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## **BALANCED FAT BASES FOR FUNCTIONAL SPREADS**

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**Abstract.** The article deals with the aspects of creating a balanced fat base, taking into account the norms of the physiological needs of a modern person in lipids and their structural components. The analysis of the fatty acid composition of natural oils of various fatty acid groups and modified fats has been carried out. The content of polyunsaturated fatty acids is from 10 to 15%, while the ratio between  $\omega 6/\omega 3$  fatty acids is 10:1, which corresponds to the normal requirement of a healthy person. When adjusting the optimal ratio, not only the medico-biological requirements for the consumption of one or another essential acid, but also the structural and rheological characteristics of the produced product should be taken into account. The data on the balance of fatty bases, natural and modified vegetable oils and fats provide consumer properties of functional fatty products.

**Keywords:** balanced fat bases, spreads, functional purpose, fatty acid composition, polyunsaturated fatty acids.

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**Аннотация.** В статье рассмотрены аспекты создания сбалансированных жировых основ с учетом норм физиологических потребностей современного человека в липидах и их структурных компонентах. Проведен анализ жирнокислотного состава природных масел различных жирнокислотных групп и модифицированных жиров. Содержание полиненасыщенных жирных кислот составляет от 10 до 15%, при этом соотношение между  $\omega 6/\omega 3$  жирными кислотами составляет 10:1, что соответствует норме потребности здорового человека. При корректировке оптимального соотношения должны быть учтены не только медико-биологические требования по потреблению той или иной эссенциальной кислоты, но и структурно-реологические характеристики вырабатываемого продукта. Представлены данные по сбалансированности жировых основ, природных и модифицированных растительных масел и жиров обеспечивают потребительские свойства функциональных жировых продуктов.

**Ключевые слова:** сбалансированные жировые основы, спреды, функциональное назначение, жирно-кислотный состав, полиненасыщенные жирные кислоты.



**Түйіндеме.** Мақалада қазіргі адамның липидтерге және олардың құрылымдық компоненттеріне физиологиялық қажеттіліктерінің нормаларын ескере отырып, теңдестірілген май базасын құру аспектілері қарастырылады. Әр түрлі май қышқылдары тобы мен модификацияланған майлардың табиғи майларының құрамына талдау жүргізілді. Полиқанықпаған май қышқылдарының мөлшері 10-15% құрайды, ал  $\omega 6/\omega 3$  май қышқылдарының қатынасы 10:1 құрайды, бұл сау адамның қалыпты қажеттілігіне сәйкес келеді. Оңтайлы коэффициентті реттеу кезінде сол немесе басқа эфир қышқылын тұтынуға медико-биологиялық талаптарды ғана емес, сонымен қатар өндірілетін өнімнің құрылымдық және реологиялық сипаттамаларын да ескеру қажет. Майлы негіздердің, табиғи және модификацияланған өсімдік майлары мен майларының балансы туралы деректер функционалды майлы өнімдердің тұтынушылық қасиеттерін қамтамасыз етеді.

**Түйінді сөздер:** теңдестірілген май негіздері, спредтер, функционалды мақсаты, май қышқылдарының құрамы, полиқанықпаған май қышқылдары.

**Introduction.** Currently, the spread is becoming a new product of higher quality, which gives the right to classify it as a functional product. So in terms of organoleptic and structural-mechanical indicators, they are increasingly approaching butter. The fat base for spreads is selected in such a way as to ensure a balanced fatty acid composition, an optimal content of polyunsaturated fatty acids, a low concentration or complete absence of trans fatty acids; in most cases, spreads are enriched with fat-soluble vitamins A, D, E; due to the prevalence of vegetable oils in the composition, spreads contain a minimum amount of cholesterol; medium and low fat spreads have a reduced calorie content [1]. A person's nutritional balance implies such a state of his diet when the body receives all the ingredients necessary for it in certain proportions that ensure the normal functioning of the body. The balance of substances that are not synthesized in the human body is especially important. Lipids are one of the most important components of food vital for humans, which determine its nutritional, energy value and biological effectiveness. The main factor in the effectiveness of the use of lipids supplied with food is the balance of their fatty acid composition. To maintain health, a person needs a balanced content of  $\omega$ -3 and  $\omega$ -6 fatty acids [2].

The range of butter-vegetable spreads is expanded due to the correct regulation of the fatty acid composition of the product by introducing vegetable oils or non-dairy fats compositions into the formulation; reducing calorie content by changing the ratio between fat and non-fat components in favor of the latter; the admissibility and expediency of the use of

fatty base quality improvers, including structure stabilizers, antioxidants and others, the basic principles of the selection of which are primarily focused on functional ingredients. The combination of vegetable oils provides the possibility of mutual enrichment of the ingredients in these products according to one or more factors and allows you to create products with a balanced composition. Thus, the selection of the composition and properties in order to create products that most fully correspond to the balanced nutrition formula predetermines the directions for the development of new technologies. While  $\omega$ -6 can be obtained from most vegetable oils,  $\omega$ -3 is found only in flaxseed oil. Therefore, a deficiency of  $\omega$ -6 in the diet is rare, while  $\omega$ -3 is sorely lacking. For the normal functioning of the body, their balance is necessary [3].

**Materials and methods.** The resulting new fat and oil products based on vegetable raw materials must meet the requirements of the Technical Regulations for fat and oil products TR CU 024/2011 in terms of ensuring the quality and safety of edible fats and will be aimed at improving the technologies for the production and processing of oils, ensuring better use of raw materials, high productivity and improving quality products with the simultaneous achievement of their food safety.

**Results and their discussion.** Fatty bases of vegetable origin, namely rapeseed and flaxseed oils, are necessary to create new functional fat and oil products - spreads, balanced by the main physiological and biochemical parameters. When choosing the recipe composition of these oils, a number of factors were taken into account: an increased content of polyunsaturated fatty acids of the  $\omega$ -3 and  $\omega$ -6 classes, monounsaturated fatty acids; the absence of trans isomers of fatty acids, an adequate level of intake of tocopherols in the body. Since flax is one of the oldest plants cultivated by man, the oil is obtained from the reddish-brown seeds of flax, and it has a pleasant brown to golden color, depending on the degree of purification. Flaxseed contains vitamin F and large amounts of vitamins A and E. Flaxseed oil is a valuable food product that differs from most oils in its high content of essential linolenic acid (up to 70%).

Flaxseed oil is an indispensable product in the human diet, participating in many metabolic processes, used for the prevention and treatment of diseases such as coronary heart disease, atherosclerosis, cancer, diabetes and many others. As a result of scientific research, it has been revealed that the lignins contained in flaxseed oil have the ability to destroy estrogen compounds that cause breast cancer. In addition to lignins,

flaxseed oil enters the human body with alpha-linolenic acid, which also has significant anticarcinogenic properties, especially in breast cancer diseases [4]. The density of linseed oil at 15°C is 934 ... 935 kg/m<sup>3</sup>, the refractive index at 15°C is 1.4858 ... 1.4872, the kinematic viscosity at 20°C is 15.5 × 10<sup>-6</sup> m<sup>2</sup>/s. The composition of flaxseed oil from seeds of various varieties can vary significantly depending on varietal characteristics, cultivation areas, soil and climatic conditions of plant growth. The most important components of flaxseed oil: α - acid (from 41.4% to 57.5%) oleic acid (from 21.7% to 28.4%), linoleic acid (from 12.2% to 20.7%). Stearic and palmitic acids make up about 10% in total. The oil contains about 40-50 mg% tocopherols. Its characteristic feature is the presence of lignans in the composition. Experimental and clinical studies have shown that lignans have hepatoprotective, antitoxic, antioxidant, antiallergic, anti-tumor effects, inhibiting the multiplication of the human immunodeficiency virus [5]. It should be noted that the consumer properties of flaxseed oil are determined mainly by the high content of linolenic acid. Linolenic acid is irreplaceable, the body is not able to synthesize it on its own, so it must be present in food. For the human body, linolenic acid has a double effect: it is an essential nutrient that maintains the normal functioning of the physiological functions of the body, as well as an important drug for the treatment of many diseases [6].

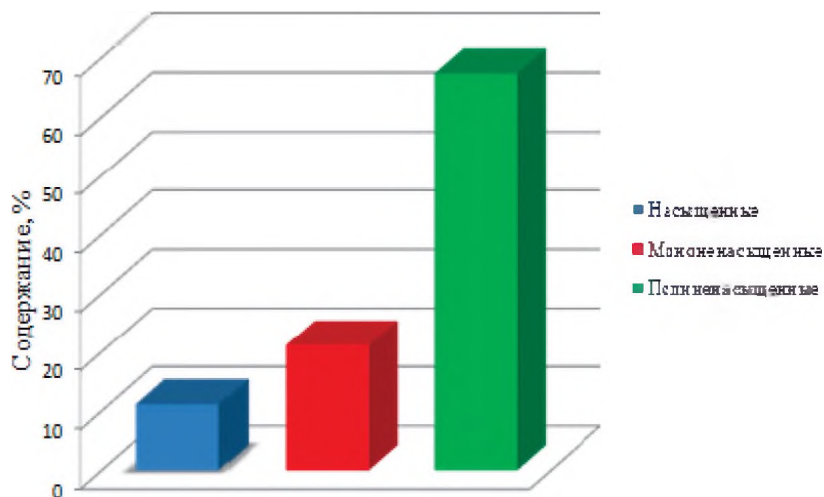


Figure 1 – The content of saturated fatty acids, monounsaturated fatty acids and polyunsaturated fatty acids in linseed oil

As can be seen from Figure 1, in terms of the content of polyunsaturated fatty acids of the  $\omega$ -3 and  $\omega$ -6 groups, flaxseed oil surpasses many products. The high proportion of polyunsaturated fatty acids in spreads significantly distinguishes it from butter. Polyunsaturated fatty acids are an important and indispensable component of a fatty product, a necessary initial building material for cell membranes and the biosynthesis of substances - mediators that regulate metabolic processes: prostaglandins and leukotrienes. The share of polyunsaturated fatty acids in spreads can reach 25%, while in butter their level is no more than 3.5%. Thus, the use of vegetable oils, namely flaxseed oil, as a fatty base for spreads is fully justified. The product obtained from the processing of rapeseed is widely used for human consumption. In its unrefined form, it contains erucic acid, which causes disturbances in the development of the body, in particular, slowing down the onset of reproductive maturity. That is why it is recommended to eat only refined rapeseed oil. Useful properties and contraindications are fully contained in its composition. Its benefits for the body are as follows: in terms of biochemical composition, it is superior to olive oil; contains a large amount of vitamin E, polyunsaturated and monounsaturated acids; normalizes the work of all body systems [7].

Much attention is paid to  $\omega$ -3 polyunsaturated fatty acids as a nutritional element with therapeutic and prophylactic properties. However, to maintain optimal health, a person needs a balance in the diet of the content of  $\omega$ -3 and  $\omega$ -6 polyunsaturated fatty acids. Excess amounts of  $\omega$ -6 polyunsaturated fatty acids and a very high  $\omega$ -6 /  $\omega$ -3 ratio contribute to the development of a number of diseases, including cardiovascular, oncological, inflammatory and autoimmune, while elevated levels of  $\omega$ -3 polyunsaturated fatty acids have an inhibitory effect. The most favorable ratio of these acids for different age groups and different health conditions (diet of a healthy person or diet of preventive and therapeutic orientation) ranges from 10/1 to 1/1 [8].

As can be seen from Figure 2, saturated and unsaturated fatty acids are the main suppliers of energy to the human body. The main sources of saturated fatty acids - palmitic and stearic - are animal oils and cocoa beans. Their content in rapeseed oil is 68-58%. To achieve a healthy balance in the human body, you must adhere to the recommended daily intake of fatty acids and emphasize the diversity of your diet.

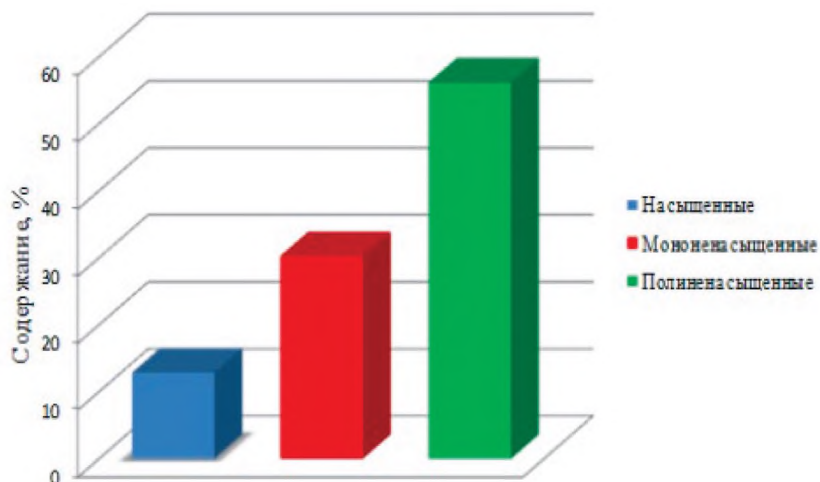


Figure 2 – The content of saturated fatty acids, monounsaturated fatty acids and polyunsaturated fatty acids in rapeseed oil

**Conclusions.** Thus, when using rapeseed and flaxseed oil as fatty products, special attention should be paid to the main quality indicators. Based on the analysis of the content of saturated fatty acids, monounsaturated fatty acids and polyunsaturated fatty acids in rapeseed and flaxseed oils, it determines the unique properties of these fatty products. Saturated acids are found in food most often: these are sweets of all kinds, and dairy products. It is customary to associate an increased level of cholesterol in the body with their consumption. The negative effect occurs only in the case of abuse of products containing significant amounts of saturated fatty acids. In moderate doses, they are essential for health, since they strengthen the skeletal system, improve the function of the liver and the immune system. The use of rapeseed and flaxseed oil will make it possible to obtain butter-vegetable spreads, optimized in terms of fatty acid composition, with the necessary ratio of  $\omega$ -3 and  $\omega$ -6 fatty acids for various population groups. At the same time, the supply of the required amount of tocopherols is achieved, protecting fatty acids from free radical oxidation in the human body with excessive consumption of polyunsaturated fatty acids. From all of the above, it follows that spreads are new products, so choosing the right technology will allow you to preserve all the naturalness of natural oils. For functional spreads, it is advisable to improve the fat base, because the introduction of functional ingredients requires a more

careful selection of the fat base, therefore the second direction is the regulation of the fatty acid composition: reducing and eliminating trans fatty acids, reducing the amount of saturated fatty acids.

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