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JUSTIFICATION OF THE NUTRITIONAL AND ENERGY VALUE OF LOW-CALORIE MAYONNAISE BASED ON VEGETABLE OILS WITH A BALANCED CONTENT OF POLYUNSATURATED FATTY ACIDS

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Abstract

A technology for low-calorie mayonnaises with a fat mass fraction of 30% and 40% based on vegetable oils with a balanced content of polyunsaturated fatty acids has been developed. The content of omega-3 fatty acids in these mayonnaises ranges from 1.1-2.9 g/100g, which allows them to be classified as products rich in omega-3 fatty acids. The nutritional and energy value of mayonnaises was calculated. The Moldovan Standard SM 332:2023 "Low-calorie mayonnaises rich in omega-3 fatty acids" was developed.

Keywords: Low-calorie mayonnaises, nutritional and energy value, polyunsaturated fatty acids

INTRODUCTION

The Institute has conducted research and developed a technology for the production of low-calorie mayonnaise, in which the fat content is 30-40% [1], [2].

Vegetable oils with a balanced content of polyunsaturated fatty acids, the production technology of which was developed by us earlier, are used as the fat phase.

The characteristic of the optimal fatty acid composition is its balance in the ratio of essential fatty acids, the most significant of which for vegetable oils are omega-3 alpha-linolenic acid and omega-6 linoleic acid. These acids are equally necessary for the prevention of cardiovascular and other diseases, but their ratio is important, which in the diet of a healthy person in accordance with the recommendations [3] and should be from 1:5 to 1:10.

In nature, there is no vegetable oil with a composition that ensures the intake of the necessary fatty acids into the human body in the right amount and in the right ratio, which can be achieved by blending oils [4].

The Moldovan standard SM 315 provides for the production of blended vegetable oils, in which the content of omega-3 fatty acids is 3-8%, and the omega-3:omega-6 ratio is in the range of 1:4-1:11 [5].

The use of such oil both directly and for the manufacture of products, including mayonnaise, will significantly increase the consumption of omega-3 fatty acids, which is extremely important for preventing the development of cardiovascular diseases - the main cause of mortality in the Republic of Moldova.

The objective of these studies is to study whether the use of these vegetable oils will allow to obtain low-calorie mayonnaise rich in omega-3 fatty acids. For this purpose, the content of α -linolenic acid in them should be at least 0.6 g/100g in accordance with the requirements of the "Sanitary Regulations and information on nutritional value and health benefits", approved No. 196 of March 25, 2011.

MATERIALS AND METHODS

The data on the fatty acid composition of vegetable oils given in the reference book [6] (see Table 1) were used for calculations.

Table 1. Fatty acid composition of vegetable oils

Oil name	Fat acid, g/100 g		
	Saturated	Mono unsaturated	Poly unsaturated
Rapeseed	6,6	59,3	29,3
Sunflower oil	12,0	20,5	63,3
Corn	14,4	29,9	51,3
Soy	15,6	21,3	58,8
Grape	11,5	14,3	69,9

The fatty acid composition of blended vegetable oils with a balanced content of polyunsaturated fatty acids including the average value of omega-3 and omega-6 fatty acids, we calculated using formula (1) [7, 8].

Formula for calculating the fatty acid composition of blended vegetable oils:

where:

$$C_k = \frac{m_1 \times C_1 + m_2 \times c_2 + \dots + m_n \times c_n}{m_1 + m_2 + \dots + m_n}$$

C_k – fatty acid content of blended oil;

$C_1 \dots C_n$ is the corresponding reference content of the test acid in the original oils.

$m_1 \dots m_n$ – mass of initial oils used for blending;

n – number of types of vegetable oil used for blending.

The research results are shown in Table 2.

Table 2. Fatty acid composition of blended vegetable oils with a balanced content of polyunsaturated fatty acids.

Name	Oil ratio, %						
	Sunflower-rapeseed 51:49	Sunflower-rapeseed-soy 48:47,5	Sunflower-rapeseed-grape 49:48,5:2,5	Corn-rapeseed 59:41	Rapeseed-corn 68:32	Corn-rapeseed-grape 55,5:41,5:3,0	Soy-rapeseed 84:16
Fat acid:							
Saturated	9,3	9,6	9,4	11,2	9,1	11,4	14,2
Mono unsaturated	43,5	38,8	39,4	41,9	49,8	43,4	27,4
Polyunsaturated, including	42,6	46,9	47,1	43,3	36,4	43,3	51,5
Omega-3	3,7	3,8	3,7	3,5	7,2	3,5	5,2
Omega-6	38,9	43,1	43,4	39,8	29,2	39,8	46,3

The nutritional and energy value of low-calorie mayonnaise is calculated according to the recipes developed by us (see Table 3) for all types of blended vegetable oils.

Table 3. Recipes of low-calorie mayonnaise

Name of components	Component content, %, for mayonnaise	
	with a mass fraction of fat 30 %	with a mass fraction of fat 40 %
Vegetable oil	30,0	40,
Stabilization system	8,	6,0
Salt	1,0	1,0
Sugar	1,5	1,5
Baking soda	0,05	0,05
Mustard powder	0,75	0,8
Acetic acid 8% concentration	3,5	3,0

The calculations took into account the contribution of the main nutrients contained in the stabilization system, consisting of skimmed milk powder, pectin, modified potato starch in a ratio of 68:5:27.

RESULTS AND DISCUSSION

The fatty acid composition and nutritional and energy value of low-calorie mayonnaise are presented in Tables 4 and 5.

Table 4. Nutritional and energy value of mayonnaise with a fat content of 30%

Energy value	Sunflower-rapeseed	Sunflower-rapeseed-soy	Sunflower-rapeseed-grape	Corn-rapeseed	Rapeseed-corn	Corn-rapeseed-grape	Soy-rapeseed
Fats, g	30	30	30	30	30	30	30
of which: saturated fatty acids, g	2,9	3,0	2,9	3,5	2,8	3,5	4,6
monounsaturated fatty acids, g	13,7	12,2	12,4	13,0	15,8	13,3	8,8
polyunsaturated fatty acids, g	13,4	14,8	14,7	13,5	11,4	13,2	16,6
including omega-3	1,1	1,1	1,7	1,7	2,2	1,1	1,6
omega-6	11,7	12,9	13,0	11,9	8,8	11,9	13,9
Carbohydrates	61,4						
Of which Sugar	4,43						
Starch	1,71						
Organic acids	0,28						
Salt	1,0						
Proteins	2,1						
kJ/kcal	125 4/30 4						

Table 5. Nutritional and energy value of mayonnaise with a fat content of 40%

Energy value	Sunflower-rapeseed	Sunflower-rapeseed-soy	Sunflower-rapeseed-grape	Corn-rapeseed	Rapeseed-corn	Corn-rapeseed-grape	Soy-rapeseed
Fats, g	40	40	40	40	40	40	40
of which: saturated fatty acids, g	3,9	4,0	3,9	4,6	3,8	4,6	6,1

monounsaturated fatty acids, g	18,2	16,3	16,5	17,4	20,9	17,7	11,8
polyunsaturated fatty acids, g	17,9	19,7	19,5	18,0	15,3	17,7	22,1
including omega-3	1,5	1,5	1,4	1,4	2,9	1,4	2,1
omega-6	15,6	17,2	15,9	15,9	11,7	15,9	18,5
Carbohydrates	5,0						
Of which Sugar	3,7						
Starch	1,3						
Organic acids	0,24						
Salt	1,0						
Proteins	1,65						
kJ/kcal	1596 /387						

Analysis of the obtained data on the fatty acid composition shows that the content of omega-3 fatty acid in mayonnaise with a fat mass fraction of 40% ranges from 1.4 to 2.9g / 100g, and in mayonnaise with a fat mass fraction of 30% is 1.1-2.2 g/ 100g. This, in accordance with the "Sanitary Regulations and information on nutritional value and health benefits", approved No. 196 of March 25, 2011, allows these mayonnaises to be attributed to products rich in omega-3 fatty acids, since in accordance with the said regulations, the content of α -linolenic acid in such products should be at least 0.6g/100g.

There is no egg powder in the proposed mayonnaise, so the cholesterol content in them is minimized and amounts to 0.2-6 mg/100g (for comparison, the cholesterol content in high-calorie mayonnaise is 75-100 mg/100g [5]). This is relevant in connection with the recommendations of nutritionists provided at the Congress of International Societies in 2008 in Geneva to reduce the development of cardiovascular and other alimentary-dependent diseases limited by cholesterol intake to 300 mg per day.

The energy value of low-calorie mayonnaise is 304-387 kcal, which is 1.8-2.2 times lower than in high-calorie [5]. Taking into account the above data, the developed low-calorie mayonnaise can be attributed to healthy food products.

Based on the conducted research, the Moldovan Standard SM 332:2023 [9] was developed.

CONCLUSIONS

Studies have been conducted on the development of low-calorie mayonnaise with a fat mass fraction of 30% and 40% using vegetable oils with a balanced content of polyunsaturated fatty acids as the fat phase.

The fatty acid composition and nutritional and energy value of these mayonnaise are calculated. Calculations show that the

content of α -linolenic acid in them exceeds 0.6 g/100g, which allows them to be added to products rich in omega-3 fatty acids. Based on the conducted research, the Moldovan Standard SM 332 [9].

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