A STUDY OF THE CHEMICAL COMPOSITION OF BLACKCURRANT FRUITS GROWN IN THE KHOREZM REGION

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Abstract. *Currants have been grown in the natural and climatic conditions of the Khorezm region are rich in carbohydrates, vitamins and have a variety of taste qualities. The article discusses the rich concentration of macro and microelements in the composition of black currants were grown in the Khorezm region. The blak currant berries in the region have high antiradical activity, which is observed during experimental work. Black currant (Ribes nigrum) is the most widespread berry crop. The berry is valued for its high medicinal and dietary qualities, its suitability for almost all types of industrial processing, its early maturity, yield, winter hardiness, ease of propagation, and the possibility of complete mechanization of cultivation and harvesting. Ensuring the normal functioning of the human body is achieved by observing complex relationships between numerous nutritional factors. The main focus is on the use of local raw materials of plant origin, which have the most digestible nutrients and ensure the strengthening of antioxidant protection and the non-specific human organism. There is a growing global trend of increased demand for red anthocyanin pigments, which possess biological activity. Black currants contain substances that provide color, such as anthocyanin pigments, in addition to beneficial, biologically active components.*

Keywords: *concentration, system, molecular, particles, diffusion, homogeneity, vitaminis, element*

1. Introduction

As a result of observations of currant berries grown in the conditions of Khorezm, it was found out that the berry has a stable immunity to external natural factors and ecological instability. Black (Ribes nigrum) is a widespread crop in the Khorezm region, the Gooseberry family (Crossulariaceae) berries contain a complex of valuable biologically active substances (BAS). During the research, it was found out that the berry leaves contain more biochemical components than the fruits themselves. The berry crop (Ribes nigrum) can be called an organic product since it is not processed with chemicals; the rich biochemical components in the composition (flavonoids, macro-micro elements) protect the berry crop from external damage. The berry crop leaves contain more flavonoids than the berries. [5; 697-703] With the aim of monitoring chemical components of blackcurrant berries, literary data on their composition were analyzed. The dry and hot climatic conditions of the Khorezm region cause low humidity and high dry matter content in the fruits grown. As the berries ripen, the content of pectic substances decreases and the sugar

content increases under the influence of pectinase, which catalyzes the hydrolysis of pectic substances to sugars and accumulates in the fruit as it matures . An important property of pectins is their ability to absorb bacterial toxins and heavy metal ions, remove and bind cholesterol from the body, and prevent the oxidation of ascorbic acid and catechins in fresh fruits.

The glycosides, organic acids, vitamins, aromatic substances, and trace elements contained in anthocyanins possess a multitude of beneficial properties: they lower cholesterol levels, prevent the formation of blood clots, increase the elasticity of blood vessels, accelerate wound healing, positively affect vision, and contribute to the prevention of oncological diseases. Furthermore, according to literature sources, anthocyanin solutions exhibit anti-radical activity. The ability of anthocyanins (Ribes nigrum) to alleviate eye fatigue (as a result of prolonged work in front of computer monitors) has been discovered. Thus, the development of methods for extracting pigments from the fruits of this plant becomes even more relevant. The following article, in addition to highlighting the biochemical composition of the blackcurrant berries grown in the region, serves as proof that they are high-quality raw materials. The nutritional value of black currants is so high that they can be classified as functional foods. Due to their polyphenol antioxidants, the berries possess numerous medicinal properties. Consuming foods rich in antioxidants reduces the concentration of intracellular reactive oxygen species, increases the activity of antioxidant enzymes, soothes inflammatory processes caused by microbes, reduces oxidative stress, and slows down the aging processes of organs.

2. Materials and methods

Morpho-biological, chemical properties of the studied object of black currant berries (Ribus nigrum). To study black currant berries (Ribes nigrum) ripening in the lower reaches of the Amu Darya, in particular taking into account natural conditions and the patterns of formation of a fruitful harvest of berries and a long period of ripening of its chemical composition. Research on blackcurrant cultivation was conducted in Tashkent and Khorezm regions. During the study, the biological structures of blackcurrant fruits (Ribes nigrum) were identified

We used the macroscopic method to study the external appearance, internal structure (through cross-sections), and biological properties of black currant (Ribes nigrum) berries. In addition, we also determined the weight of the berries, the external structure of the bushes, and the root system. Morphology: 1-2 meter high deciduous shrub, the shape of the bush is compressed or spreading. It has a powerful root system, the main mass of roots at a depth of 35-45 cm. Leaves are simple, 3-5 to 12 cm long and wide, with serrated edges, three-five-lobed. The lobes are usually broadly triangular, the middle one is often elongated. The surface of the leaf blade is dull, dark green, bare, fluffy underneath along the veins. The leaves are aromatic due to the trichomes, which contain thiols, especially 4-methoxy-2-methylbutane-2-thiol, a component that adds a specific aroma to the top fruity notes. [5; 697-703] Thanks to their rich chemical composition, the berries are of interest as a source of

plant raw materials with antioxidant activity. The dry matter content in black currants ripening in the Kushkupir district is 20-22%, while in the Khanka district it is higher, at 22-25% in early July. Sugars, mainly represented by glucose, fructose, and sucrose, determine the nutritional value of the fruit. Fructose (5%) dominates in the sugar composition, followed by glucose (2%) and sucrose (1.5%), along with 3% fiber and pectins (up to 2%). Black currant fruits from the Khanka regions are dominated by a high pectin content. Inflorescences are drooping racemes 4-5 to 10 cm long, 5-10 colors, with bare or fluffy peduncles 4-7 mm long and bracts 1-1.5 mm long, the shape varies from oval to linear-lanceolate. Flowers are 7-8 mm long, 4-5 mm in diameter, five-membered bell-shaped, pinkish-yellowish, mostly densely pubescent.

The petals are oval, the sepals are bent outward, pointed, and quite wide. The anthocyanin pigment, which gives blackcurrant berries their color, also ensures not only the color but also the activity of their biochemical substances. The anthocyanin pigment, which gives blackcurrant berries their color, also ensures not only the color but also the activity of their biochemical substances. Anthocyanins are pigments found in cell sap and determine the color of berries, depending on the cellular pH content. This changes during fruit ripening as the cell contents become more acidic. Increased anthocyanin formation is promoted by lower ambient temperatures. By inhibiting chlorophyll synthesis, they absorb all light in the ultraviolet and green regions of the spectrum. The absorbed energy is converted into heat, raising the leaf temperature by 1-4°C [7; 365-373]. The biochemical composition of blackcurrant berries grown in the climatic conditions of Uzbekistan was studied. In this study, the amount of acidity, specifically ascorbic acid ($C_6H_8O_6$), in the berries was determined using the iodometric method, where ascorbic acid acts as a reducing agent in the reaction. In the iodometric titration method for determining ascorbic acid in blackcurrant, potassium iodate KIO_3 and starch paste were used. A blue-violet color is visually observed in the juice of the berry raw material.

Anthocyanins also absorb excess light quanta, protecting photolabile compounds, chlorophyll, and the cell's genetic apparatus. Anthocyanin stability depends on several factors, such as enzymes and associated components of the plant matrix, the concentration of anthocyanidins and their structure, solvent pH, temperature, oxygen, light, and the presence of metals [4; 122-128]. Anthocyanins possess capillary-strengthening activity and have antioxidant, antibacterial, and anti-carcinogenic properties. They are widely used in medicine for the treatment and prevention of several diseases [6; 46]. The antioxidant properties of anthocyanins and their affinity for eye tissues allow them to have a positive effect on the eyes during various visual and oxidative stresses, promoting the storage of glutathione (which) determines the antioxidant protection of tissues in the eyes and protects against damage from free radicals. Visual acuity in twilight is also enhanced. Clinical trials have shown that anthocyanin consumption does indeed improve daytime, twilight, and night vision. However, the effect of anthocyanins on visual functions was not observed in all experiments, but depended on the dose taken, its composition, and duration.

3. Results and discussion

Locally sourced organic black currant berries are a source of valuable biochemical components, including vitamins, organic acids, pectic substances, aromatic compounds, minerals, and anthocyanins. A promising feature of black currant pomace is its maximum content of dietary fiber, containing a significant amount of natural antioxidants (polyphenolic group) bound to a carbohydrate matrix. Thus, black currant pomace possesses the properties of two types of substances: dietary fiber and antioxidants. Black currant berries are a good biochemical raw material base for obtaining anthocyanins and antioxidants. Pomace extracts in suitable forms such as powders or extracts possess antioxidant properties that prevent oxidative spoilage. These extracts can be used in animal products to improve their microbiological safety and extend the shelf life of the finished products. Studying the chemical composition and properties of currant berries during ripening, we were convinced that direct sunlight enhances photosynthesis biochemical processes. Table 1. The fruit is an edible fragrant berry, with an average diameter of 1-1.5 cm at the beginning of ripening, greenish at the end, black-brown with a glossy skin and seeds. In 1 kilogram there are about 1300 berries or 9 to 25 seeds, the weight of the berry is 0.9-1.5 grams. Table 1.

Table 1. Physico-chemical indicators of berries (Ribes nigrum) varieties in Uzbekistan

№	Indicators	Nuclear	Pygmy	Martin	Iroda
	color	purple	purple	purple	
1	smell	medium special	squinty	spicy	squinty
2	seeds of 1st berry	10	15	20	25
3	Progeny ratio:seeds(%)	72,4:27,4	64,2:35,8	60,8:38,2	67,8:31,8
4	Soil impurity (%)	3	5	4	6
5	weight of 1 berry.gram	1,5	0,9	1	1,2
6	1 kg berries (in pieces)	1200	1250	1250	1220
7	Diameter of the berry, mm	1,5	1	1,2	1,3
8	Mass fraction of juice (%)	35	30	31	31

Table 2.The chemical composition of blackcurrant berries depends on weather conditions, fertilization, maturity, variety and other conditions. The taste qualities of blackcurrant berries are largely determined by their biochemical composition. The studied varieties contain from 12.7 to 14.5% soluble dry matter and from 8.6 to 9.8% sugars with the highest content in the fruits of the "Yaderny" variety.

Table 2. Chemical composition of blackcurrant berries of Uzbekistan varieties.

Calories	**Quantity**	**Vitamins**	**Quantity**	**Vitamins**	**Quantity**
Proteins	1	Vitamin A	17 mcg	C аскорбин	200mg
Carbohydrates	0,4	B1 thiamine	0,03 mg	E alphatocopherol	0,7 mg
Fats	7,3	B2 Riboflavin	0,04 mg	H biotin	2,4 mcg
Organic acids	2,2	B4 Choline	12,3 mg	K phylloquinone	0,1 mg
Dietary fiber	4,9	B5 pantothenic	0,4 mg	Vit PP	0,4 mg
Water	83,2	B6 pyridoxine	0,13 mg	Niacin	0,3 mg
Cinder	0,9	B9 folates	5 mcg	beta carotene	0,1 mg

By the method of mass spectroscopy with inductively coupled plasma determined the elemental and molecular composition of black currant varieties grown in the region. The analysis revealed saturated molecular concentration of black currant rich in vitamins, macro-microelements significant mass fraction of carbohydrate, protein, fat and organic acids. Rich vitamin and mineral composition, based on regional factors, forms the berry fruit multicomponent system, which can be called a therapeutic elixir. [10; 9-12]. Free water is an active participant of biochemical reactions. The solution of carbohydrates, proteins, macro and microelements of currants in water forms in the fruit multicomponent molecular concentration with kinetic properties. Biochemical rich composition of currant berries as a pantry pharmacy contains antioxidant in vitro polyphenolic compounds catechin and excessive amounts of vitamin (C). [4; 122-128]. Molecular concentration, particles of black currant fruit is formed under the action of two opposing forces of gravity and diffusion. Concentration has molecular kinetic properties due to and spontaneous movement of particles Kinetic stability of concentration depends on the size of their particles.

Table 3.The chemical composition of black currant and caloric value of the product is indicated as follows.

Table 3. Nutritional value per 100 grams

Macro element	Quantity	**Micro element**	**Quantity**	**Micro element**	**Quantity**
Potassium-K	300mg	Alumin Al	500mkg	Copper-Cu	126 mkg
Calcium-Ca	34mg	Borum-B	54mkg	Molybdenum	22 mkg
Silicon--Si	60mg	Vanadium-V	4mkg	Nickel - Ni	1,5 mkg
Magnesium Mg	33mg	Iron-Fe	1,2mkg	Rubidum-Rb	11,6 mkg
Natrium - Na	36mg	Cobalt-Co	3mkg	Selenium -Se	1,2 mkg
Sulfur -S	3mg	Iodine l	0,8mkg	Fluorine-F	16 mkg
Phosphor-F	30mg	Lithium-Li	0,8mkg	Chromium-Cr	0,8 mkg
Chlorine--Cl	16 mg	Manganese Mg	0,17mkg	Zinc-Zn	0,9 mkg

Blackcurrant varieties grown in the region from the group of wild varieties contain more than 3.84% of organic substances (fruit acids). In wild varieties of blackcurrant, the ratio of sugar content to acidity is usually reduced, the amount of pectin substances is from 0.66 to 1.09%. Blackcurrant berries have a number of positive qualities that have a beneficial effect on the human body.Black currant fruits contain the maximum amount of vitamin (C), but the leaves are more vitamins than the fruits. Table 4.A table has been prepared based on the results of the analysis.

Table 4. Main bioflavonoids of blackcurrant berries and leaves

№	Vitamin(C) content mg %	maximum		minimum		average	
		berries	leaves	berries	leaves	berries	leaves
1	Flavonols	30	2600	6	232	16	692
2	Bioflavonoids	460	7360	92	1950	298	4310
3	Hydroxycinnamic acids	76	414	22	0	36	146
Flavans							
4	Free catechins	100	940	10	114	60	442
5	proanthocyanidins	196	2172	7	160	84	856
6	Condensing catechins	176	4410	28	322	92	2165

It was found that delphenidin-3 glucoside can inhibit piatelet activation and thereby significantly suppresses the processes of thrombus formation in blood vessels. In addition, the ability of anthocyanins to reduce the level of cholesterol in the blood and as a result of normalization of the processes of its removal by the liver was discovered. During experimental work, the manifestation of the property of iron (III) in black currant pomace is observed. Adding sodium carbonate Na2CO3 changes the berry's color to black. And this change in color to black is a property of metals. The study of the antiradical activity of anthocyanins was conducted using the DPPH (2,2-diphenyl-1-picrylhydrazyl) method (123,134). This method is based on the interaction of antioxidants with a stable chromogen radical.

Antiradical activity (ARA) was determined using the following formula:

(ARA) = A(control) / Ax × 100%

(ARA) = 50 / 400 × 100 = 12.5%

Where Ax is the optical density of the test solution, and A (control) is the optical density of the control sample. For the separation of multicomponent mixtures, a Shimadzu LC-20 Prominence HPLC (Shimadzu, Japan) liquid chromatograph equipped with an ultraviolet detector was used. The gradient elution program was as follows: 0.01-4 min, 100% A; 4-60 min, 100-25% A; 60-75 min, 25-0% A. The entire HPLC analysis was recorded with an SPD detector at a wavelength of 400 nm; the temperature was maintained at 30℃.Antioxidants can exhibit different mechanisms of action; therefore, it is advisable to study their activity using various methods. In this work, the ARA of extracts was evaluated in relation to the DPPH free radical. The antioxidant properties of anthocyanins are higher than those of commonly used antioxidants such as α-tocopherol (Wangert, 1997), Trolox, and catechin (Heinonen, 2003). Studies have shown that the antioxidant activity of anthocyanins is due to their molecular structure, hydroxyl groups, the presence of a catechin fragment in the B-ring, and the free oxygen ion (O_2) of the oxonium pattern of hydroxylation, acylation, and glycosylation in the C-ring. Experimental results have shown that anthocyanins can inhibit the growth of pathogenic microorganisms such as Enterococcus spp. and Clostridium perfringens, and also exhibit beneficial effects by accelerating the growth of Lactobacillus spp. and Bifidobacterium spp.

4. Conclusion

As a result of research shows that black currant berries contain ascorbic acid three times more than citrus fruits and 16-22 times more than apple and pear fruits.High content of vitamin C and poly phenolic compounds of berry fruit increases its pharmacological properties. The group of poly phenolic compounds of C6 -C3 -C6 series represents flavonoids. Most flavonoids are water-soluble glycosides and are formed in cell sap (vacuoles). During hydrolysis, anthocyanins break down into carbohydrates (galactose, glucose, rhamnose, etc.) and aglycones, represented by anthocyanides. We examined the chemical composition and potential as a raw material for food purposes from blackcurrant (Ribes nigrum). We developed a technology for extraction of food additive with coloring

properties on the basis of berry squeeze and determined the optimal conditions including temperature, stability and other parameters. The anthocyanin biosynthesis follows the phenylpropanoid pathway through the transformation of phenylalanine into a papa-coenzyme (1), which is the first precursor molecule in the biosynthetic pathway of flavonoids. The specicephic enzyme that works on the anthocyanin pathway is the halconsintase it produces the halconic skeletons which are further constructed by flavonoids.Black currant berries contain water-soluble and alcohol-soluble chemical compounds with antioxidant properties. It is revealed that in the process of ripening changes the chemical composition of black currant berries, while increasing the content of dry soluble substances, which additionally favorably affects the diffusion in obtaining extracts. The main vitamins found in black currants, including vitamin C, vitamin B1 (thiamine), vitamin B2, vitamin B5, and vitamin PP, are beneficial for the cardiovascular system. The micro- and macro-elements within the berries are rare and not found in other berry crops. Mass spectrometry analysis revealed catechins, epigallocatechin gallate, and epigallocatechin gallate, making up 20% of the total black currant extract fraction, similar to the catechins found in green tea.

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