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Development on the basis of vegetable oils and seeds of olive crops of products for feed of sportsmen

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The purpose. Substantiation and development of protein-fatty basis for sacchariferous confectionery products with the increased biological value, downgraded caloricity and extended shelf life which can be used for organization of balanced diet for sportsmen. **Methods.** Organoleptic and physicochemical parameters of protein-fatty basis, fat content in olive seeds are determined by means of standard techniques; amino acid composition — by ISO 13903:2005; oxidative stability — by rapid method of «active oxygen» at temperature 85±1°C at easy approach of light and air in reactor of barbotage type with constant feed rate of air and mixing; period of induction is determined graphically on curves of change of peroxide value. To design experiments and process data they applied mathematical methods with the use of software packages Microsoft Excel and Statistica. For calculation of ratio of ingredients in protein-fatty basis they used Sheffe simplex-trellised plan. Results. Sampling of ingredients of protein-fatty basis is proved. The volumetric part of olive seeds is counted which matches to ratio 2:1:1 on essential amino acids leucine:isoleucine:valine. Calculation of the optimum content of olive seeds in protein-fatty basis with the purpose of delay of oxidation processes is carried out: seeds of sunflower — 20±5% vol., flux — 50±5, sesame — 30±5% vol. Conclusions. Sampling and content of ingredients is substantiated of protein-fatty basis balanced on essential amino acids with branched circuit (leucine, isoleucine, and valine) and tryptophan, and also irreplaceable polynonsaturated fatty acids. The developed protein-fatty basis is used in structure of sacchariferous confectionery products that promotes raise of biological value, decrease of caloricity and raise of oxidative stability last.

Key words: feed of sportsmen, vegetable oils, olive seeds, essential amino acids, polynon-saturated fatty acids.

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Formulation of the problem. According to most nutritionists, in the diet of the world's population there is an acute shortage of essential ingredients, such as essential amino acids and minerals. All of these components are under-consuming and 80% of the population of our country, that is, the level of consumption of products that are commonly used does not meet the standards recommended by experts, both in structure and in total energy value [1, 2].

Modern sports are characterized by intense physical, emotional and mental stresses, and therefore the presence of balanced nutrition in the diet of athletes is one of the priority tasks [3, 4]. And a well-balanced diet of an athlete can help reduce the effect on the body of exercise during multiple training and intense competition and become a powerful means that will restore the performance of both the physical and emotional component of this condition. However, due to the lack of full information on physiological and biochemical changes in the athlete's body during multiple training sessions, nutritionists do not have a single nutrition strategy for this population. It is known that the most effective way of eliminating detected deficiencies of nutrients in the diet of athletes, as well as improving the prevention of diseases caused by malnutrition, is the use of food products enriched with biologically valuable infants. Sugar confectionery products with high calorie content, high carbohydrate content, high fat and low protein content are very popular foods and have a steady demand among consumers, especially children and young people.

But modern confectionery has two main drawbacks - low shelf life and imbalance of the composition. Extension of the shelf life is already solved by the introduction of antioxidants [5, 6], most often of synthetic

origin. The vegetable fat used in the production of sugar confectionery products is unbalanced by the fatty acid composition [7-11]. Consequently, sugar confectionery products today can become products for health purposes. The above stipulates the relevance of this work, which is aimed at creating high-quality domestic products for the daily diet of athletes, by introducing into its composition of such biologically valuable components as unsaturated fatty acids, amino acids and proteins.

The purpose and main objectives of the study. The purpose of the study is to substantiate and develop the protein-fatty basis for sugar confectionery products of high biological value, reduced calorie content and extended shelf-life, which can be used for organizing rational nutrition of athletes. In order to achieve this goal, the following tasks must be solved, namely, to substantiate the composition of the protein-fatty base, which has a balanced content of essential amino acids, and to investigate the oxidative stability and organoleptic parameters of the confectionery mass with the proposed protein-fat basis.

Materials and methods of research. The following materials were used for research:

- sunflower seeds according to DSTU 7011:2009;
- flax seeds according to DSTU 4967:2008;
- sesame seeds according to DSTU 7012:2009;
- palm oil according to DSTU 4306:2004;
- chocolate cream according to the current normative documentation.

Organoleptic and physico-chemical parameters of protein-fat base, fat content in oilseed are determined according to standard methods; amino acid composition - according to the recommendations of ISO 13903:2005; oxidation stability - by the accelerated method of "active oxygen" at the temperature of 85 ± 1 °C with the free access of light and air in a bubble-type reactor with a constant rate of air supply during mixing; the induction period is determined graphically by the curves of the change of the peroxide number. For planning the experiment and data processing, mathematical methods using the software packages of Misrosoft Excel and Statistica are used. To calculate the ratio of components in protein-fat basis, a simplex-lattice Sheffe plan was used.

Results of work. Perspective components for the development of protein-fat basis for rational nutrition in order to overcome the deficit of essential amino acids and trace elements are raw materials of plant origin - seeds of oilseeds and / or oils from them. On the basis of the analysis of domestic and world scientific and technical information, seeds of the following oilseeds, such as sunflower, sesame seeds and flax, were selected. This choice can be explained by the fact that the seeds of these, yet genetically modified, oilseeds can become a source of proteins of plant origin, as well as a source of a number of valuable compounds and trace elements that are necessary for human health, especially young people. Seeds of these oilseeds on the content of protein in them is not inferior to other sources, and the amino acid composition of flax seed proteins are similar to soy proteins, which are considered the most caloric. In addition, sesame seeds contain a substance of a phenolic nature, such as sesamol, which can slow down the oxidation processes. Due to this substance, sesame oil has good stability for a long shelf life. Also, in the form of sesame oil there are tocopherols, in particular high-temperature -tocopherol stable. Sezamol is able to enhance the antioxidant action of -tocopherols in oils [6], and therefore the complex of -tocopherols with sesamol can be offered for use as antioxidants in fatty products.

Seeds of selected oilseeds are rich in essential amino acids such as leucine, isoleucine, valine, and they are an indispensable material for the construction of muscle tissue and participate in the processes of anabolism and recovery [7]. The indispensable amino acids in the blood of human plasma compete with the amino acid tryptophan, which determines the rate of penetration of tryptophan into the brain and provoking a decrease in motor activity and efficiency, ie, the appearance of fatigue. Thus, the enriched protein-fat base for sugar products must necessarily contain, under the requirements of nutritionists, indispensable amino acids in the ratio of leucins: isoleucine: valine, which is 2:1:1.

The volume fraction of oil seed is calculated, which corresponds to the ratio of 2:1:1 to the essential amino acids of leucine: isoleucine: valine and the following system of equations is obtained:

$$Y_1(x_1,x_2,x_3) = 1{,}934 \cdot x_1 + 1{,}709 \cdot x_2 + 1{,}676 \cdot x_3 - \\ -0{,}025 \cdot x_1 \cdot x_2 - 0{,}219 \cdot x_1 \cdot x_3 - 0{,}032 \cdot x_2 \cdot x_3, \quad (1)$$

$$Y_2(x_1,x_2,x_3) = 1{,}254 \cdot x_1 + 1{,}51 \cdot x_2 + 1{,}582 \cdot x_3 - \\ -0{,}046 \cdot x_1 \cdot x_2 + 0{,}163 \cdot x_1 \cdot x_3 + 0{,}055 \cdot x_2 \cdot x_3, \quad (2)$$

$$Y_3(x_1,x_2,x_3) = 0{,}648 \cdot x_1 + 0{,}884 \cdot x_2 + 0{,}944 \cdot x_3 - \\ -0{,}043 \cdot x_1 \cdot x_2 + 0{,}147 \cdot x_1 \cdot x_3 + 0{,}047 \cdot x_2 \cdot x_3, \quad (3)$$

$$Y_4(x_1,x_2,x_3) = 336{,}887 \cdot x_1 + 296{,}944 \cdot x_2 + 653{,}434 \cdot x_3 - \\ -12{,}227 \cdot x_1 \cdot x_2 - 19{,}112 \cdot x_1 \cdot x_3 - 18{,}341 \cdot x_2 \cdot x_3, \quad (4)$$

where x_1 – the content of sunflower seeds in the mixture,% vol .;

x_2 – the content of sesame seeds in the mixture,% vol .;

x_3 – content of flaxseed in a mixture,% vol .;

Y_1 – Leu/Ile ratio;

Y_2 – Leu/Val ratio;

Y_3 – Ile/Val ratio;

Y_4 – Trp content.

According to the results of processing of the equations system (1) - (4), the range for each of the selected oilseeds in their mixture is determined: sunflower - 20 ± 5% vol., linseed - 50 ± 5% vol. and sesame seeds - 30 ± 5% vol. The resulting base can be used to enrich the biologically active substances and increase the stability to oxidation in fatty candy masses.

As an object of enrichment with a protein-fat basis, the candy mass was selected for the production of chocolates (such as "truffle"), which is a finely divided mass on the basis of sugar, fat, with or without the addition of cereals or other crops, food additives and other types of raw materials, from mass fraction of fat is not less than 18%. In the laboratory, a candy mass containing chocolate cream was obtained - about 82% by weight, palm oil with a melting point of 25-40 ° C - about 8% by weight. and protein-fat base - about 10% by weight. The oxidation stability of the manufactured candy mass in comparison with the control sample was investigated. As a control sample, a candy mass was used, in which the protein-fat product was replaced by a mixture of crushed sunflower seeds with sunflower oil. The correlation between fat and protein components in samples of candy masses is preserved. The period of induction of accelerated oxidation of candy mass enriched with protein-fat product is increased by 1.4 times in comparison with the control sample of candy mass.

Samples of the obtained candy mass made with the addition of proteinaceous and fatty products, according to the basic physical and chemical parameters, do not differ from the samples obtained by the industrial formulation. Expected shelf life due to the presence of antioxidants such as sesamol and tocopherols should be 2-4 months.

Conclusions

1. The choice and content of the components of the protein-fatty base, which is balanced by essential branched chain amino acids (leucine, isoleucine, valine) and tryptophan, and also indispensable PUFAs, are substantiated. 2. Protein-fat basis is used as a part of sugar confectionery product, which promotes increase of biological value, decrease of calorie and increase of oxidative stability of the latter.

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