UDC 664.6.584.19

FUNCTIONAL INGREDIENTS OF WILD BERRIES TO INCLUDE INTO DIETS FOR MILITARY PERSONNEL

Simakhina Galina,
doctor of technical sciences, professor
galinasimahina@gmail.com
Naumenko Nataliia,
doctor of philology, professor
lyutik.0101@gmail.com
National University of Food Technologies,
Kyiv, Ukraine
Masliychuk Olga
candidate of technical sciences, associate professor
maslijchukolia@gmail.com
Ivan Franko Lviv National University

Summary. The article represents the results of experimental studies over black currant biological value. There was confirmed that they are the rich source of the wholesome complex of biologically active substances necessary for normal functioning of a soldier's body, especially during active combats. Therefore, using black currant in the new technologies to obtain the foodstuff with increased biological value is affirmed as the way to widen the range of food for military personnel, proven scientifically, expedient technologically, and profitable economically.

Keywords: military personnel, specified nutrition, wild plants, black currant, synergists, vitamins, mineral substances, pectin complexes.

The wild-growing fruit and berries are the rich source of vitamins, carbohydrates, lipids, proteins, organic acids, aromatics, minerals, and others. As the curative raw and foodstuff component, they are valuable due to the complex of

biologically active substances that have the capillary-strengthening, anti-sclerotic, hypotensive, anti-inflammation, and hormonal action [1, p. 113]. Many species of wild-growing berries have the high nutritional value, so that they would become the important reserve to create the new poly-functional compounds for enriching the traditional food products [2, p. 193]. However, the range of such a raw to use in food industry is significantly limited by now. The studies over the biological value of wild plant raw materials are one of the main ways to introduce them into the sphere of food technologies; henceforth, it would allow widening the range of plant resources.

The **purpose** of this work is to define the main biocomponents in the samples of black currant grown in Chernihiv and Zhytomyr regions, and to estimate their polyfunctional properties from the viewpoint of its influence on the live organism.

The authors of this article used the standard physical and chemical methods of estimating the plant raw, which are *the Bertrand half-micro method modified by Bierry* to determine the sugars' sum; *calcium-pectate method* to determine the pectin substances; *titration of the samples by 0.1 n. solution of sodium hydroxide* to define the general content of organic acids; *method based on the ascorbic acid's ability to restore the 2.6-dichlorphenolindophenol cyan solution into colorless compound* to define the ascorbic acid content; *using the Fauline-Dennis reagent* to determine the polyphenol substances.

The analysis of the data published recently evidence that the main biological value of wild berries (including black currant) is represented by the following components: pectin substances, organic acids, sugars, ascorbic acid, polyphenol compounds, and mineral substances.

Just those were the indices which we determined experimentally with additional orientation on literary data for several of them. The obtained results are shown in Tables 1 and 2.

Table 1

The main biologically active components in black currant (mg / 100 g)

Samples	Dry substances content	General sugar content	Pectin substances		Organic acids
			Protopectin	Soluble pectin	
Sample No.1	19.6	7.8	0.448	0.264	0.98
Sample No.2	20.4	8.0	0.425	0.248	0.76
Sample No.3	22.2	8.6	0.488	0.265	1.44
Sample No.4	20.8	8.2	0.470	0.258	1.12

Four samples of black currant (samples No. 1 and 2 were harvested in Chernihiv region and samples No. 3 and 4 were harvested in Zhytomyr region) were researched in our paper.

The analysis of the obtained data shows the following facts.

To begin with, all of the samples contain the efficient sum of dry substances. The content of general sugars vacillates between 7.8 and 8.6 percents. Moreover, according to the literary data, this range is significantly wider – from 4.6 to 14.6 percents. The profound researches also showed that inverted sugar is prevalent in black currant, but sucrose content is very low or nil.

This is the important characteristic of black currant, because such carbohydrate content allows implementing the products made of it into diets for sick, disabled persons, old-age people and children. Subsequently, the organism would not need to spend energy for dissolving sucrose to simple sugars that would come into blood directly.

Second, all of the studied samples contain circa 1 per cent of pectin substances (0.673 to 0.753 percents). Besides, their significant part falls on soluble pectin (35.2 to 37.0 percents).

According to literary data, black currant can contain 0.52…1.2 percents of pectin substances [4, p. 1171]. There was confirmed that protopectin is dominant on all the phases of black currant' development. As we can see, the mature berries have twofold more protopectin than soluble pectin.

This convinces once more to recognize expedient the usage of wild-growing plants in producing foodstuff with both common and special destination, considering the outstanding role of pectin substances in normalizing different processes in human organism (particularly, prophylactic and healing intestine diseases, regulation and removal of heavy metals, radionuclides, cholesterol residua, and so on).

Third, the black currant contain the significant amounts of organic acids, according to our data – from 0.76 to 1.44 per cent (the literary data show that the acidity of different black currant species may vacillate within 0.94…2.01 per cent).

The samples of black currant harvested in Chernihiv region contain a little less organic acid than the Zhytomyr region samples do. These indices correlate with the general sugar content (7.8…8.0 in Samples No. 1 and 2; 8.2…8.6 in Samples 3 and 4).

The researchers who investigated the changes in black currant's general acidity dependently on the growing place came to conclusion that acidity, along with saccharine index, is increasing in north area. Consequently, these indices are higher for berries grown in Zhytomyr region.

It is well-known that organic acids like apple, lemon, and oxalic, are prevalent in fruit. Succinic, fumaric, vinous, cinchona, chlorogenous and other similar acids are present in smaller amounts. Black currant are not an exception – lemon acid is dominant in them, less are present apple, cinchona, and succinic acids. All of these acids are extremely important for human organism normal functioning, as they support the acid and alkaline balance, oppress the harmful bacteria's activity, and protect the organism from nuclear damages.

Yet, the succinic acid is attracting more and more scientists today. This is not a wonder, as the range of its influences is very wide – it stimulates the activity of kidneys and bowels, shows anti-stress, anti-inflammation, anti-toxic and other

actions. Succinic acid is used to heal the anemia of different etiology, lumbago, and heart diseases.

Table 2 represents the vitamin compound of black currant.

Table 2

Vitamin content in black currant (mg / 100 g)

Samples	Ascorbic acid	Polyphenol compositions	Carotenoids
Sample No.1	67.8	2447.0	10.2
Sample No.2	54.6	2143.0	8.4
Sample No.3	129.4	2646.0	14.9
Sample No.4	88.5	2097.0	10.7

The analysis of data given in Table 2 evidences the rich vitamin content of black currant. As the biologically active substances of this culture are not yet studied properly, all the experimental results are a contribution into knowledge about still unidentified possibilities of black currant.

The index of ascorbic acid content in black currant is quite high, especially in Samples No. 3 and 4. Of course, these indices are significantly more humble than those for eglantine berries (that contain 1 531…3 094 mg per cent of ascorbic acid). However, they are almost equal for such ascorbic acid rich cultures as haw (14.2…110 mg per cent), wild cherry (26.6…75.5 mg per cent), black currant (49.4…123.0 mg per cent). Along with that, black currant overcome sea-buckthorn (that contains 12…45 mg per cent of vitamin C), Cornelian cherries (28.6…36.8 mg per cent), guelder berries (7.0…39.7 mg per cent), raspberries (26.7…49.4 mg per cent), and barberry (20.2…28.4 mg per cent) by the ascorbic acid content [3, p. 4].

The black currant' attractiveness to use in food technologies and production of poly-functional enriching substances is based on their ability to accumulate not only the significant amounts of ascorbic acid, but also the polyphenol compounds, because the mentioned combination is the most efficient for human organism functioning.

The mechanism of flavonoids activity is defined as blocking the metals' catalytic influence by constraining them into stable complexes that are resistant to any chemical reactions. The flavonoids help the organism to spend ascorbic acid more economically. The flavonoids' ability to strengthen the vessel membranes and regulate their penetrability is universally recognized. There was also proved that the effect of flavonoids' influence on capillaries gets maximally intensive with simultaneous introduction of ascorbic acid.

The figures presented in Table 2 showed that the high level of polyphenol compounds coincides with sufficient C-vitamin activity in all of the examined samples of black currant. Generally, a lot of researchers noticed that black currant exceeds the majority of other wild berries and fruit by the polyphenol substances content.

According to the entire listed criteria, black currant should take the priority place among high-vitamin plants and therefore be used widely in food and pharmaceutical industries.

High carotenoid content is also the important characteristic of black currant (8.4…14.9 mg per cent; See Table 2). The comparison of Table 2 figures showed that the carotenoids (vitamin A precursors) synthesize in plants less intensively than ascorbic acid and polyphenols do.

Carotenoids are represented by β-carotene and its isomers. Vitamin A plays the polyfunctional role in human organism. As the daily dose of this vitamin is only 1…2 mg (or 2…4 mg of β-carotene), the small amount of wild fruit and berries would be sufficient to provide the human organism with noticed substance.

To conclude, it should be mentioned that the experimental data show that wild growing berries (including black currant) are very rich source of a complex of biologically active substances, which would allow obtaining the new foodstuffs with increased biological value, destined for well-balanced nutrition of military personnel. Taking black currant for a base to create the biologically active additives and polyfunctional ingredients is grounded scientifically, expedient technologically, and

profitable economically; henceforth, the expected products from black currant would have a great demand on both domestic and foreign markets.

Therefore, using the wild berries with enhanced content of antioxidant vitamins, pectin substances and other biologically active components in food technologies is the perspective trend to obtain the natural functional fortifiers for production of a wide range of foodstuffs destined for people whose life activity goes on in extreme condition (in particular, military personnel in active hostilities zone).

References

1. Farnath Khanum, Anand, T., Ilaiyaraja, N. et al. Health Food for Soldiers. *Defense Life Science Journal*. Vol. 2, No. 2. April, 2017. P. 111-119.

2. Ukrayinets, A.I., Simakhina, G.A., Stetsenko, N.O., Naumenko, N.V., Kochubey-Lytvynenko, O.V. Novi produkty dlya ratsioniv viyskovosluzhbovtsiv: monografiya [New foodstuffs for military personnel diets: A monograph]. Kyiv: Stal' Publishers, 2017. 292 p.

3. Cortez, R., Gonzalez de Mejia, E. Blackcurrants (Ribes nigrum): A Review on Chemistry, Processing, and Health Benefits. *Journal of Food Science*. Vol. 84, issue 1. 2019. P. 1-15.

4. Buchweitz, M., Kammerer, D.R., Carle, R. Impact of pectin type on the storage stability of black currant (Ribes nigrum L.) anthocyanins in pectic model solutions. *Food Chemistry.* Vol. 139, issue 1-4. 2013. P. 1168-1178.