OPTIMISATION OF FATTY-ACID COMPOSITION OF VEGETABLE OILS

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Abstract: We researched the possible way to optimise vegetable oils in terms of number and ratio of essential fatty acids.
Such oil may be obtained through blending two or more vegetable oil with well-known fatty acids in proportions determined by the theory that has been empirically demonstrated.
Keywords: essential fatty acids, optimal ratio

Oil and fat are ubiquitous in food-stuff and represent one of the most important energy sources for humans. Vegetable and animal fats differ in types of fatty acids; those acid types are classified in saturated and unsaturated fats. Saturated fats are globally used for providing energy; an overrated use of them – namely taking more fat than needed by one's organism – leads to an increased level of low-density cholesterol and lipoprotein cholesterol in bloodstream, and results in cardiovascular diseases.

Amongst monounsaturated fatty acids the most common is oleic acid. Vegetable oils, rich in oileic acid, allow for a reduction of low-density lipoprotein in bloodstream; amongst technological advantages, one has to name a slower oxidation process.

Polyunsaturated acids have a particular significance in human food-stuff. These acids are irreplaceable and essential for they are not synthetized by the organism – they can only be ingested from food.

Polyunsaturated acids are divided into two groups: ω-3 and ω-6. The α-linolenic, eicosapentaenoic, and docosapentaenoic acids belong to the first group; while the linoleic acid, γ-linolenic, and arachidonic acids belong to the second. Polyunsaturated fatty acids are the building block of cell membranes and are used to ensure a steady development and adaptation of human organism in face of 'adverse' events from the environment. The lack of essential fatty acids is lacking stops the organism growth and may lead to serious diseases.

A minimum amount of polyunsaturated fatty acids is needed in food but one has to bear in mind an accurate ratio. With regard to the FAO/WHO recommendations the optimal ratio is ω-6: ω-3, from 5:1 to 10:1 [1]. If those fatty acids are not consumed according to the optimal ratio there is a high chance they will not be well assimilated by the organism resulting in a deficit in prostaglandins (hormone-like molecules that are crucial to regulating various processes in the organism).

Ω-6 fatty acids are present in almost all kind of oils. The main source of ω-3 fatty acids are mainly fatty fish and some see-foods. As for vegetable oils ω-3 are present in linseed, soy-bean and crucifers-seed oils. Sunflower oil, which is the most consumed in the Republic of Moldova, does not contain any of such fatty acids.

To this point, it is to be noted that no natural oils present the fatty acid ω-6 and ω-3 ratio. The only oils that display this characteristic are synthetic (using selection or genetic

modifications of oilseeds). The surest way to creating oils with the right ratio of ω-6 and ω-3 polyunsaturated fatty acids is through blending vegetable oils according to the technique described hereafter: such oil may then be used for everyday consumption or be further processed. [2]

Our research's aim was to create a blended vegetable oil on the base of sunflower oil presenting the right ratio.

For optimising the quantity of fatty acids in sunflower oil through blending it is necessary to use other oils containing α-linolenic acid. Firstly, it is a flax oil in which according to data [3] depending on types and region of origin, flax may contain from 59.6% to 34.1% of α-linolenic acid. Besides, rapeseed oil may contain also quite high proportion of it (from 5.0% to 14.0%) and also soy-bean oil [4].

These oils (chosen for creating blended oils), were first researched into for containing fatty acids. Afterwards, some oil blends were calculated using Pearce, in accordance to which oil blends were created with a definite amount of fatty acids.

The very high proportion of fatty acids was determined via a method based upon turning fatty acid triglycerides into their methyl ethers and also upon a gas-chromatographic analysis of those former ethers.

During our research we used refined sunflower, rapeseed, and soy-bean oils, as well as non-refined flax oil. The fatty acid content of these oils is presented in table 1.

Table 1. Fatty acid composition of vegetable oils

Oil type	Proportion of each acid type in relation with triglyceride amount in oil, %						
	$C_{14:0}$	$C_{16:0}$	$C_{16:1}$	$C_{18:0}$	$C_{18:1}$	$C_{18:2}$ ω-6	$C_{18:3}$ ω-3
Sunflower	0.15	7.4	0.20	3.00	37.75	53.00	none
Flax	0.09	7.22	traces	1.58	23.40	19.20	48.5
Soy-bean	0.06	13.16	-	1.99	23.64	53.39	7.75
Rapeseed	0.10	5.19	traces	0.84	62.87	20.00	11.00

In compliance with obtained data we elaborated receipts that allows for an essential fatty acids content and we prepared compositions of vegetable oil blends presenting the optimal ratio between ω-3 and ω-6 fatty acids within the following boundaries: 1:5-10.

We determined factual content of fatty acids in obtained compositions and then we compared it to the estimated values that are presented in table 2.

These data demonstrate that the receipt estimation method we used allows for obtaining vegetable oil compositions containing the optimal ration of essential fatty acids.

Such oil may be obtained through blending two or more vegetable oil with well-known fatty acids in proportions determined by the theory that has been empirically demonstrated.

Table 2. Compositions of vegetable oils presenting the optimal ratio of ω-3 and ω-6 fatty acids

№	Composition content		Proportion of fatty acids in compositions			
	Oil type	Contain oil, %	Estimation		Fact	
			ω-3	ω-6	ω-3	ω-6
1	Sunflower Flaxseed	89 11	15.34	49.28	6.2	51.4
	ω-3: ω-6 ratio		1:9.2		1:8.3	
2	Sunflower Flaxseed	80 20	9.70	46.24	9.8	51.4
	ω-3: ω-6 ratio		1:4.8		1:5.2	
3	Sunflower Rapeseed	62,5 37,5	4.12	40.62	3.7	39.9
	ω-3: ω-6 ratio		1:9.9		1:10.8	
4	Sunflower Soy-bean	35 65	5.04	53.26	4.70	52.3
	ω-3: ω-6 ratio		1:10.6		1:11.1	
5	Sunflower Soy-bean, Rapeseed	48 36 16	4.46	44.6	4.35	46.2
	ω-3: ω-6 ratio		1:10		1:10.6	

Therefore, there is a possibility to create a vegetable oil of mass consumption, for example on the basis of sunflower oil with improved consumer properties.

Vegetable oil blend with optimal ratio of fatty acids ω-3 and ω-6 is a “healthy food product” whose utilization in adult and child nutrition can positively influence their heath.

References

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