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Jam from Green Walnuts is an Important Source of Iron, Iodine, Chromium, and a Number of Other Elements

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Abstract

This article provides an overview of green walnuts and presents the results of experimental studies of the chemical composition of jam obtained from green walnuts. Green walnuts as raw materials are very rich in ballast substances and have a very diverse macro- and micro-elemental composition. A study of the literature shows that green walnuts are very rich in trace elements such as iodine, which can be used as iodine-containing raw materials for the manufacture of a number of food products. Experimental studies performed by us have shown that the main macro-elements of jam from green walnuts are sodium, potassium, magnesium, calcium, and iron and the trace elements are iodine, zinc, cadmium, nickel, cobalt, aluminum, and silicon. Due to the diverse macro- and micro-elemental composition, jam from green walnuts is considered useful for the human body. It can be used as a food product in the food industry, as well as a prophylactic for several diseases, especially iodine deficiency in humans, which affects a number of regions of Uzbekistan and other countries located far from the sea coast. Green walnut jam is also a gourmet product that can be served as a finished product.

Jam from green walnuts can also serve as an additional source of the trace element cobalt. Our research found that the cobalt content in jam is 23 mcg per 100 grams of product. Another important trace element in jam from green walnuts is cadmium, where its content is 10 micrograms per 100 grams of product. Comparing the values of these indicators with the daily norms of cobalt and cadmium, we can conclude that this product can serve as an essential source of these trace elements, which favorably affect the development of the human body.

Green walnuts are high in functional ingredients such as ascorbic acid and polyphenolic compounds. In the production of jam, the bulk of these components are preserved. In this regard, we can say that jam from green walnuts is a product that has antiviral, anti-inflammatory and anti-thrombotic properties. Using this product, the human body will receive the elements that it requires.

Keywords: *macro; trace element; analysis; ashing; prophylaxis; experiment*

1. Introduction

One of the foremost promising sorts of gardening in Uzbekistan is that the nut-bearing crops yielding fruits, known under the economic name of walnut. Nuts are called fruits and consist of a dry woody shell with an edible core. Included in these fruits are walnuts, pecans, pine nuts, etc.

In the Republic of Uzbekistan, the foremost common nut of commercial importance is the walnut. However, the supply does not yet meet the demand. Therefore, the Association of Walnut Producers and Exporters has been established within the republic, which is

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implementing a programme to make modern plantations of highly productive walnut varieties adapted to the local natural climate, and also because of the widespread introduction of science-based cultivation methods and modern resource-saving technologies.

In the literature, there is evidence of the successful use of kernels and vegetable oil for the treatment of inflammatory and ulcerative diseases of the stomach and intestines and the therapeutic effects are related to the presence of linolic acid [19, 27]. They are also able to remove toxins from the body, and stimulate and strengthen important organs such as the heart, kidneys, liver, spleen, and alimentary canal [20].

Joint studies with researchers at the Institute of Chemistry of Natural Compounds of the Academy of Sciences of Uzbekistan and scientists of the Samarkand Institute of Economics and Repair have shown that the walnut kernel may be a rich source of oil, which contains vital unsaturated fatty acids [1].

A study by other authors has shown that walnut kernels are rich in proteins, minerals and lipids, containing approximately 70% polyunsaturated fatty acids [2, 21]. A variety of studies show That the regular use of walnuts significantly improves the vascular functions of the body [3,4,5,6,7,8]. A few researchers have noted that walnut kernels are a high-quality source of fatty acids and tocopherols. In this regard, walnut kernels contribute to lowering blood cholesterol, which results in a lower risk of developing coronary heart conditions [9,10].

Some researchers associate the high value of walnuts with a high concentration of phenolic compounds [11,12] and antioxidants [13,14] compared with other fruits and vegetables. Walnuts are used both for direct consumption and as a part of other food products [15].

2. Materials and methods

Especially valuable are unripe (green) walnut fruits. The content of vitamin C in green walnut fruits is not equal to that of other fruits. It has been established that of the green fruits, vitamin C can be up to 3000-5000 mg%, i.e., 3-4 times that of black currant berries and 100 times that of lemons and oranges. Green fruits are also rich in vitamin P, organic acids, mineral salts, tannins, and tonic substances, and they contain a large amount of iodine and thus are utilized in traditional medicine for the treatment of certain diseases of the thyroid [16].

In this regard, we made jam from the green walnut fruits grown in the weather and soil and climate of Uzbekistan to investigate the qualitative and quantitative content of macro- and microelements.

The analysis was performed after wet ashing by mass spectral analysis with inductively coupled plasma. A 1 gram sample was taken from the presented samples of jam and poured into 10 ml of concentrated nitric acid, 1 ml of $HClO_3$ and decomposed to obtain a transparent solution. The resulting solution was quantitatively transferred to 100 ml volumetric flasks and used for further analysis.

The analysis was performed on an Agilent 7500a ICP-MS. Parameters of the device: carrier gas, – argon; plasma power, 1300 W; integration time, 0.1 sec. As a typical solution, a 22 element multi-element standard solution from Agilent Technologies was used.

The macro- and micronutrient contents are presented in Table 1. The data in Table 1 indicate that the macro- and micro-elemental composition of the jam made from green walnut fruits is extremely diverse. The macronutrients with the highest content from green walnut fruits are sodium, potassium, iron, chromium and calcium.

As it is understood, constantly and in significant quantities, potassium is present in food products, especially those of plant origin. Our data suggest that within the jam from the fruits of a green walnut, the predominant macronutrient is sodium, with a mean content of

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114.8 mg%. Usually, the diet of individuals contains a sufficient amount of sodium since salt is added to food.

According to our data, the preservation of green walnut fruit can function as a crucial source of iron, where its content is 3.46 mg%. Its value lies within the incontrovertible fact that it is a part of the foremost important organic compounds of blood haemoglobin, myoglobin, certain catalase enzymes, peroxidase, cytochrome oxidase, etc. This iron product is like bread or beef. In particular, jam is prized from the green fruits of walnut due to the high content of the deficient chemical element iodine. Within the diet of individuals living in our region, iodine may be a deficient chemical element. Research has established that in plants and organisms in the mountainous regions or those distant from the ocean coast, iodine has little accumulation. In this regard, when an insufficient amount of iodine is ingested with food, the activity of the thyroid is disturbed, and a significant disease called a plague goitre develops. This is consistent with our research (Table 1).

Table 1. The Content of Macro- and Micronutrients in the Jam Sample

Trace elements		Macro elements	
Name of element	Content, mg/kg	Name of element	Content, mg/kg
Boron	11.3	Sodium	1147.9
Magnesium	5.94	Potassium	304.28
Aluminium	27.66	Iron	34.58
Silicon	27.66	Chromium	95.43
Phosphorus	3.73	Calcium	53.94
Sulfur	5.67		
Manganese	0.33		
Cobalt	0.023		
Nickel	0.39		
Copper	3.04		
Zinc	0.12		
Arsenic	0.1		
Cadmium	0.1		
Iodine	1.2		
Mercury	0.1		
Lead	0.04		

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The iodine content of green walnut jam is 120 µg per 100 g of product. If we consider that the daily human need for iodine is 100-260 mcg [22], then the utilization of 100 grams of this product at 80-100% covers the daily rate of this mineral.

We can also see this information in the following diagrams: Figure 1, Trace elements and Figure 2, Macroelements.

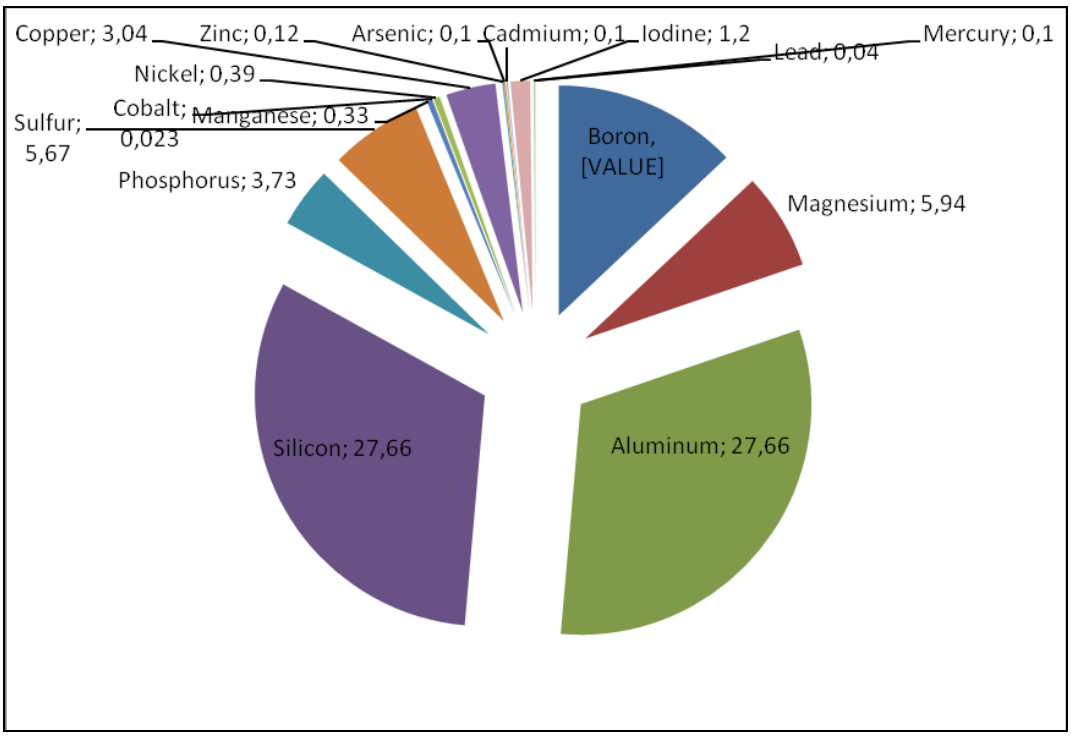

Figure 1. Trace Elements

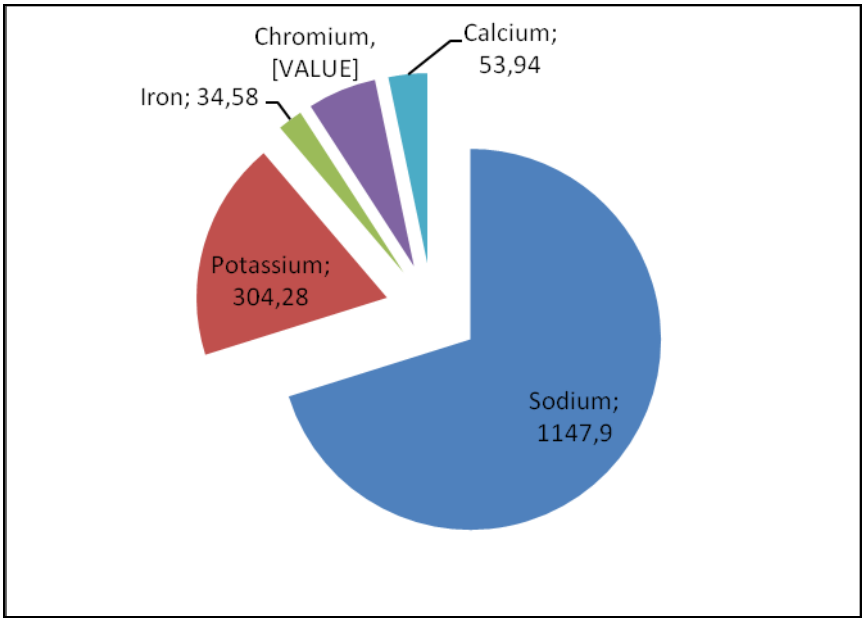

Figure 2. Macro Elements

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Jam from green walnuts can also serve as an additional source of the trace element cobalt, which is deficient in our region. The biological role of cobalt in living organisms was described in the works of Eric Underwood [24], A.I. Voiner [25], V.V. Kovalsky [17], A.P. Avtsyn [26], and others. A study of these literary sources shows that cobalt is involved in the process of haematopoiesis in combination with copper and iron, activates the activity of pancreatic and insulin enzymes, improves immunity, and lowers blood cholesterol.

In the course of this study, we found that the cobalt content in the jam from green walnut fruits is 23 mcg per 100 grams of product. This means that consuming 50-100 grams of jam is enough to satisfy the daily cobalt requirement for the human body. Based on these data, it can be concluded that jam from green walnut fruits can serve as an additional source for a deficiency in a trace element such as cobalt.

Another important chemical element contained in green walnut jam is chromium, where, consistent with our data, its content is 9.54 mg%. It is known that the foremost important biological role of chromium is the regulation of carbohydrate metabolism and blood sugar levels. Research has established that chromium normalizes the permeability of cell membranes for glucose for use by cells to function in conjunction with insulin. It is believed that chromium and insulin form a posh regulating the extent of glucose within the blood. Fatigue occurs with chromium deficiency. Headaches and increased cholesterol and triglycerides in the blood increase the danger of diabetes and coronary heart conditions [18].

Aluminum, like other trace elements in the body, performs a crucial physiological function. This element is involved in the formation of phosphate and protein components, the processes of the regeneration of bones, connective tissue and the epithelium. In addition, silicon is one of the most important trace elements. Often this is an important component of the sensitive tissue, tendons and blood vessels. With a scarcity of silicon within the body, diseases such as atherosclerosis, osteochondrosis and those of the circulatory system begin to progress. Due to the content of aluminum and silicon, jam from green walnut fruits can also be used when these elements are absent in the body. It should be noted that there are only a few studies on the content of aluminum and silicon in fruits grown in the weather and soil climatic conditions of Uzbekistan, as well as in processed products. In this regard, we were ready to determine the content of aluminum and silicon within the jam from green walnut fruits. Consistent with our data, the quantitative contents of aluminum and silicon in green walnut jam are equal, where their average content 27.66 mg %. As long as the daily requirement of silicon within the body is 30 g, 100 g of green walnut jam is enough to meet this amount. In this regard, jam from green walnuts can become a crucial source of aluminum and silicon for the body.

Recently, great attention has been paid to the development of functional foods. Naturally, these food products contain one or more functional elements. Some of the important functional ingredients in green walnut fruits are ascorbic acid and polyphenolic compounds. In this regard, we believe that the jam developed by us from green walnut fruits can also serve as an antiviral, anti-inflammatory and anti-thrombotic product.

3. Results and Discussion

In summary, we will conclude that jam from green walnut fruits is often successfully used as a prophylactic for an organism with a deficiency of trace elements such as aluminum, silicon, iodine, cobalt, chromium, iron, boron, copper, and zinc. This jam can also be utilized in the confectionery industry as an additive or filler for sweets.

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4. Conclusion

In recent years, interest in natural food products that are prepared from raw materials with a truly rich composition of trace elements has increased significantly. Such interest is dictated by the fact that in the manufacture of food products, manufacturers often use synthetic food additives that are harmful to the human body.

Therefore, technology, the improvement of these technologies, and the organization of food production from raw materials of natural origin, are some of the urgent problems in the food industry. The Republic of Uzbekistan has rich resources from which to obtain natural food products. One of the sources of this sort of staple is that the fruit of green walnuts, which can be used make jam rich in micro- and macro-elements.

Studies have shown that jam made from green walnuts contains macro-elements such as sodium, potassium, iron, chromium, and calcium and microelements such as iodine, zinc, copper, cobalt, manganese, magnesium, boron, sulfur, and nickel. Thanks to the high iodine content of green walnut jam, it can function as a crucial source of iodine for people living in iodine-deficient areas such as Uzbekistan. Green walnut jam can also be utilized in cases of micronutrient deficiency, such as zinc, copper, cobalt, manganese, magnesium, boron, sulfur, and nickel deficiencies.

5. Conflicts of interest

We have no conflicts of interest to declare.

6. References

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