., Aromov M. Kh. The chemical composition of Raphanus sativus L. leaves in Uzbekistan has not yet been fully studied, and the amount of macro and microelements was determined by us at the Andijan State University, "Commodity Chemistry and Folk Medicine" Scientific Laboratory Center using inductively coupled plasma mass spectrometry [9]. It can be seen that the amount of macro and microelements in samples taken from 1 kg of Raphanus sativus L. leaves distributed in Uzbekistan, Pakistan and Russia was presented in the decreasing order of Ca> K> Na> Mg> P> Fe. In this case, the leaves of Raphanus sativus L. grown in Uzbekistan contain a lot of Na, K, Fe, Se, Au, Ag, Mn and Cu.

In this case, Na^+ ions are involved in the transmission of nerve impulses, the polarization of cell membranes and the control of the body in the body. These processes also affect the functioning of the immune system. A certain amount of sodium helps to maintain the immune system at an active level, which can lead to regeneration reactions. Potassium deficiency can lead to mitochondrial dysfunction and oxidative stress. This condition enhances the recovery processes [7]. If potassium is sufficient, cells are protected and prevent regeneration. Calcium deficiency can lead to the development of diseases associated with weak bones, osteoporosis. The effect of the element magnesium on the disease is very important, it participates in many chemical processes in the immune system and cell signaling [8]. Copper, on the other hand, has antioxidant properties. The antioxidant properties of copper help reduce inflammation and ensure the normal functioning of the immune system [10].

Experimental part. The objects of the study were dried leaves of *Raphanus sativus L.* collected in the Andijan region of the Republic of Uzbekistan on the 40th day of October 2024. The amount of macro- and microelements was determined by inductively coupled plasma mass spectrometry. A 1 g sample, previously dried, crushed, weighed on a balance with an accuracy of 0.001 g (Navigatortm, OHAUS®), was ashed in a porcelain crucible using the dry ashing method by heating to 500 0C in a muffle furnace (Nabertherm, Germany). Initially, it was heated to 500 0C at a rate of 100 0C/h and held at 500 0C for 5 hours. The resulting ash was added with 6 ml of ISP-MS grade concentrated HNO3 and 2 ml of 60% H2O2 and heated on a hotplate in a fume cupboard until white smoke was no longer produced. The cooled solution was transferred to a 100 ml polypropylene volumetric flask and made up to the mark with ultrapure water. This working solution was filtered using a syringe filter and used for analysis. Solutions with concentrations of 500 µg/l, 100 µg/l and 10 µg/l were prepared by diluting a standard solution of 12 elements in 2% HNO3 with a concentration of 10 mg/l (Highpuritystandards, USA) and a calibration line was created using ultrapure water.

Conclusion. The amount of macro and microelements in the leaves of Raphanus sativus L., a plant widely distributed in different countries, was determined and compared. It can be seen that the amount of macro and microelements in samples taken from 1 kg of Raphanus sativus L. leaves distributed in Uzbekistan, Pakistan and Russia was presented in the decreasing order of Ca> K> Na> Mg> P> Fe. In this case, Sa, K, Fe, Se, Au, Ag, Mn and Cu are found in abundance in Raphanus sativus L. leaves grown in Uzbekistan.

Currently, *Raphanus sativus L.* leaves are considered rich enough to be included in the list of functional products in order to preserve food naturally, avoid artificial additives and thus contribute to optimizing the production of new products.

Although radish is one of the well-studied plants internationally, some aspects are still insufficiently studied or open to scientific research. The content of radish leaves and bark has not yet been fully studied. Research on the recycling of waste into new foods or bioactive additives is limited. In-depth studies on the effects of radish on human gut microflora and overall health are lacking. With this in mind, we set out to study the chemical composition and medicinal properties of radish leaves.

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