Analysis of the chemical composition of wildlife raw material of the Far Eastern region having endoecological action

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Abstract. The development of the production of functional products based on plant materials is the most important scientific direction, based on modern physiological ideas about adaptation, homeostasis, the provisions of biological cybernetics and the theory of functional nutrition. From the point of view of the biochemistry of nutrition, the human body needs, in addition to vitamins and minerals, an extensive set of other compounds that have a diverse physiological effect on it. The main part of toxins during environmental pollution passes from the blood into the extracellular and then the intracellular space of human organs and tissues. If the changes they cause are not yet irreversible, in this case some medicinal plants with endoecological effects can help. The article presents an analysis of the chemical composition of plant raw materials of the Far Eastern region. The assessment of quality characteristics, chemical composition and safety indicators of certain types of plant materials is given. According to the results of research, it was established that freshly harvested wild fruit and berry raw materials have a high moisture content (79–84%). In wild berries, the content of pectic substances was in the range of 0.66–1.72%. The highest amount of vitamin C is found in actinidia colomicta 112.3 mg / 100 g, Chinese magnolia vine 136.3 mg / 100 g and rosehip 166.3 mg / 100 g, the lowest amount of ash is 44.9 mg / 100 g. Analyzed medicinal and technical raw materials are also quite rich in biologically active substances. All investigated types of raw materials can be used in the production of functional products.

1. Introduction
Nutrition is a determining factor in the regular supply of the human body with the necessary macro- and micronutrients to maintain health and longevity, protection from harmful factors. For the normal functioning of the body and all its systems of micronutrients, not only vitamins and minerals, more precisely, balanced vitamin-mineral complexes, but a much wider range of natural food components, to which the human body has genetically adapted and, therefore, are also factors of nutrition are necessary.

In his writings Pokrovsky A.A. emphasized that "... food is essentially a complex of many hundreds and thousands of substances, each of which has a certain measure of biological activity ..., food should be considered not only as a source of energy and plastic substances, but also as a complex pharmacological complex" [1].
From the point of view of the biochemistry of nutrition, substances that the body needs, in addition to vitamins and minerals, include an extensive set of other compounds that have a diverse physiological effect on the body.

Plants and plant food, respectively, are the sources of these substances. The main groups of mineral components of food plants are contained not only in cultivated, but also wild plants, which can largely compensate for the micronutrient deficiency in the diet of the population.

Biologically active structures of herbs, vegetables and fruits are peculiar stimulators of the humoral sphere of the body. The vitamins contained in them are actively involved in metabolic processes, neuro-endocrine regulation, immunobiological defense mechanisms, blood formation processes, blood clotting and a number of other body functions. The ability to compensate for the lack of vitamins due to biologically active plants allows you to balance the diet, provide the body with enough vitamins, enhance energy potential and maintain the detoxification function of the body [2,3].

The aim of the work is to analyze the chemical composition of fruits, berries and medicinal and technical raw materials with endoecological action.

2. Research results and discussion

The value of plant materials, including wild plants, is determined by the content of biologically active substances. Ensuring the quality and safety of plant materials and beverages produced on their basis, becomes one of the priorities of society, determining the health of the population and the preservation of its gene pool [4].

Food plants of Siberia, the Far East - this is a large potential for improving the quality and expanding the quantitative range of phyto-drinks to cover intra-regional needs and the development of export supplies [6].

To give the drink a special aroma, plants containing aromatic substances that improve the taste and digestibility of their body are used for them: St. John's wort (Hypericum), narrow-leaved willow herb (Chamerion angustifolium), narrow-leaved boil-herb (Epilobium angustifolium), Chinese schisandra (Schisandra chinensis), Tilia), Rhodiola rosea (Rhodiola rosea), mountain ash (Sorbus aucuparia), Asian yarrow (Achillea asiatica sér), Eleutherococcus spiny (Eleutherococcus sentícósus) and others [5].

Fruit and berry plants in the Far East include: actinidia colomicta (Actinidia kolomikta), hawthorn (Crataegus), lingonberry (Vaccinium vitis-idaea), marsh cranberries (Oxyccocus), Chinese lemongrass (Schisandra chinensis), Chinese cranberry (Oleococcus), Chinese lemongrass (Schisandra chinensis), Chinese cranberries, Chisandra (Chisandra chinensis), Chinese cranberries, Chisolnica (Chisandra chinensis), Chinese cranberry, Chromis vine, Chisolacu (Chisandra chinensis), Chinese cranberry (Oleococcus), Chinese Schisandra chinensis, Chronicis, Chiselberry (Chisandra chinensis), Chinese cranberries (Chisandra chinensis), Cranberries (Oxyccocus), Chinese lemongrass (Schisandra chinensis); ), wild rose (Rosa) and others [8].

A significant number of these groups of plants are recognized for a long-term use of medicinal plants [7].

The proposed plants have a sufficiently rich resource potential, and also have a rather “deep” pharmacological and therapeutic effect. When choosing raw materials, we also took into account that it should be economically determined. Based on this, for the production of functional products we propose using renewable parts of plants.

The chemical composition of some wild-growing fruits and berries in average values for the analyzed period is given in table 1.

| Name of raw materials | moisture, % | sugar, % | titratable acid, % | pectic substances, % |
|-----------------------|------------|----------|--------------------|---------------------|

Table 1. The average value of nutrient content in fresh berries in the period from 2012-2018.
According to the results of research, it was established that freshly harvested wild fruit and berry raw materials have a high moisture content (79–84%). Sugar in combination with acids determine the taste of berries, and their technological features. In the analyzed raw materials, the highest content of sugars was observed in actinidia colomict - 11.6%, the lowest in Chinese magnolia vine - 3.1%. Studies have shown that an important role in the accumulation of the amount of sugars in the analyzed raw materials is played by environmental conditions, moisture and heat supply during the growing season, the stage of fruit maturity, but this is not characteristic of all types of berry raw materials.

In wild berries, the content of pectic substances was in the range of 0.66 - 1.72%. Pectins act as stabilizers of ascorbic acid and are an antidote to heavy metals and other toxic substances, contribute to the excretion of toxins, cholesterol and radioactive cobalt and strontium. It is revealed that the pectin solutions, after heat treatment, continue to retain antibacterial properties. Pectin is involved in aroma formation. The specificity of the accumulation of pectic substances and the ratio of their individual forms are different for each type of berry raw material, the high content of which was observed in wild rose berries - 1.72%.

There are considerable interspecific and even intraspecific differences in the quantitative content and qualitative composition of organic acids in fruit and berries of wild-growing raw materials, depending on the characteristics of the type and environmental conditions. The total acidity in the process of fruit ripening in most of the studied plants increases. In the analyzed plants, malic acid prevails, in some species contained in equal quantities with citric acid. Certain acids have some radioprotective effect, they cause the taste of raw materials and finished products [20].

The fruits of mountain ash ordinary have the lowest titratable acidity - 1.1%, the largest Chinese magnolia vine - 3.6%. Currently, special importance is given to biologically active substances. Of particular interest are flavonoids, carotenoids, ascorbic acid, etc.

The physiological role of ascorbic acid in plants and the human body is diverse. Ascorbic acid is involved in the regulation of redox processes, affects cholesterol metabolism, increases the body's resistance to colds. Its joint action with bioflavonoids (vitamin P) is especially marked. They strengthen the walls of blood vessels and regulate their permeability, contribute to the accumulation and better use of ascorbic acid. Used in the treatment of cardiovascular diseases [10]. Thiamin is involved in the absorption of carbohydrates by the body. With a significant predominance of carbohydrates, the need for thiamine increases. In case of an insufficient amount of it, peripheral nerves may be affected, edemas may appear, and cardiac and vascular system disorders may occur. Thiamine can be prescribed by a doctor for chronic fatigue, nervous disorders and exhaustion, any diseases caused by disorders of the nervous system. The content of biologically active substances in the analyzed fruits is presented in Table 2.

Table 2. The average content of biologically active substances in the analyzed fruits from 2012-2018, mg / 100 g.

| Name of raw materials | Vitamin C | Polyphenolic substances | Vitamin B1 | Vitamin B2 |
|-----------------------|-----------|-------------------------|------------|------------|
| Lemongrass Chinese    | 136.3±0.4 | 594.8±0.2               | 0.02±0.01  | 0.07±0.02  |
| Mountain ash          | 44.9±0.1  | 349.2±1.1               | 0.03±0.05  | 0.11±0.01  |
The average data for the analyzed period shows that the greatest amount of vitamin C is contained in actinidia colomicta 112.3 mg / 100 g, Chinese magnolia vine 136.3 mg / 100 g and rosehip 166.3 mg / 100 g, the lowest number is rowan 44.9 mg / 100 g. Raw materials with P-vitamin activity strengthen the walls of blood vessels and regulate their permeability. The mechanism of the physiological action of polyphenols is their interaction with ascorbic acid. One of the manifestations of the synergism of these two vitamins is antibiotic activity. It is established that derivatives of polyphenols are preparations of general biological action, a number of them in increased quantities have antitumor activity. Catechins have the highest P-vitamin activity. The research results show that the average content of polyphenolic substances in dogrose during the analyzed period was 825.9 mg / 100 g. At the same time, the polyphenolic compounds of dogrose are catechins, leucoanthocyanins, phenolic acids, anthocyanins, flavonols. The content of polyphenolic substances for the analyzed period in actinidia of colomycta was 405.8 mg / 100 g. It was noted that the content of polyphenols changed in different years.

In physiological processes occurring in the body, minerals play a significant role. They take part in a number of redox processes and affect the synthesis of carbohydrates, proteins, nucleic and organic acids, vitamins, etc. Mineral substances are part of a number of enzymes, hormones and determine their activity and direction of action. In berries, minerals are in an easily accessible form for the body, in addition, they contain a number of trace elements.

Minerals are cofactors (non-protein part) of enzymes. With a deficiency of minerals, the body functions inefficiently. Calcium is a component of the cascade coagulation mechanism. Its insufficient intake in the body contributes to the release of parathyroid hormone, which stimulates the excretion of calcium from bone tissue into the blood, contributing to their demineralization. It has anti-inflammatory and anti-allergic effects, affects the function of the endocrine glands, regulates vascular tone.

Magnesium is a calcium antagonist. Magnesium is necessary as a factor in the functioning of ATP - a universal battery and energy transmitter. In ischemic heart disease, magnesium contributes to the expansion of blood vessels, improvement of oxygen supply of the myocardium, removal of cardiopasm. In combination with the ability of magnesium to increase the resistance of neurons in the brain to ischemic damage, indicates the protective effect of magnesium in stroke, as well as reducing the risk of this disease with sufficient provision of the body with this element [11,12].

Calcium and magnesium combined with pectin acid form the basis of the pectin complex of fruits. The water-holding capacity of protoplasm of cells depends on the calcium content. The average values of the content of macronutrients in fresh fruits for the analyzed period are presented in tables 3.

| Name of raw materials | Ca     | Mg     | K     | Na     |
|-----------------------|--------|--------|-------|--------|
| Lemongrass Chinese    | 133.1±0.1 | 33.9±0.5 | 380.1±0.2 | 1.03±0.1 |
| Mountain ash          | 253.7±0.5  | 62.1±0.1  | 172.1±0.4  | 1.41±0.9  |
| Actinidia colomicta   | 621±0.3  | 61.1±0.7  | 213.8±0.3  | 1.33±0.6  |
| Hawthorn              | 525.9±0.2  | 142.4±0.9  | 247.9±0.5  | 1.83±0.4  |
| Lingonberry           | 28.1±0.4  | 9.1±0.2   | 65.3±0.9   | 0.37±0.1  |
Zinc is a structural and functional component of lactate dehydrogenase, an enzyme that controls the reversible conversion of pyruvic acid to lactic acid. The interaction of zinc with copper is a cofactor of the antioxidant metalloenzyme. Zinc helps to provide tissues with vitamin A, which affects the body's antioxidant defense. It has a pronounced immunotherapeutic effect, and prevents the development of immunodeficiencies, especially in the elderly and under stress.

The main biochemical function of selenium is an active part in the formation and functioning of the antioxidant system of the body. It protects the body from the accumulation of lipid peroxidation products. The antioxidant effect of selenium is enhanced in combination with vitamin E, which is associated with the synergism of their action. Selenium plays a significant role in the functioning of the immune system. The immunotropic effect of selenium is enhanced when combined with zinc, vitamin A, E, C. Selenium helps reduce the risk of bone tumors.

The average values of the content of microelements in fresh fruits for the analyzed period are presented in tables 4.

### Table 4. Average values of the content of microelements in fresh fruits from 2012-2017, mg / 100 g.

| Name of raw materials   | Mn     | Fe     | Cu     | Zn     |
|-------------------------|--------|--------|--------|--------|
| Lemongrass Chinese      | 0.44±0.01 | 1.23±0.01 | 0.04±0.03 | 0.25±0.04 |
| Mountain ash            | 1.15±0.02 | 1.18±0.06 | 0.11±0.03 | 0.33±0.09 |
| Actinidia colomicta     | 1.90±0.06 | 2.40±0.04 | 0.16±0.04 | 0.13±0.07 |
| Hawthorn                | 0.32±0.01 | 2.09±0.08 | 0.10±0.05 | 0.55±0.01 |
| Lingonberry             | 0.66±0.03 | 0.51±0.07 | 0.05±0.07 | 0.40±0.02 |
| Rosehip                 | 4.30±0.09 | 1.42±0.09 | 0.11±0.06 | 0.38±0.04 |

The research results showed that the analyzed fruit and berry raw materials have a high content of macro- and microelements, the value of which lies in the fact that these substances are contained in the complex. At the same time, the combination of all the constituent components creates a certain pharmacological and therapeutic orientation of one or another fruit and berry raw material and its benefit for the human body [10]. Technological advantage of medicinal and technical raw materials (LTS), is determined by the content of basic chemicals safe for humans, the transformation of which in the process of processing causes the formation of quality indicators of the resulting product. This necessitated the chemical analysis of drug-technical raw materials.

The data obtained indicate that in the conditions of the Far Eastern region, plant raw materials are able to accumulate salts of heavy metals such as lead and arsenic, but their value is within acceptable limits.

Thus, wild-growing raw materials with endoecological effects, growing in the Far Eastern Federal District, are suitable for the production of functional products, and the use of modern technologies and control methods contributes to a significant reduction in the content of toxic elements during its processing. As a biotechnological solution to the problems of creating functional foods, the inclusion of the studied raw materials in food products is its integral part.

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