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ANALYSIS OF CONSUMER PROPERTIES OF MICROGREEN AND BENEFITS OF USE IN NUTRITION

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Modern trends in the formation of a healthy diet dictate the need to create new products with increased biological and physiological value. An important role in this is played by the possibility of using traditional agricultural raw materials grown in the immediate vicinity of the places of its processing, which significantly reduces the cost of transportation and storage of raw materials, to expand the range of food products.

Improving the nutrition of the population is possible due to the use in the recipe of food products of natural plant raw materials, traditionally grown, harvested, prepared in Ukraine, which has a high biological value. The need to monitor the development of modern technologies requires constant improvement and implementation of innovations in the food industry on its own due to the use of foods high in biological compounds.

Based on the analysis of literature sources on the use of microgreens in food, allows us to conclude that today this raw material is promising and belongs to innovative foods. The use of microgreens in the diet allows you to fill the human body with organic nutrients such as proteins, vitamins such as C, B, K, E, carotenoids, minerals and other nutrients: potassium, calcium, phosphorus, magnesium, iron, iodine, sulfur, and also essential oils. The paper presents the results of research on the biological value of microgreens of different crops and its impact on the human body. The use of the benefits of microgreens in the diet is associated with a therapeutic effect, namely the presence in its composition of vitamins, amino acids that have a wide range of biological activity with antibacterial, antiviral effect.

Key words: food industry, microgreens, biological compounds, vitamins, amino acids, consumer properties.

Горач О.О. Аналіз споживчих властивостей мікрозелені та переваги застосування у харчуванні

Сучасні тенденції формування здорового раціону харчування диктують необхідність створення нових продуктів із підвищеною біологічною та фізіологічною цінністю. Важливу роль в цьому відіграє можливість використання традиційної сільськогосподарської сировини, яка вирощується у безпосередній близькості від місць її переробки, що дозволяє помітно скоротити витрати на транспортування і зберігання сировини, розширити асортимент продуктів харчування.

Поліпшення харчування населення можливе завдяки використанню в рецептурі харчових продуктів натуральної рослинної сировини, традиційно вирощеної, зібраної, підготовленої в Україні, що має високу біологічну цінність. Необхідність відстеження розвитку сучасних технологій потребує постійного удосконалення та впровадження інновацій у харчовій промисловості насамперед завдяки використанню продуктів харчування з високим вмістом біологічних сполук.

Аналіз літературних джерел із використання мікрозелені у продуктах харчування дозволяє зробити висновок, що наразі ця сировина є перспективною та належить до інноваційних продуктів харчування. Використання мікрозелені в раціоні харчування дозволяє наповнити організм людини поживними органічними речовинами, такими як білки, вітаміни С, В, К, Е, каротиноїди, мінерали та інші корисні елементи (калій, кальцій, фосфор, магній, залізо, йод, сірка), а також ефірні олії. В роботі наведено результати досліджень біологічної цінності мікрозелені різних сільськогосподарських культур та її вплив на організм людини. Використання переваг застосування мікрозелені в раціоні харчування пов'язане з лікувальним ефектом, зокрема, з наявністю в її складі вітамінів, амінокислот, що мають широкий спектр біологічної активності з антибактеріальним, антивірусним ефектом.

Ключові слова: харчова промисловість, мікрозелень, біологічні сполуки, вітаміни, амінокислоти, споживчі властивості.

Formulation of the problem. Modern trends in the formation of a healthy diet dictate the need to create new products with increased biological and physiological value. An important role in this is played by the possibility of using raw materials grown in the immediate vicinity of the places of its processing. This significantly reduces the cost of transportation and storage of raw materials, expand the range of food. Improving the nutrition of the population is possible through the use in the recipe of natural plant raw materials, traditionally grown, collected, prepared and processed in Ukraine, which has high biological value is an important scientific and technical task of the food industry.

Today, the requirements for food are constantly growing – they must not only meet the established, traditional tastes of consumers, but also belong to the category of healthy foods, not to harm the human body, but to strengthen it. There is a new need for nutrition, in which the necessary component of food is recognized not only useful but also dietary fiber. It is known that innovative products include those foods that have a preventive or curative effect on the human body. One of such innovative products is microgreens, which can be grown at home without the use of special techniques and techniques of cultivation [1].

The cultivation of microgreens was started in the USA. Microgreens began to appear on the menu of chefs in the 1980s in San Francisco (California). In Southern California, microgreens began to be grown around the mid-1990s. At the beginning of the use of microgreens as a food product with a high content of organic compounds, not many of their varieties were used. Crops such as arugula, basil, beets, cabbage, cilantro and a mixture called Rainbow Mix were mainly used for this purpose. Today, microgreens are grown in many parts of the United States and the diversity of its species is increasing every year. In the United States, there are many small producers who sell their greens in farmers' markets or restaurants. A small plastic container with drainage holes, such as a flat box for seedlings or a packaging salad box, allows you to grow sprouts on a small scale. Growing and marketing, high-quality microgreens on a commercial scale is much more complex.

The main advantage of using microgreens in the food industry is that it is growing rapidly. The crop can be removed in 7–10 days after planting, it does not require a special place for growing, enough space on the windowsill. Greens can be grown all year round, especially in the winter and spring, when the human body is in dire need of vitamins. In addition to the positive impact on the human body and quite convenient and practical cultivation, the use of microgreens in raw form, can significantly save time on cooking [2].

The purpose of the study is to analyze the results of research on the biological value of microgreens of different crops and its impact on the human body.

Analysis of recent research and publications. Based on the analysis of literature sources on the use of microgreens in food, allows us to conclude that today this raw material is promising and belongs to innovative foods. The use of microgreens in the diet allows you to fill the human body with nutritious organic substances such as proteins, vitamins (C, B, K, E), carotenoids, minerals and other nutrients (potassium, calcium, phosphorus, magnesium, iron, iodine, sulfur), as well as essential oils.

Microgreens are often called modern superfoods, because they allow you to replenish the human body with nutrients, vitamins and trace elements. Almost all crops can be used as microgreens. These young plants are not exposed to any environmental influences, so they are of maximum benefit. Scientists have proven that microgreens contain 100 times more enzymes than raw vegetables, because it is in the active stage of growth. During the first 10 days of its life, microgreens do not have time to accumulate harmful substances from the atmosphere and live in environmentally friendly conditions [3; 4].

In addition, the recent discovery of the medical and hygienic properties of microgreens, namely the content of large amounts of beta-carotene in it has led to its use in the daily diet. From a medical point of view, the beneficial properties of microgreens are due to the fact that it blocks ultraviolet radiation, protecting our skin, hair and nails from the negative effects of the environment [5].

In addition, scientific studies to study the composition of microgreens show, however, that the germinated sprouts contain a lot of vegetable protein, vitamins (C, B, K, E), carotenoids, minerals and other nutrients (potassium, calcium, phosphorus, magnesium, iron, iodine, sulfur), and it is characterized by a high content of essential oils. Each of these components has a positive effect on the human body.

Presentation of the main research material. Studies of the properties of individual components allow to establish a positive effect on the human body. Yes, folic acid is needed for the formation of new blood cells, which is especially important for women who are planning to become pregnant. Vitamin C is the best antioxidant. Carotenoids promote better immune function. Routine prevents blood clots and has an anti-inflammatory effect. Chlorophyll is a well-known antioxidant with antitumor activity.

Also a feature of the use of microgreens is its therapeutic effect on the body. With regular use of microgreens can improve the functioning of the cardiovascular, digestive, nervous, reproductive and endocrine systems. In addition, microgreens prolong youth, improve the condition of the skin, nails and hair, and are a diet food with minimal calories [6].

As microgreens, seeds of different crops can be used, as it is possible to grow microgreens from almost all crops, namely cereals, legumes and vegetables, except for plants of the nightshade family (potatoes, tomatoes, eggplants and peppers), because their seedlings contain solanine, which is a poisonous substance and can cause digestive problems. It is also not necessary to grow pumpkin plants, because the microgreens of them turn bitter. Bean sprouts contain toxic substances that can be poisoned.

The range of microgreens includes dozens of different crops, but the most popular are: beets, radishes, sunflowers, peas, cabbage, watercress, soybeans, oats, buckwheat, mustard, daikon, cilantro, amaranth [7]. Scientists from the United States analyzed the content of vitamins C, E, K, beta-carotene and other carotenoids in 25 commercially available species of microgreens. In general, the content of these vitamins and carotenoids in microgreens was about 5 times higher than in mature plant counterparts. To grow microgreens, use only environmentally friendly microgreen seeds that have not been previously treated or collected by hand.

The taste of microgreens of different cultures differs. Green sprouts taste similar to the fruits of an adult plant, but are softer and more fragrant. For lovers of spiciness suitable: mustard, onion, cilantro and radish, and for lovers of sweet food, you should pay attention to sunflower, corn, amaranth and peas.

Characterizing microgreens of anatomical and morphological structure are germinated plants in the phase of cotyledon leaves up to 15 cm tall, with 1–2 leaves. Microgreens are grown from seeds of common greens and seeds of cereals. Solanaceae are not used because they contain alkaloids. It takes 10–14 days from sowing seeds to harvesting. Biological value of microgreens of different crops in tab. 1.

Thus, microgreens are a useful food product. In addition to vitamins, it contains mineral elements (calcium, potassium, phosphorus, magnesium, iodine, iron, etc.), essential amino acids, chlorophyll. Regular consumption of microgreens strengthens the immune system, increases the body's efficiency, has a beneficial effect on the endocrine and nervous systems, improves kidney function. Microgreens contain insoluble fiber, which promotes the excretion of toxins and toxins, as well as increases intestinal motility. Rutin,

Table 1

Biological value of microgreens of different crops

№	Microgreens	Biological value	Health effects
1.	Alfalfa	vitamins, minerals, 14 amino acids that are necessary for the proper functioning of our body and prevent a number of diseases	accelerates wound healing; cleanses the body; useful for the skin; protects against osteoporosis
2.	Pea	vitamins: C, PP, groups B, A, E, minerals: phosphorus, manganese, iron, potassium, iodine, calcium, copper, magnesium, beta-carotene, folic acid, carotenoids, enzymes, chlorophyll, antioxidants	promotes weight loss
3.	Arugula	vitamin C, carotene, iodine	providing the body with energy
4.	Chia	vegetable protein, healthy fats, fiber	prevention of blood clots
5.	Sunflower	iodine, phosphorus, magnesium, calcium, zinc, vitamins E and K, folic acid	maintaining immunity
6.	Asparagus	potassium, vitamin A	prevents aging of vessel walls
7.	Amaranth	vitamins, phytosterols, which have cholesterol-lowering properties	improving blood circulation
8.	Turnip	vitamins K, A, C, E and B6, folic acid, copper, manganese, dietary fiber, calcium, potassium, magnesium, iron, phosphorus	strengthens immunity
9.	Barley	proteins, dietary fiber, vitamin E, beta-carotene, minerals	intensively affects the metabolism
10.	Beet	strengthens the immune system, contains vitamins K, C and E, beta-carotene and lutein	promotes the excretion of cholesterol
11.	Broccoli	vitamins A, C, K, soluble fiber, sulfur, protein and calcium	gives the body endurance and strength
12.	Buckwheat	buckwheat microgreens contain the “poisonous” substance phagopyrine, moderate consumption will not cause problems, but excessive can cause problems with skin sensitivity	strengthening blood vessels
13.	Carrot	vitamin A, which helps prevent vision loss, fiber, which helps digestion; vitamin K, magnesium, calcium, folic acid, potassium	improves hematopoiesis, metabolism
14.	Wheat	nutrients, vitamins A, C, B, amino acids, minerals	helps fight joint pain

contained in microgreens, reduces the permeability of capillaries and has anti-inflammatory effects, and sulforaphane has anti-cancer and antibacterial effects [7].

The advantage of microgreens is its unpretentiousness to light, heat, space. The harvest requires wide pallets and substrate – earth or jute, depending on the selected crop. The lighting can be lamps fixed in the top part of a rack with a gap of 50–60 see In one cycle – 10–12 days with an area of 4 m² you can get 20 kg of shoots. In fig. 1 shows an example of growing microgreens from seeds of different crops.



Fig. 1. Growing microgreens from seeds of various crops

Conclusions. Based on the analysis of scientific research on the use of microgreens in the food industry as a source of nutrients and nutrients with high biological value, we can conclude that it is a valuable food raw material. Studies to determine the consumer properties of microgreens, we conclude that it contains a large number of vitamins, essential amino acids, minerals such as calcium, potassium, phosphorus, magnesium, iodine, iron, etc. and chlorophyll, in addition, has a preventive and curative effect. It strengthens the immune system, increases the body's efficiency, has a beneficial effect on the endocrine and nervous systems, improves kidney function, improves cardiovascular function, reduces capillary permeability and has anti-inflammatory effects, and sulforaphane has anti-cancer and antibacterial effects. However, the further use of microgreens in the food industry requires further studies of consumer properties, which took into account their impact on the human body, ie sanitary, antiseptic, biological properties, as well as their energy and medicinal value. In addition, today the issues of developing resource-saving technologies for processing and storage of finished products remain unresolved and relevant, which will significantly extend the shelf life and use of raw materials, which in the future will lead to the possibility of using these products not only domestic but also European markets.

Therefore, the development, expansion and systematization of consumer characteristics of microgreens as food raw materials from different crops is an important task today, given the trends in innovative technologies in the world and in Ukraine.

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