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Evaluation of the Properties of a Sunflower–Rapeseed Oil Blend

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INTRODUCTION & AIM

Lipid-based products, including those derived from vegetable oils, are widely consumed food items incorporated into the daily diet across all population groups. They serve as important sources of essential nutrients and, when appropriately selected and consumed, contribute significantly to maintaining a balanced and adequate diet. However, their high energy value and often unbalanced fatty acid composition may promote metabolic disorders. Consequently, there is an increasing need to expand the assortment of oil-and-fat products by developing new formulations that align with current scientific advances and contemporary nutritional recommendations.

Most researchers agree that the optimal dietary balance of polyunsaturated fatty acids (PUFAs) for a healthy individual corresponds to an *ω*-6/*ω*-3 ratio of approximately 10:1. For therapeutic or preventive nutritional strategies, a lower ratio – typically between 3:1 and 5:1 – is recommended. Maintaining this balance is essential for regulating hormonal, metabolic, cellular, and other physiological processes. According to calculations by A.P. Levytsky, the mixed diet of an average Ukrainian is characterized by an *ω*-6/*ω*-3 ratio of 43.6:1, which substantially exceeds the acceptable level of *ω*-6 PUFAs intake.

One of the key challenges in developing fat-containing foods aligned with healthy dietary trends is optimizing the fatty acid composition. Blending traditional vegetable oils is a cost-effective and practical approach for designing products with targeted levels and ratios of PUFAs.

Refined deodorized sunflower oil is the most widely consumed edible oil in Ukraine. As a major source of *ω*-6 polyunsaturated fatty acids – with linoleic acid accounting for approximately 50–75% – it contains negligible amounts of *ω*-3 linolenic acid. Its tocopherol profile is dominated by *α*-tocopherol, which represents 90–96% of the total tocopherol content. Refined rapeseed oil is also widely available in Ukraine and produced on an industrial scale. It exhibits a favorable *ω*-3/*ω*-6 fatty acid ratio for blending applications and is characterized by a high proportion of *β*-, *γ*-, and *δ*-tocopherols, which together account for 67.4–73.1% of total tocopherols. Therefore, rapeseed oil is a promising component for blends aimed at enhancing biological value and optimizing the fatty acid composition of the final product. Furthermore, a blend of rapeseed and sunflower oils can be expected to demonstrate improved resistance to autoxidation compared with sunflower oil alone. This improvement is attributable to the increased total content of the more antioxidant-active *β*-, *γ*-, and *δ*-tocopherol fractions in the blend, while still maintaining a sufficiently high level of the most biologically active α-tocopherol.

Our previous research identified that a blend of 52% sunflower oil and 48% rapeseed oil provides a balanced *ω*-6:*ω*-3 ratio of 9.8:1.0. This study aimed to evaluate the physicochemical and sensory properties of this blend.

METHOD

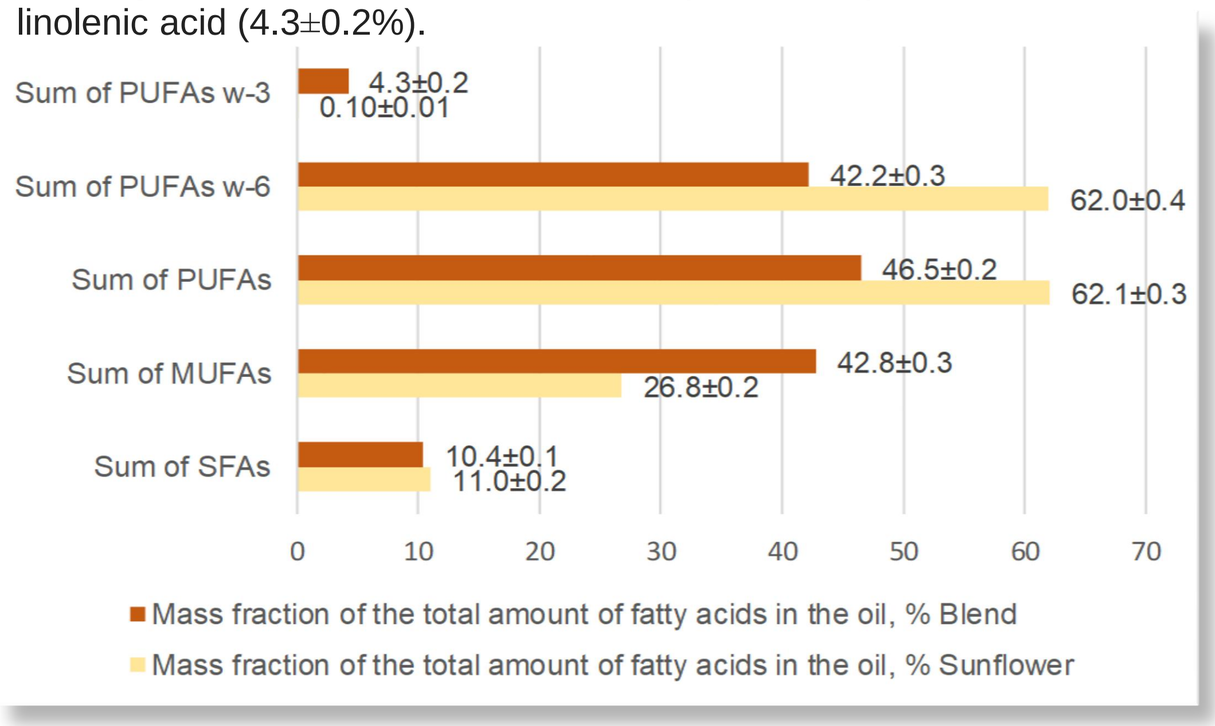
Fatty acid composition was analyzed using gas–liquid chromatography.

To assess the fatty acid balance in oils, several criteria was used that characterizes the content and ratio of saturated (UNFAs), monounsaturated (MUFAs) and polyunsaturated (PUFAs) fatty acids. Total tocopherol and *α*-tocopherol contents were determined via high-performance liquid chromatography. Standard analytical methods were used to assess other physicochemical parameters. Sensory properties were evaluated using quantitative descriptive analysis based on transparency, taste, flavour, and colour.

Statistical analysis was performed using parametric tests, with significance accepted at $p<0.05$.

RESULTS & DISCUSSION

The blend exhibited a favourable fatty acid profile for balanced nutrition, with high monounsaturated oleic acid (42.6±0.3%) and sufficient *ω*-3 linolenic acid (4.3±0.2%).



	MUFAs : SFAs	PUFAs : MUFAs : SFAs	PUFAs *ω*-6 : PUFAs *ω*-3
Sunflower oil	1.00 : 0.41	1.0 : 0.4 : 0.2	620.0 : 1.0
Oil Blend	1.00 : 0.24	1.0 : 0.9 : 0.2	9.8 : 1.0

It demonstrated improved hydrolytic and oxidative stability, which was confirmed by the significantly lower acid and peroxide values after 30 days of storage at (20±1)°C compared to pure sunflower oil by 5.3% and 19.7%, respectively.

Physico-chemical parameters of blended and sunflower oil samples

Indicator	Sunflower oil	Sunflower–Rapeseed Oil Blend
Acid value, mg KOH/g:		
– at the beginning of the storage period;;	0.20±0.01	0.23±0.01
– at the end of the storage period	0.38±0.02	0.36±0.01
Peroxide value, mmol 1/2 O/kg:		
– at the beginning of the storage period;	1.53±0.02	1.72±0.02
– at the end of the storage period	5.74±0.03	4.61±0.03
Average rate of increase in peroxide value during oil storage	0.140±0.005	0.096±0.005

The accumulation rate of primary oxidation products was 1.5 times lower in the blend ($p<0.05$). These findings may be attributed to a higher content of antioxidant-active tocopherol isomers (*β*-, *γ*-, and *δ*-tocopherols) derived from rapeseed oil. Sensory evaluation confirmed the blend's compliance with regulatory quality standards.

CONCLUSION

Evaluation of the properties of a sunflower–rapeseed oil blend demonstrated improved performance compared to the widely used sunflower oil. The developed sunflower–rapeseed oil blend is a promising option for functional fat-containing products aimed at dietary improvement and disease prevention.

FUTURE WORK

Future research is planned to be aligned with practical implementation in production