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Fatty Acid Profile of Functional Emulsion-Based Food Products Containing Conventional and Unconventional Ingredients

Almas Mukhametov[1]*, Laura Mamayeva[1], Moldir Yerbulekova[1], Gulsim Aitkhozhayeva[2]

[1]Department of Technology and Safety of Food Products, Kazakh National Agrarian Research University, 8 Abai Avenue, Almaty, Kazakhstan; [2]Department of Land Resources and Cadastre, Kazakh National Agrarian Research University, Almaty, Kazakhstan

***Corresponding Author:** Almas Mukhametov, Department of Technology and Safety of Food Products, Kazakh National Agrarian Research University, 8 Abai Avenue, Almaty A05D5F7, Kazakhstan. Email: almmukhametov@rambler.ru

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PAPER

Abstract

The creation of new emulsion-based food products has great potential for the food industry at the present stage of its development. The purpose of the paper is to explore the physical and chemical characteristics (content of fatty acids and tocopherols) of nine mixtures (blends) of conventional and unconventional vegetable oils with regard to the changes in the peroxide values of the oil blends stored under different temperatures for different periods. The study was conducted in 2020 in Almaty (Kazakhstan). Nine vegetable oil blends were prepared by mixing conventional and unconventional ingredients. Each of the resulting blends was tested in 30 replicates for the content of fatty acids (oleic, linoleic, and linolenic acids) and tocopherols. The blends were stored at 10°C and 20°C. Samples were taken to determine peroxide values. The results were compared to the control (refined sunflower oil). In all nine blends, the optimal ratio of the evaluated fatty acids and the optimal concentration of tocopherols were confirmed. After 6 months of storage, the peroxide values of blend No. 1 stored at 10°C and 20°C were 3 and 6, respectively. Blend No. 2 stored for the same period at the same temperatures demonstrated the respective peroxide values of 2.5 and 4.5. For blend No. 3, the respective values obtained were 2.5 and 5.5, and for blend No. 4, the respective values were 3.0 and 6.5. The most drastic changes were observed in blend No. 5, with respective peroxide values of 2.5 and 7.2. The respective peroxide values of blend No. 6 were 3.7 and 5.5, blend No. 7, 3.5 and 7.0, blend No. 8, 4.0 and 6.5, and blend No. 9, .5 and 5.5. All in all, the peroxide values of the nine tested blends were significantly lower than those of the control ($p \leq 0.05–0.01$). The proposed nine blends can be used as food additives exhibiting biological activities. After 6 months of storage, the minimal changes in the peroxide values were observed in blend Nos. 2 and 3, while the maximum changes were reported for blend Nos. 5, 7, and 8. In the future, an investigation of the therapeutic effects of the obtained blends should be undertaken, with a focus on possible adverse heating-induced changes in some components (flaxseed oil).

Keywords: blends; food additives; peroxide value; storage temperature conditions

Introduction

Functional foods make up a significant part of modern diet. These data are supported by the global trend toward consumption of functional foods. This trend is predominantly observed in the developed countries. For example, in the United States, the increase in the consumption of special-purpose fat products exceeds the overall food production growth. The use of functional food products is primarily promoted by the studies concerning the structure of modern diet. People want to benefit from the declared properties of functional foods, which include stabilization of metabolic processes in the body and maintaining the normal functions of the immune, nervous, and endocrine systems (Truzzi *et al.*, 2021). Among modern functional fatty products, a focus of the food industry is on the development of mayonnaise, various fat pastes, and creams (Khudzaifi *et al.*, 2019). Inevitably, manufacturers introduce into their products some additives that are typical for certain regions of the planet, taking into account the preferences of the local population. Plant and animal products are often combined. A variety of sources are available due to various flavors rather than spices, as the latter are added only in small quantities. Fat and water-soluble vitamins and dietary fibers contribute to the taste and texture of the finished fatty products (Marchetti *et al.*, 2019). The mixtures obtained in this experiment can be used as an alternative to sunflower or olive oil, which are widely used globally. One important and urgent task to be undertaken in the nearest future is to reduce the calorie content of functional food products that are being developed. Of note, the average dietary intake of fat is 35% of total calories. Therefore, the fat content of food is often reduced so that it falls within the range of 5–25%. This determines the relevance of developing new formulations of functional food products containing fat emulsions. The ultimate goal of developing functional emulsion-based food products is to make them appropriate for consumption by people of different age groups.

In order to work properly, the human body needs fatty acids (in particular, linoleic, arachidonic, and linolenic acids). In most cases, this need is met in the diet by including various vegetable oils made from conventional forage crops (sunflower, corn, soybeans, and olive; Cerceau *et al.*, 2020). However, in addition to the conventional vegetable oils, oils are also extracted from unconventional crops, which have not been widely used in the food industry. This refers to the oils obtained from the processing of cereals, fruits, seeds, and nuts. Wheat germ oil and oils extracted from other cereals are of special importance. These unconventional oils are rich in linolenic, hexaenoic, pentaenoic, and other fatty acids, which are vital for the human body (Vargas Jentzsch *et al.*, 2018). The optimal ratio of ω-6 and ω-3 fatty acids that constitutes the oil is 10:1. The role of fatty acids (e.g., linoleic and linolenic acids) is crucial, since they form important components of cell membranes, participate in hormone synthesis, regulate cellular metabolic processes, maintain normal blood pressure, remove excess cholesterol from the body, and improve the elasticity of blood vessels. Since these acids are not produced in the human body (Bulat and Volkov, 2016), they are considered essential (Juliani *et al.*, 2006). As for arachidonic acid, its synthesis involves linoleic acid and vitamin B_6. An insufficient intake of these acids from food sources triggers cardiovascular diseases and activates pathological processes in cell membranes. Linoleic acid and its derivatives inhibit platelet aggregation, reduce the levels of cholesterol, blood pressure, and the amount of low-density lipoproteins that are harmful to the body. Interestingly, the smallest quantities of linolenic acid are found in the body of infants and senior people.

Thus, fatty acids and phospholipids are one of the most important compounds required by the human body for forming cell membranes and maintaining the normal functioning of the immune system. In this regard, it is very important to look for new, unconventional ingredients that may be incorporated into emulsion-based food products (Safonov, 2022). Unfortunately, there are very few papers covering the topic, and this fact determines the relevance of this study. Most of the available papers have considered generally the effect produced by a single unconventional ingredient. This paper describes nine different blends containing unconventional ingredients. The authors assumed that the physical and chemical properties of the experimental blends would be at least non-inferior to those of conventional emulsion-based food products (with shelf life being equivalent or longer).

The purpose of the study was to explore the physical and chemical properties of new blends of refined vegetable oils that could be used in the production of functional emulsion-based food products, subject to the shelf life of obtained blends. The objectives of the study include the following: (a) to prepare the blends of refined vegetable oils for producing functional emulsion-based food products; (b) to explore their physical and chemical properties (fatty acid profile and tocopherols); and (c) to determine the shelf life of the obtained blends.

Materials and Methods

Methods

The study was conducted in 2020 in Almaty (Kazakhstan). The formulations presented in this paper used both vegetable oils obtained from conventional sources (sunflower, soybeans, and corn; refined oils were used) and unconventional vegetable oils. Unconventional oils were extracted by oil seed pressing and purified by separation of plant residues. Refined vegetable oils derived from conventional sources were mixed with different amounts of unconventional oils. Thus, the mixtures were obtained that could be suitable for the preparation of oil-in-water emulsions.

The blends intended for fat emulsions were prepared using the ingredients shown in Table 1.

The content of fatty acids in the blends and oils under investigation was determined according to the GOsudarstvennyy STandart (GOST) 30418-96 (*Vegetable*

Table 1. Composition of the vegetable oil blends under investigation.

Blend No.	Oils used for blend recipe	Blend ratio of oils	Amount of oils as related to the total volume of fat emulsion
1	Sunflower, soybean, and flaxseed oils	20:15:10	45
2	Sunflower and pumpkin seeds oils	35:15	50
3	Sunflower, corn, and sea buckthorn oils	30:15:10	55
4	Sunflower, wheat germ, barley, and sea buckthorn oils	5:10:5:10	30
5	Sunflower, millet seed, walnut, and apricot kernel oils	10:15:5:5	35
6	Sunflower, rapeseed, tomato seed, oat, and plum kernel oils	8:8:8:8:8	40
7	Sunflower, sesame, lupine, rye, and flaxseed oil	10:5:5:5:5	45
8	Sunflower, mustard, cherry, buckwheat, and rice oils	10:10:10:10:10	50
9	Olive, wheat germ, barley germ, rosehip, and chestnut oils	15:15:15:5:5	55

oils. Method for determination of fatty acid content). For this, the capillary column gas chromatography method was applied. The researchers used polar columns Zebron ZB-50 with the column length of 30 m and internal diameter of 0.32 mm. The peaks were identified by comparing the chromatograms obtained for the analyzed blends and a mixture of fatty acid methyl esters as standards. Graphs of the peaks observed were plotted separately for saturated and unsaturated fatty acids. To build all straight lines, the investigators proceeded from the fact that 2–3 points were required for saturated fatty acids and only 1–2 points for unsaturated ones. The volume of each sample was 1 mm^3 of hexane solution containing fatty acid methyl esters.

Study design

The study consisted of two parts. In the first part, the researchers assessed the fatty acid profiles of vegetable oils (i.e., measured the levels of oleic, linoleic, and linolenic acids) and quantified the content of tocopherol. The second part of the study highlighted the changes in the stability of the tested oil blends observed at different time points of the storage period (time interval from the beginning of the experiment to 6 months of the experiment). The peroxide value was chosen as the tested parameter. The storage temperatures were 10°C and 20°C. These temperature regimes were convenient for comparing the stability of the experimental blends at different time points of the storage period. The study followed international standards applicable to scientific research. It intended to develop effective blends of vegetable oils using conventional and nonconventional ingredients for their subsequent testing and use asemulsion-based food products.

Statistical analysis

In order to analyze statistical differences, the Statistica program (version 10) was used. Arithmetic mean values were calculated for each of the tested parameters (the content of fatty acids and other components). For each comparison, the sample size of 30 was used. Differences were identified using Student's *t*-test. The level of significance was set at $p \leq 0.05$.

Results

The studied blends were found to contain different amounts of fatty acids. In blend No. 1, soybean and flaxseed oils were 0.5 times inferior to sunflower oil in terms of oleic acid content ($p \leq 0.05$), and flaxseed oil was twice inferior to soybean and sunflower oils ($p \leq 0.01$), the content of linolenic acid in flaxseed oil was seven times higher than in soybean oil ($p \leq 0.001$) and more than 100 times higher than in sunflower oil ($p \leq 0.0001$). Soybean oil had a slightly higher content of tocopherols as compared to the other two oils (Table 2).

In blend No. 2, the content of oleic acid in sunflower oil was 0.5 times higher than in pumpkin seed oil ($p \leq 0.05$), with no significant differences in the content of linoleic acid ($p \geq 0.05$). Pumpkin seed oil had 16 times higher content of linolenic acid ($p \leq 0.001$). There were more tocopherols in sunflower oil ($p \leq 0.05$).

In blend No. 3, sea buckthorn oil had the highest content of oleic acid. The levels of oleic acid determined in sea buckthorn oil were 1.5–2.0 times higher than in sunflower and corn oils ($p \leq 0.05$). Corn and sunflower oils had the highest content of linoleic acid as compared to the other oils used in the blend ($p \leq 0.05$). Corn oil had the highest content of linolenic acid ($p \leq 0.01$). The content of tocopherols in sunflower oil was twice lower than in sea buckthorn and corn oils ($p \leq 0.05$).

In blend No. 4, oleic acid was found in abundance in sea buckthorn oil, with twice less of it found in sunflower oil ($p \leq 0.05$), and four times less of it found in wheat germ and barley oils ($p \leq 0.01$). In terms of the content of linoleic acid, wheat germ and barley oils were not inferior

Table 2. Content of fatty acids and tocopherols in oils used for the blends under investigation.

Blend no.	Oils used for the blend recipe	Oleic acid (%)	Linoleic acid (%)	Linolenic acid (%)	Tocopherols (mg)
1	Soybean oil	25	52	8	160
	Flaxseed oil	28	20	57	113
	Sunflower oil	36	56	0.5	116
2	Sunflower oil	36	56	0.5	116
	Pumpkin seed oil	26	55	8	86
3	Sea buckthorn oil	63	38	0.1	250
	Sunflower oil	36	56	0.5	116
	Corn oil	48	56	0.8	247
4	Sea buckthorn oil	63	38	0.1	250
	Sunflower oil	36	56	0.5	116
	Wheat germ oil	14	59	4.5	140
	Barley oil	16	56	5.6	100
5	Sunflower oil	36	55	0.5	116
	Millet seed oil	27	67	10	96
	Walnut oil	35	83	15	52
	Apricot kernel oil	79	32	1.5	78
6	Sunflower oil	36	55	0.5	116
	Rapeseed oil	44	42	11	55
	Tomato oil	30	62	2.5	127
	Oat oil	41	43	2	75
	Plum kernel oil	72	25	0.5	130
7	Sunflower oil	36	55	0.5	116
	Sesame oil	48	55	3	144
	Lupine oil	55	23	8	2
	Rye oil	17	68	12	91
	Flaxseed oil	28	20	57	113
8	Sunflower oil	36	55	0.5	116
	Mustard oil	31	24	18	110
	Cherry oil	50	42	10	10
	Buckwheat oil	40	39	4	50
	Rice oil	43	53	4	110
9	Olive oil	80	22	2.5	90
	Wheat germ oil	13	65	5.5	480
	Chestnut oil	72	30	2	78
	Rosehip oil	55	30	2	260
	Barley oil	16	58	7	98

to sunflower oil ($p \geq 0.05$), with the levels of linoleic acid in wheat germ and barley oils being twice higher than those in sea buckthorn oil ($p \leq 0.05$). Wheat and barley oils contained 8–10 times more linolenic acid than found in sunflower oil ($p \leq 0.01$) and 40–50 times more linolenic acid than in sea buckthorn oil ($p \leq 0.0001$). Sea buckthorn oil contained twice more tocopherols than found in the rest of oils making up the blend ($p \leq 0.05$).

In blend No. 5, apricot oil contained twice more oleic acid than in the other oils ($p \leq 0.05$). The content of linoleic acid in walnut oil was 83%. The levels of linoleic acid in walnut oil exceeded by 2.5 times that determined in apricot oil ($p \leq 0.05$) and by 1.5 times than that determined in millet seed and sunflower oils ($p \leq 0.05$). Maximum content of linolenic acid was observed in walnut oil, followed by millet seed oil ($p \leq 0.05$), but 7–20 times less linolenic acid was found in the rest of oils ($p \leq 0.001$). All oils exhibited lower content of tocopherols as compared to sunflower oil ($p \leq 0.05$).

In blend No. 6, oleic acid accounted for 72% of the fatty acid composition of plum oil. There was 1.5–2.0 times less oleic acid in rest of the oils added to the blend

($p \leq 0.05$). Linoleic acid was found in abundance in tomato oil, thrice less abundant in plum oil ($p \leq 0.01$), and 1.5 times less abundant in the rest of the analyzed oils. The maximum content of linolenic acid was reported in rapeseed oil (11%), with its content being 5–20 times lower in the other oils making up the blend ($p \leq 0.01$). The content of tocopherols in plum and tomato oils was slightly higher than in sunflower oil ($p \leq 0.05$). Oat and rapeseed oils contained twice less tocopherols than found in plum and tomato oils ($p \leq 0.05$).

In blend No. 7, the maximum amount of oleic acid was observed in lupine oil, 0.5–1.5 times less oleic acid was found in sesame, sunflower, and flaxseed oils ($p \leq 0.05$), and the minimum amount of oleic acid was observed in rye oil ($p \leq 0.01$). The content of linoleic acid was maximum in rye, sesame, and sunflower oils, with twice less of it detected in lupine and flaxseed oils ($p \leq 0.05$). Flaxseed oil was richest in linolenic acid. The content of linolenic acid was 5 times lower in rye oil ($p \leq 0.01$), 7 times lower in lupine oil (≤ 0.01), and 20 times lower in sesame oil ($p \leq 0.001$). The minimum content of linolenic acid was reported for sunflower oil ($p \leq 0.0001$) in comparison to its content in flaxseed oil. Tocopherols were found in abundance in sesame oil, with the minimum levels observed in lupine oil ($p \leq 0.00001$).

In blend No. 8, the highest content of oleic acid was the characteristic for cherry oil, while the other oils contained 0.3–0.5 times less oleic acid ($p \leq 0.05$). Linoleic acid was in abundance in sunflower and rice oils. The other oils making up the blend were 0.5 times (buckwheat and cherry oils) and twice (mustard oil) inferior to sunflower and rice oils in terms of the content of linoleic acid ($p \leq 0.05$). Levels of linolenic acid were maximum in mustard oil, twice lower in cherry oil ($p \leq 0.05$), and four times lower in buckwheat and rice oils ($p \leq 0.01$). The minimum content of linolenic acid was observed in sunflower oil ($p \leq 0.001$). The content of tocopherols was maximum in rice, sunflower, and mustard oils, twice lower in buckwheat oil ($p \leq 0.05$), and 10 times lower in cherry oil ($p \leq 0.01$).

In blend No. 9, the highest content of oleic acid was reported for olive oil. Slightly lower level of oleic acid was revealed in chestnut oil ($p \leq 0.05$), 1.5 times less oleic acid was detected in rosehip oil ($p \leq 0.05$), and seven times less in barley and wheat germ oils ($p \leq 0.01$). The maximum amount of linoleic acid was found in wheat germ and barley oils and the minimum amount was found in chestnut, rosehip, and olive oils ($p \leq 0.05$). Maximum linolenic acid was found in wheat germ and barley oils, with the other oils being twice inferior to wheat germ and barley oils regarding content of linolenic acid ($p \leq 0.05$). The maximum content of tocopherols was documented for wheat germ oil, twice less tocopherols were quantified in rosehip oil ($p \leq 0.05$), and four times less tocopherols were quantified in the rest of oils making up the blend ($p \leq 0.01$).

The qualitative parameters of oil mixtures are shown in Figures 1–5. In each of these figures, the curves corresponding to numbers 3 and 4 reflect the changes observed in the control sample (refined sunflower oil) stored at 20°C and 10°C. The analysis demonstrated that the peroxide values of all nine oil blends prepared by the researches increased insignificantly even after 3 months of storage. Following 6 months of storage, the maximum peroxide value obtained was 7.2 mmol of active oxygen (½ O) per kg of oil blend. This variable was identified for blend No. 5.

The results of statistical analysis of changes in peroxide values are presented in Table 3.

After 6 months of storage, the peroxide values of blend No. 1 stored at 10°C and 20°C were 3 and 6, respectively (Figure 1A). Blend No. 2 stored for the same period under the same temperature conditions demonstrated the peroxide values of 2.5 and 4.5, respectively (Figure 1B). For blend No. 3, the respective values obtained were 2.5 and 5.5 (Figure 2A), for blend No. 4, the respective values were 3.0 and 6.5 (Figure 2B). The changes were more drastic in blend No. 5, with respective peroxide values of 2.5 and 7.2 (Figure 3A). The respective peroxide values

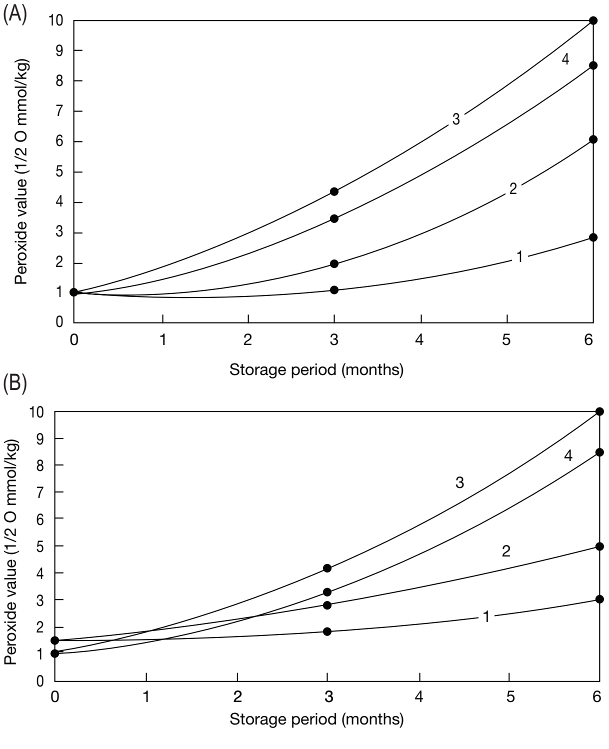

Figure 1. Peroxide values of (A) blend No. 1, and (B) blend No. 2. *Note:* Curves 3 and 4 reflect the values obtained for the control sample. Curves 1 and 2 correspond to the experimental blends stored at 10°C and 20°C, respectively.

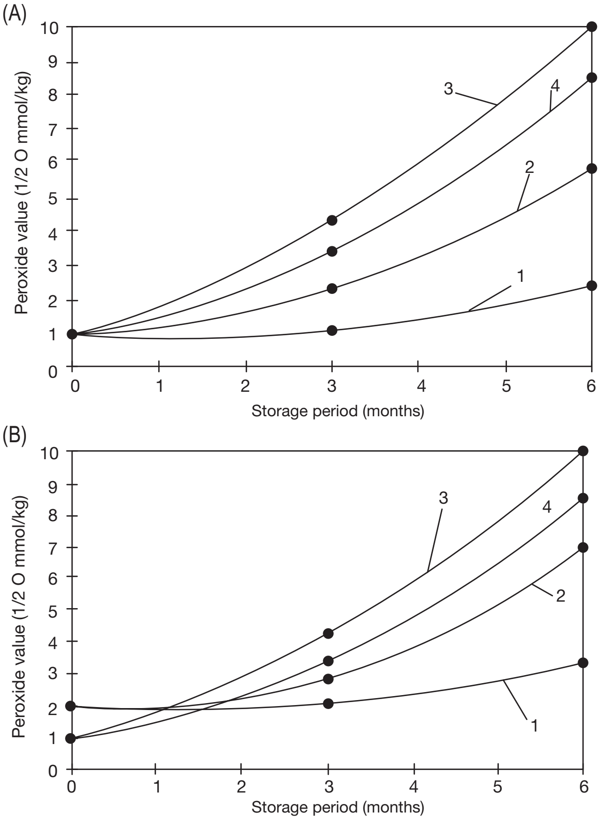

Figure 2. Peroxide values of (A) blend No. 3, and (B) blend No. 4. *Note:* Curves 3 and 4 reflect the values obtained for the control sample. Curves 1 and 2 correspond to the experimental blends stored at 10°C and 20°C, respectively.

of blend No. 6 were 3.7 and 5.5 (Figure 3B), for blend No. 7 3.5 and 7.0 (Figure 4A), for blend No. 8 4.0 and 6.5 (Figure 4B), and for blend No. 9 4.5 and 5.5 (Figure 5). In all cases, the peroxide values of analyzed blends were significantly lower than the peroxide values of control ($p \leq 0.05$).

Discussion

The results presented in this article indicate that the proposed blends of different vegetable oils have a much longer shelf life as compared to the control sample of sunflower oil. This is confirmed by the fact that peroxide values of the prepared oil blends kept under different storage conditions increased by 0.5–2.0 times slower than the peroxide value of the control sample. A range of theoretical and practical studies established that blending of conventional and unconventional vegetable oils not only increases their shelf life but also provides the optimal balance of the three main fatty acids required for functioning of the body: oleic, linoleic, and linolenic acids (Samburova *et al.*, 2022). Kinetic dependencies signaled that the proposed blends have a longer shelf life and are less susceptible to oxidative processes than the control sample.

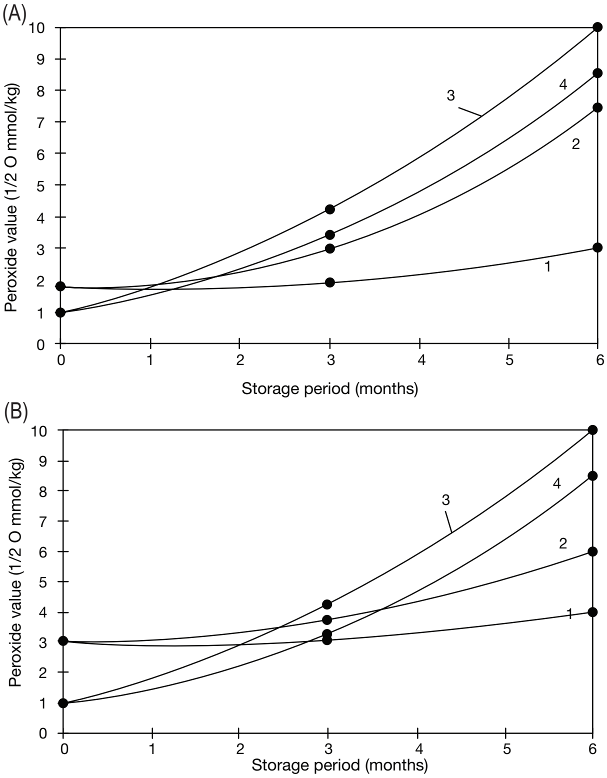

Figure 3. Peroxide values of (A) blend No. 5, and (B) blend No. 6. *Note:* Curves 3 and 4 reflect the values obtained for the control sample. Curves 1 and 2 correspond to the experimental blends stored at 10°C and 20°C, respectively.

Vegetable oils have been studied quite well. They are characterized by the basic ratio of fatty acids (Papotti *et al.*, 2015). However, most nutritionists favor the use olive and flaxseed oils. Corn, sunflower, and cottonseed oils are claimed to have benefits if used from time to time (Marchetti *et al.*, 2019; Popescu *et al.*, 2015). Ingredients that are typically present in oil mixtures (blends) are sunflower, soy, and flax (Vigli *et al.*, 2003). All of these were used in the proposed nine blends. It must be remembered that some reports support the use of flaxseed oil blends in a cold form, since flaxseed oil gives off a rather specific smell when exposed to heat (Ventsova and Safonov, 2021). Hence, the content of flaxseed oil in a blend should not exceed 5% (Marchetti *et al.*, 2019). The blends offered by different studies meet the above requirement and are recommended for consumption in a cold form. Some authors have observed that flaxseed oil is instable (Raveau *et al.*, 2020). They claim that additional protective measures must be taken to compensate for the rancidity of flaxseed oil. Nevertheless, stability of the oil blends used in this experiment has been demonstrated.

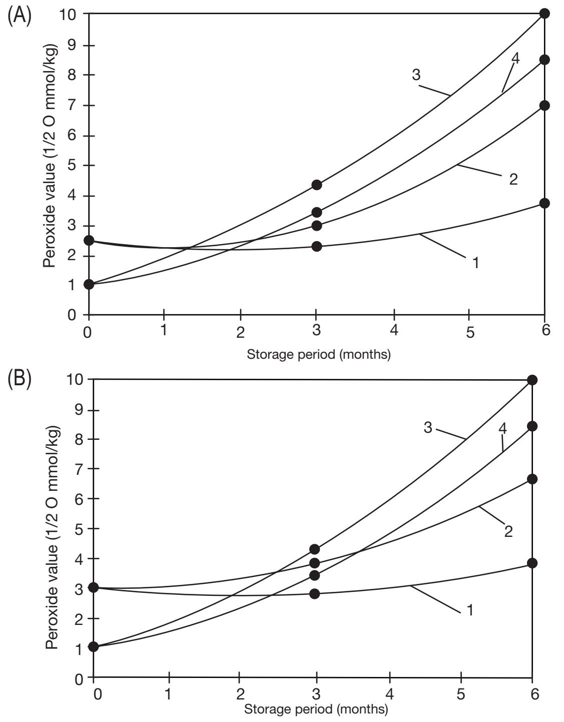

Figure 4. Peroxide values of (A) blend No. 7, and (B) blend No. 8. *Note:* Curves 3 and 4 reflect the values obtained for the control sample. Curves 1 and 2 correspond to the experimental blends stored at 10°C and 20°C, respectively.

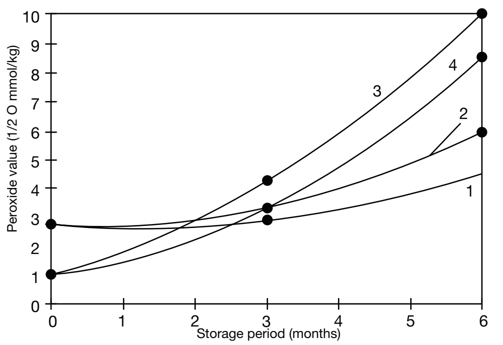

Figure 5. Peroxide value of blend No. 9. *Note:* Curves 3 and 4 reflect the values obtained for the control sample. Curves 1 and 2 correspond to the experimental blend stored at 10°C and 20°C, respectively.

In addition, oils extracted from unconventional sources, such as pumpkin, watermelon, amaranth, and wheat, are being used more extensively. These types of oils have not only high nutritional value but also an apparent therapeutic effect (Orsavova *et al.*, 2015). Moreover, there is a gradual increase in the production volumes of camelina and hemp oils, both rich in linolenic acid.

The blends described in the article organically combine three essential fatty acids. Quite often, blends are made

Table 3. Changes in peroxide values calculated for the nine blends and control sample stored for different periods under different temperatures.

Blend no.	At the beginning of the experiment	Control		Experiment		Significance of differences for 3-month storage	Control		Experiment		Significance of differences for 6-month storage
		After 3 months of storage at 10°C	After 3 months of storage at 20°C	After 3 months of storage at 10°C	After 3 months of storage at 20°C		After 6 months of storage at 10°C	After 6 months of storage at 20°C	After 6 months of storage at 10°C	After 6 months of storage at 20°C	
1	1	3	4	1.1	1.6	0.05	8	10	2	5.8	0.05
2	1.5	3	4	1.2	2	0.05	8	10	2.5	4.5	0.05
3	1	3	4	1.1	2.2	0.05	8	10	2.5	5.8	0.05
4	2	3	4	2.2	2.8	0.05	8	10	3	6.9	0.05
5	2	3	4	2.2	2.7	0.05	8	10	3	7	0.05
6	3	3	4	3.2	3.5	0.05	8	10	3.7	5.5	0.05
7	2.5	3	4	2.7	2.9	0.05	8	10	3.5	7	0.05
8	3	3	4	3.1	3.7	0.05	8	10	3.5	6.5	0.05
9	3	3	4	3.1	3.2	0.05	8	10	3.9	5.9	0.05

from sunflower and camelina oils. The grassy taste associated with camelina oil becomes milder if its content in the oil blend is limited to 15–30%.

Wheat germ oil is often used in blends because of having a high content of tocopherols (Rueda *et al*., 2014). To clarify, the content of tocopherols in different components of the blends is one of the aspects considered in this paper. It should be mentioned that wheat germ oil is added to blends only in small amounts ranging from 1% to 5%, as it is quite expensive. An effective marketing approach is labeling of therapeutic effects of wheat germ oil used as a blend component. Some blends contain pumpkin seed oil and other oils of unconventional origin (such as sea buckthorn, apricot, and hazelnut oils; Vigli *et al*., 2003). Most of the mentioned unconventional vegetable oils presented in this paper are components of the analyzed blends.

Limitations of this study are associated with the small-scale production of the proposed unconventional oils. This means that production of blends based on these types of oils cannot be started and boosted immediately. Further research is required focusing mainly on the development of methods of production increase and investigation of therapeutic effects of unconventional vegetable oils. At this stage, the proposed blends can be used as biologically active food additives.

Conclusions

Following an analysis of the obtained graphical models of dependencies, the researchers revealed that all nine oil blends demonstrated a slight increase in peroxide value after being stored for 3 months. Following 6 months of storage, the maximum peroxide value was confirmed for blend No. 5 (7.2 mmol of active oxygen/kg of oil blend). The obtained results established that the quality of experimental blends improved as compared to sunflower oil. These findings justify the use of these blends as a source of fats in the production of emulsion-based food products.

Owing to theoretical and experimental studies, scientific basis has been provided for obtaining the fatty phase of emulsion-based food products by using blends having optimal amounts of conventional and unconventional vegetable oils. This approach allows enriching the fatty acid composition of emulsion-based food products.

Appropriate criteria have been formulated to evaluate the effects of fatty acid profile on the biological and nutritional values of emulsion-based food products. Besides, respective dependences have been revealed that are valuable from the practical point of view.

Optimal storage conditions and shelf life were determined based on the kinetics of oxidative processes occurring in the developed blends of vegetable oils and emulsion-based food products.

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Conflict of Interest

The authors declared no potential conflict of interest with respect to the research, authorship, and/or publication of this article.

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Data Availability

Data will be available on request.

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