

БИОЛОГИЧЕСКИЕ НАУКИ

CHEMICAL COMPOUNDS OF BERRIES AND THEIR HEALTH BENEFITS

Zhumabayeva Sara Erkinovna

Candidate of Biological Sciences, associate professor

Gibadilova Aizhan Meiramovna

Senior lecturer, Master

Mrzabek Aizhan

Student of the 3rd year

Kokshetau State University, Kokshetau, Kazakhstan

ABSTRACT

The aim of the work is to review the chemical composition of wild edible berries as sources of biologically active substances. They demonstrate a broad spectrum of pharmacological activity (antioxidant, anti-inflammatory, radioprotective, antimicrobial and anti-carcinogenic effects). Due to these substances, the berries have high nutritional and healing properties and prevent chronic diseases.

АННОТАЦИЯ

Целью работы является обзор химического состава дикорастущих съедобных ягод как источников биологически активных веществ. Они показывают широкий спектр фармакологической активности (антиоксидантное, антимикробное, противовоспалительное, радиозащитное, и антиканцерогенное действие). Благодаря этим веществам ягоды обладают высокими питательными и лечебными свойствами и предотвращают хронические заболевания.

Ключевые слова: дикорастущие ягоды, биологически активные вещества, фармакологическая активность веществ ягод.

Keywords: wild berries, biologically active compounds, pharmacological activity of berry substances.

The phytochemicals of berries are necessary for normal metabolism of the human organism and the prevention of chronic diseases. The consumption of berries contributes to an increase in human longevity. Berries contain significant amounts of water (up to 90%), which dissolves sugars, acids, mineral salts, etc. [6].

Berries are rich in both macro- and micronutrients which provide strength to muscles in humans and play an important role in development of bones and teeth. Minerals take part in many important biochemical processes in humans and regulate water and electrolyte balance, oxygen binding, and hormone functions. They are also important factors for bone and membrane formation [1-2, 4].

Potassium and sodium salts are rapidly excreted in the urine. The diuretic effect of berries is widely used in clinical nutrition, especially for cardiovascular disease, kidney disease treatment. Berries are the sources of Fe, Ca, Mg, P, Cu, Mn, Zn, Co, I, Al [1-2].

Most berries contain a small amount of carbohydrates (no more than 10%), much of them are in easily digestible form (in the form of mono- and disaccharides – glucose, fructose, sucrose). Strawberries, raspberries, black currants, gooseberries contain cellulose. It is necessary for digestion because fibers increase the excretion of cholesterol from human organism. Pectins of berries adsorb various compounds, including endogenous and exogenous toxins and heavy metals [4].

Organic acids increase the secretion of digestive juice and enhance an intestinal peristalsis. Berries contain malic, citric, oxalic, benzoic acids. Benzoic acid has antiseptic properties. Chlorogenic acid has

anti-inflammatory action, choleric and diuretic effect and determines the resistance of the plants to diseases [3].

Berries are an important source of vitamins. Provitamin A, C, B, E vitamins reduce inflammation and help to boost the immune system. These antioxidant chemicals protect from chronic diseases such as diabetes, heart disease, and certain cancers. Blackcurrant, wild rose and strawberries concentrate high amounts of vitamin C [3, 7].

Fruits of wild rose, black currants, rowanberry, orange, grapefruit, strawberry are rich in vitamin C. The main sources of carotene are sea buckthorn, rowanberry, chokeberry, cloudberry, wild rose. Carotene is much better absorbed when combined with fat [8]. Obligatory component of the plant food are vegetable oils. They are rich in in vitamin E, especially polyunsaturated fatty acids which are necessary for cell growth, normal skin, elasticity of blood vessels, cholesterol metabolism and many other processes occurring in the body. [8]. Fruits of wild rose, aronia, blackcurrant, cherry, raspberry, grape are rich in vitamin P.

Many berry plants contain essential oils, which give it a unique flavor and aroma. In small quantities essential oils stimulate appetite, increase the separation of digestive juices and provide a diuretic effect, large irritating effects on kidney and gastric mucosa and intestine. Berries contain a lot of insoluble fibers improving digestion and help balance the bacteria in the digestive system. Tannins concentrated in fruits have a beneficial effect on the intestine with diarrhea [5].

Berries are one of the most important sources of phenolic compounds. They are the most widespread

classe of compounds which are essential for the growth and reproduction of plants. They are produced as a response to plant injury by pathogens. Phenolic compounds contain one or more hydroxyl groups bonded to carbon atoms of the aromatic nucleus. These are highly heterogeneous in their chemical structure, are found in plants in the form of monomers, oligomers and polymers [10, 12].

Among the phytochemicals in fruit, phenolic acids are as one of the major functional food components. Phenolic acids in a plant are mainly present in the bound state as esters or glycosides. They are powerful antioxidants and take part in prevention of various diseases of cardiovascular system and cancer of esophagus, colon, and lung. Raspberries, strawberries, and cloudberries possess antimicrobial properties against bacteria such as *Helicobacter pylori*, *Candida albicans*, *Bacillus subtilis*, and *Staphylococcus* species [11].

One of the most widespread groups of polyphenols in higher plants are flavonoids. There are more than 8000 different flavonoids (flavonols, flavones, catechins, anthocyanins, and proanthocyanins, etc.). Flavonoids have antibacterial, anti-inflammatory, antiallergic, antimutagenic, and skin-lightening effects and hence for their potential as additives in the cosmetic and food industries. Some of flavonoids inhibit carcinogenesis and tumor metastasis *in vivo* [3-4, 12].

Flavonols have anti-inflammatory and antioxidant activity, some of them inhibit human platelet aggregation *in vitro* and exhibits potential anticancer properties [9, 12].

Anthocyanins widely distributed in fruits, berries and vegetables inhibit inflammatory processes that increase the body's immunity to viruses and carcinogens; protect vessels, prevent the formation of clots in blood vessels. They are important for the treatment of atherosclerosis, hypertension and other diseases [4, 7, 9].

Thus, wild berries have diverse properties and play a very special role in nutrition. They are a rich source of vitamins, carbohydrates, proteins, organic acids, aromatic substances, which is an urgent need for the human body. The biological activities of phenolic compounds include prevention of cardiovascular diseases, protection against cancer. They have antitumorogenic, antimicrobial, antiinflammatory-allergic and antimutagenic properties. Fresh berries and their products have a beneficial effect in many diseases.

REFERENCES

1. Дудниченко Л.Г., Кривенко В.В. Плодовые и ягодные растения – целители. - Киев: Наукова Думка, 1987. – 112 с.
2. Киселёв А.В., Волхонская Т.А., Киселёв В.Е. Биологически активные вещества лекарственных растений Южной Сибири // Новосибирск: Наука, 1991. - С. 63-65.
3. Корулькин Д.Ю. Природные флавоноиды. - Новосибирск: Академическое изд-во "Тео", 2007. – 232 с.
4. Соколов С.Я. Фитотерапия и фитотерапевтика. - М.: Мир, 2000. - 976 с.
5. Тичмарш А. Ягоды. - СПб.: ООО Петроглиф, 2011. – 64 с.
6. Шапиро Д. К., Манциволо Н.Н., Михайловская В.А. Дикорастущие плоды и ягоды. Минск: Ураджай. 1981. – 128 с.
7. Bagchi D., Sen C.K., Bagchi M., Atalay M. Anti-angiogenic, antioxidant, and anti-carcinogenic properties of a novel anthocyanin-rich berry extract formula. *Biochemistry (Moscow)*, 2004. - Pp. 69-75.
8. Gromadzka J., Wardencki W. Trends in edible vegetable oils analysis. Part B. Application of different analytical techniques. *Polish Journal of Food and Nutrition Sciences*. 2011, Vol. 61, № 2, - Pp. 89-99.
9. Hakkinen S.H., Kärenlampi S.O., Heinonen I.M., Mykkänen H.M., Törrönen A.R. Content of the flavonols quercetin, myricetin, and kaempferol in 25 edible berries // *Journal of Agricultural and Food Chemistry*. 1999, Vol. 47. - Pp. 2274-2279.
10. Mattila P., Hellström J., Törrönen R. Phenolic acids in berries, fruits, and beverages // *Journal of Agricultural and Food Chemistry*. - 2006. - Vol. 54. - Pp. 7193-7199.
11. Nohynek L.J., Alakomi H., Kähkönen M.P., Heinonen M., Helander I.M., Oksman-Caldentey K., Puupponen-Pimiä R. Berry phenolics: Antimicrobial properties and mechanisms of action against severe human pathogens. *Nutrition and Cancer*, 2006, Vol. 54. - Pp. 18-32.
12. Strovankova S., Sumczynski D., Micek J., Jurikova N., Sochor J. Bioactive compounds and antioxidant activity in different types of berries // *International Journal of Molecular Sciences*. 2015, Vol. 16, - Pp. 24673-24706.