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FLAXSEED OIL AS A COMPONENT FOR PRODUCING SPREADS OF FUNCTIONAL DIRECTION

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The article presents the physicochemical characteristics and fatty acid composition of unrefined flaxseed oil produced in the territory of the Republic of Kazakhstan. The possibility of using this oil as a basis for obtaining a vegetable-creamy spread for functional purposes is considered. Flaxseed oil as a valuable source of linolenic acid is widely used for therapeutic and prophylactic purposes. From the research results was revealed that the ratio of ω-6 and ω-3 in unrefined flaxseed oil is 1: 3. However, for the use of flaxseed oil rich in ω-3 as a basis for the production of spreads of a functional orientation, it becomes possible only in a composition with another vegetable oil rich in ω-6, in order to achieve a balance of fatty acid balance.

Key words: flaxseed oil, spread, fatty acid composition, fat and oil industry, butter, polyunsaturated fatty acids ω-6 and ω-3.

ЗЫҒЫР МАЙЫ ФУНКЦИЯЛЫҚ СПРЕДТЕР АЛУ ҮШІН КОМПОНЕНТ РЕТІНДЕ

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Мақалада Қазақстан Республикасының аумағында өндірілетін тазартылмаған зығыр майының физика-химиялық сипаттамасы мен май қышқылдық құрамы берілген. Бұл майды функционалдық мақсатта көкөніс-кілегейлі спред алу үшін негіз шикізат ретінде пайдалану мүмкіндігі қарастырылады. Зығыр майы линолен қышқылының құнды көзі ретінде емдік және профилактикалық мақсатта кеңінен қолданылады. Зерттеу нәтижелері бойынша тазартылмаған зығыр майындағы ω-6 және ω-3 қатынасы 1:3 болатыны анықталды. Дегенмен, ω-3-ке бай зығыр майын функционалдық бағыттағы спредтерді алу үшін негіз ретінде пайдалану үшін, тепе-теңдікке қол жеткізу үшін ω-6-ға бай басқа өсімдік майы бар композицияда ғана мүмкін болады.

Негізгі сөздер: зығыр майы, спред, май қышқылдарының құрамы, май және тоң май өнеркәсібі, сары май, полиқанықпаған май қышқылдары ω-6 және ω-3.

ЛЬНЯНОЕ МАСЛО КАК КОМПОНЕНТ ДЛЯ ПОЛУЧЕНИЯ СПРЕДОВ ФУНКЦИОНАЛЬНОЙ НАПРАВЛЕННОСТИ

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В статье представлены физико-химические характеристики и жирнокислотный состав нерафенированных льняных масел, производимых на территории Республики Казахстан. Рассмотрена вероятность использования этого масла, как основы для получения растительно-сливочного спреда функционального назначения. Льняное масло как ценный источник линоленовой кислоты находит широкое применение в лечебно-профилактических целях. Из результатов исследований выявлено, что соотношение ω-6 и ω-3 в льняном нерафинированном масле равно 1:3. Однако для использования льняного масла, богатого ω-3, в качестве основ для производства спредов функциональной направленности становится возможным только в композиции с другим расти-тельным маслом, богатым ω-6, в целях достижения жирнокислотного баланса.

Ключевые слова: льняное масло, спред, жирнокислотный состав, масложировая промышленность, сливочное масло, полиненасыщенные жирные кислоты ω-6 и ω-3.

Introduction

Currently, one of the important tasks of the oil and fat industry is the production of functional, as well as therapeutic and prophylactic products that ensure human health. The content of harmful components is reduced by replacing animal fats with vegetable fats while maintaining its consumer properties. However, the modification of a traditional product into a functional one should not be

limited to replacing ingredients, but a complex process of designing a product that has restored traditional consumer and new functional properties that determine its usefulness [1].

However, none of the fats taken separately can fully satisfy the body's need for nutrients. Animal fats, including milk fat, contain vitamins A and D, as well as lecithin, which has a lipotropic effect. However, they have few essential PUFAs and cholesterol [2].

By replacing some of the milk fats (butter) with vegetable oils, after such a substitution, the product automatically becomes a spread. Spread is the most attractive product in this segment, as it becomes possible to regulate vitamin, mineral and fatty acid compositions.

The main direction of innovative development of spreads is associated with the introduction of certain types of physiologically functional ingredients into their formulations in quantities that ensure, with a portion of the product, the satisfaction of 10-50% of the recommended level of adequate consumption for this ingredient. Such a modification of the traditional composition is aimed at giving the product the ability to have a positive effect on the physiological functions and metabolic processes in the human body when regularly consumed as part of a regular diet. This fatty product can reduce the risk of developing food-related diseases while maintaining and improving health, and is classified as a functional food [3].

Flax seed oil is distinguished by a high content of polyunsaturated fatty acids (PUFA), namely, ω-6 and ω-3 acids, with a preponderance towards the content of ω-3 acid (α-linolenic). Of greatest interest is the content of ω-3 acid due to the fact that the human body is constantly experiencing a lack of this particular acid. The human body is unable to synthesize ω-6 and ω-3 acids, however, ω-6 is found in almost all vegetable oils, while ω-3 is found only in flaxseed oil and fish oil.

The US Dietary Advisory Committee (DGAC) in 2015 recommended replacing animal fats, including butter, with non-hydrogenated vegetable oils high in unsaturated fats and relatively low in saturated fatty acids [4].

Saturated fats should be less than 10% and trans fats less than 1% of total energy intake, while fat intake should replace saturated fats and trans fats with unsaturated fats [5] and strive to eliminate commercially produced trans fats from the diet [6].

Trans fatty acids have no nutritional value and WHO recommends that they be eliminated in food production so that they account for no more than 1% of the daily calorie intake [7].

Spreads, due to the presence of water (hydrophilic) and fat (hydrophobic) phases, are a convenient object for the introduction of physiologically functional ingredients into their composition [8]. To study the balance of the fatty bases of spreads, it is more important to add vegetable oils that have an optimal ratio of ω-6 and ω-3 fatty acids.

For the production of functional spreads, two potential plant components were considered as raw materials: vegetable oils (flaxseed oil) and milk fat (butter).

Flaxseed oil has tremendous benefits for heart health. In addition to lignans - phytoestrogens with anticarcinogenic and antibacterial properties, it contains α-linolenic acid. α-linolenic acid, like other fatty acids, is essential for the vital functions of cells, maintaining normal blood pressure and other important functions of the body.

A number of demographic studies have shown that α-linolenic acid reduces the risk of cardiovascular disease, slows down blood clotting also reduces blood clots. This helps to reduce the risk of heart attack and stroke in patients with atherosclerosis and diabetes by 37%.

Flaxseed oil prevents inflammatory reactions leading to plaque build-up on artery walls and circulatory disorders.

Polyunsaturated fatty acid ω-3 lowers blood cholesterol, which reduces the likelihood of blood clots in the heart, lungs, brain, lowers high blood pressure, reduces the risk of heart attacks and microinfarctions, arrhythmias, diseases associated with heart valves, heart disorders. In diabetes mellitus, ω-3 enhances the action of insulin and protects the body from the development of diabetes. By promoting fat burning, ω-3 and ω-6 are indispensable in the fight against obesity [9].

Due to the presence of a large amount of nutrients, fresh flaxseed oil is very nutritious and, when stored in a cold, closed form, retains its nutritional properties for several months.

In the food industry, unrefined flaxseed oil used, since refined oil used mainly in the production of paints and varnishes. Today, on the territory of the Republic of Kazakhstan, it produces only two types of unrefined flaxseed

oil, however, there is a possibility of the appearance of new industries in subsequent years, since the demand of the population for this product is growing every year.

Taking into account all the advantages of flaxseed oil it becomes clear that replacing animal fats with flaxseed oil will not at all worsen its properties and quality, but will only improve.

Materials and Research Methods

Two types of cold-pressed unrefined flaxseed oil of the «Lyubimoye» and «H.O.P» brands were taken as the object of research.

The organoleptic and physicochemical characteristics of flaxseed oil were determined according to ST RK 2645-2015 «Edible flaxseed oil. Technical conditions». Studies of fatty acid composition were determined using gas-liquid chromatography (GLC) in accordance with GOST 30418-96 «Vegetable oils. Method for determination of fatty acid composition». Determination of the vitamin composition of the studied oils was carried out in accordance with GOST 30417-96 and GOST 7047-55.

Results and their Discussion

Unrefined flaxseed oil, vegetable and animal oils are valued more than refined ones because of their composition and properties. Research has been carried out on the organoleptic and physicochemical parameters of flaxseed oil, which are presented in Table 1.

Table 1 - Qualitative indicators of unrefined flaxseed oil

Indicator name	Indicator value	
	for deodorized unrefined flaxseed oil	
	«Lyubimoye»	«H.O.P»
Organoleptic characteristics		
Colour	Greenish color with a golden tint	
Transparency	Transparent without sediment	
Smell and taste	The smell and taste are mild, characteristic of flaxseed oil, without foreign smell and taste	
Physical and chemical indicators		
Iodine value, g I2/100	170	172
Color number, mg of iodine	38	37
Peroxide number, mmol O2 / kg	6,2	6,0
Acid number, mg KOH / g	2,16	2,64
Mass fraction of non-fatty impurities (sediment by weight),%	0,03	0,04
Mass fraction of phosphorus-containing substances, mg / kg - in terms of stearooleolecithin,%, - in terms of P_2O_5	0,5 0,05 -	0,4 0,06 -
Mass fraction of moisture and volatile substances,%	0,1	0,1
Mass fraction of ash,%	0,1	0,1
Flash point of extraction oil, ° C	254	260
Refractive index at 20 ° C	1,481	1,481
Saponification number, mg KOH / g	170	160
Mass fraction of unsaponifiables,%	0,05	0,04

As can be seen from the data obtained, studies of the organoleptic and physicochemical composition of flaxseed oil are almost identical in their characteristics. Table 1 indicates that both samples of flaxseed oil have a greenish color with a golden hue, transparent without sediment, with a mild smell and taste characteristic of flaxseed oil without foreign smell and taste, which meets the requirements of ST RK 2645-2015.

The indices of physical and chemical properties of «Lyubimoe» flaxseed oil compared to «H.O.P» flaxseed oil showed a slightly better result, but both samples fit into the norms of normative and technical documentation (NTD). The iodine number in the oils was 170 and 172 g J2 / 100, respectively. While the peroxide number was at the level of 6,2 mmol O2 / kg in oil of the «Lyubimoe» brand and 6,0 mmol of O2 / kg in oil «H.O.P». The mineral content of the oils represented by the mass frac-

tion of ash, the ash content in the two oil samples are identical and equal to 0,1%. Mass fraction of phosphorus-containing substances in terms of stearooleolecithin in the oil «Lyubimoe» is more by 0,01% and is equal to 0,06%.

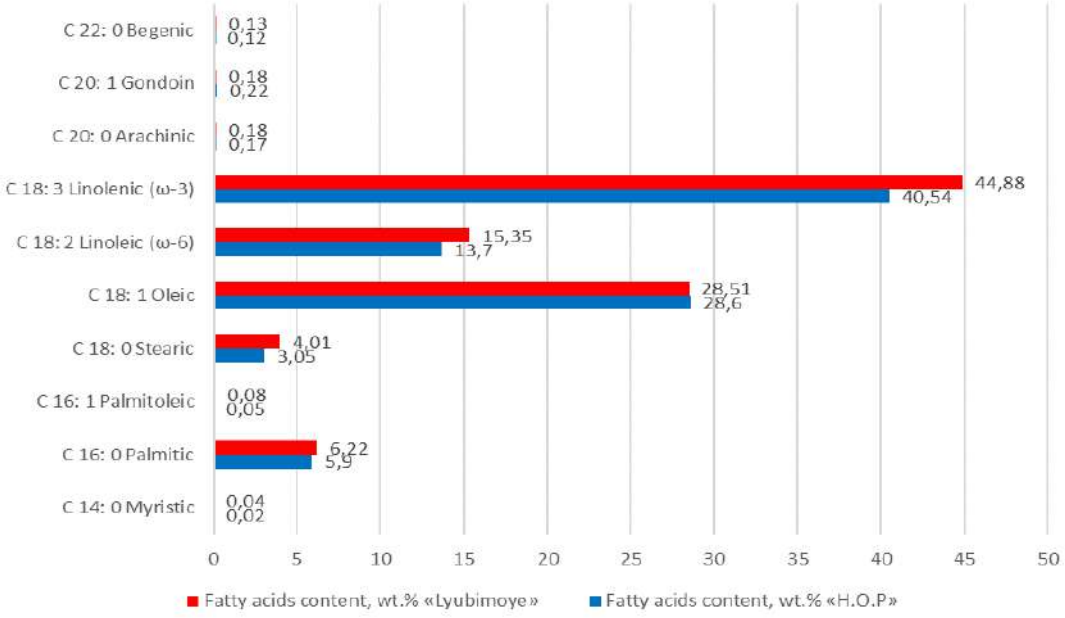
Studies have found that both samples of unrefined flaxseed oil in terms of the totality of physical and chemical indicators correspond to the second grade of unrefined edible flaxseed oil according to the requirements of ST RK 2645-2015 and are allowed to be used as raw materials for the production of vegetable-butter spread.

The fatty acid composition of fats and vegetable oils is the most important characteristic of their nutritional value. However, there is still no single criterion for determining the optimal fatty acid composition, and there are some objective reasons for this situation.

The fact is that in recent years, vegetable oils have been considered not only as a common (everyday) food product, but also as functional nutrition; they have acquired the status of an irreplaceable nutritional factor with therapeutic and prophylactic properties. Consequently, the need for certain higher fatty acids (HFA) is individualized and is determined by many factors - age, lifestyle, dietary habits and, of course, the state of human health, hence the difficulty of determining a certain generalized criterion of fatty acid composition.

The results of gas chromatographic analysis of the fatty acid composition of the studied oils are shown in Figure 1.

Picture 1 - Fatty acid composition of unrefined flaxseed oil



The ratio of linoleic and linolenic acids in the studied oils correlates with data from literature sources. Based on the indicators of the fatty acid composition of oils, which are patently suitable as bases for the production of spreads for the content of linoleic and linolenic acids, the highest indicators were found in a sample of unrefined flaxseed oil of the «Lyubimoe» brand, which amounted to 15.35% linoleic and 44.8% linolenic acids. While in the sample «H.O.P» the content of these acids was 13.7% and 40.54%. Hence, you can see that the ratio of linoleic and linolenic acids in oils is 1: 3. The content of oleic acid in both samples is practically the same, with a slight prevalence in oil «H.O.P».

The analysis of the fatty acid composition of all the studied samples of flaxseed oil showed that both types of the studied unrefined flaxseed oil are suitable as a basis for preparing a spread, due to the increased content of linoleic and linolenic acids in their composition.

Conclusions

Based on the obtained results of the study of unrefined flaxseed oil, it can be concluded that both oil samples are suitable for use as a basis for the production of functional spreads,

due to their rich physicochemical and fatty acid compositions.

However, it should be noted that in unrefined flaxseed oil there is an imbalance towards ω-3 and is 1:3. While for functional nutrition, a person needs to consume 10-5:1. To achieve such a proportion, it is necessary to add oil with a high content of ω-6, in this regard, rapeseed oil is the most balanced in terms of fatty acid composition. Subsequently, the employees of Astana branch of Kazakh Research Institute of Processing and Food Industry are planning to conduct research on the blending of refined rapeseed and unrefined flaxseed oil to achieve the functional value of the content of linoleic and lenolenic acids.

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ҚҰРАМЫНДА ЛИКОПЕН БАР ҚҰРҒАҚ ҰНТАҚ-БИОЛОГИЯЛЫҚ БЕЛСЕНДІ ҚОСПА АЛУ МАҚСАТЫНДА ҚЫЗАНАҚТЫҢ АУДАНДАСТЫРЫЛҒАН СҰРЫПТАРЫН ЗЕРТТЕУ

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Көкөніс өнімдерін қайта өңдеу (қызанақ сығу) негізінде биологиялық құнды өнімді (құрамында құрғақ ұнтақ бар ликопин) алу технологиясын әзірлеу республиканың ішкі нарығының ғылымы мен жаңа технологияларының табысты дамуына қолайлы ықпал ететіні сөзсіз, ал әзірленген технологияны енгізу және жаңа өнім (құрамында құрғақ ұнтақ бар ликопин) шығару үлкен әлеуметтік және экономикалық мәнге ие, өйткені табиғи және табиғи жағдайлармен қауіпсіз және қауіпсіз - өнімдер адамдардың денсаулығына, еңбек өнімділігіне пайдалы әсер етеді және мемлекет экономикасын дамыту мен арттырудың тиімді негізін қамтамасыз етеді. Бұл өнімдерді адамдардың күнделікті тұтыну рационында қолдану өте маңызды. Қазақстанда жеміс-көкөніс өнімдерін, оның ішінде қызанақты терең өңдеудің тиімді технологиясы жолға қойылмаған, ал қолда бар технологиялар жетілдірілмеген, демек, пайдалы көрсеткіштер мен осындай өнімдерге сұраныс төмендеуде.