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ORIGINAL PAPER

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USING OAT MILK TO REDUCE THE CALORIC VALUE OF A FUNCTIONAL MAYONNAISE SAUCE

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ABSTRACT

Background. In the food industry, fat-reducing ingredients are used to reduce the fat content of foods. Oat milk is a low-fat product which is consumed and used as an ingredient in food. The aim of this study is to formulate homemade mayonnaise sauce containing oat milk and analyze its sensory and physicochemical properties.
Materials and methods. The sensory and physicochemical properties of mayonnaise sauce containing oat milk were examined using methods specified in the international standards. Linear optimization was used to obtain the mayonnaise sauce recipe.
Results. Mayonnaise sauce containing 20.3% oat milk had better sensory properties and a higher quality index than traditional homemade mayonnaise. The developed sauce had a white color with a grayish tint, a pleasant taste and smell, and a creamy consistency. Increasing the oat milk content reduced the titratable acidity and viscosity of the mayonnaise sauce, but the emulsion stability of the sauce was 100%. Increasing the oat milk content also increased the moisture content and decreased the fat content of the sauce.
Conclusion. The functional mayonnaise sauce with oat milk had 19.9% fewer calories than traditional homemade mayonnaise.

Keywords: mayonnaise, sauce, oat milk, caloric value

INTRODUCTION

Mayonnaise is a low-pH oil-in-water emulsion which contains 70–80% fat (Gorji et al., 2016). It is one of the oldest and most widely used sauces in the world consisting of different components: oil, whole egg or egg yolk, vinegar and spices (Depree et al., 2001). Traditional mayonnaise must contain not less than 65% oil by weight, at least 2.5% acetic acid and about 5.3–8.0% egg yolk in liquid, frozen or dried form, which provides the emulsifying properties of the product (Harrison et al., 1985). The amount and quality of each of the ingredients in mayonnaise has a huge effect on emulsion quality (Taslikh et al., 2022).

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The type of oil used for mayonnaise preparation affects the textural and rheological properties of the sauce (Patil et al., 2019). Reduction in oil content of low-fat mayonnaises, which contain soy milk as a yolk substitute, from 56.25 to 37.50% led to a decrease in the apparent viscosity of the emulsion (Mozafari et al. 2017), which can be incremented by additives, especially hydrocolloids (Karas et al., 2002).

Foods high in fats are harmful for the human body because they cause several chronic diseases (e.g. obesity, cardiovascular diseases, cancer; Duan et. al., 2018). This motivates customers to prefer low-fat foods. The food industry and the restaurant business are trying to take into account these trends in healthy eating and develop recipes for low-fat foods. Therefore, it is important to produce low-fat mayonnaise sauces that have attributes similar to full-fat products.

Low-fat mayonnaise with reduced calories can be obtained by using various fat substitutes. As each ingredient has a specific impact on the properties of mayonnaise, using fat substitutes may affect the sensorial, textural and antioxidant properties of mayonnaise (Mirzanajafi-Zanjani et al., 2019).

The high cholesterol content in egg yolk, which is used as an emulsifier in mayonnaise, is a disadvantage, because it is the cause of heart disease. Therefore, plant-based proteins, including soybean protein, lupin protein, pea protein, and wheat protein, have been proposed as alternative emulsifiers in mayonnaise (Ma et al., 2012).

The pH value of mayonnaise determines its susceptibility to microbial growth. To make safe mayonnaise, the pH should be equal to or less than 4.10 or 4.00 (Xiong et al., 2000). The acidification of mayonnaise is achieved by the addition of vinegar, lemon juice, lime juice, and organic or mineral acid acidulants (Ma et al., 2012). Acetic acid and citric acid, which are used in the mayonnaise recipe, have a significant irritating effect on the mucous membranes of the gastrointestinal tract (Miedviedieva, 2016).

Salt and sugar help to reduce water activity and therefore inhibit spoilage organisms (Ma et al., 2012). In addition, salt improves the taste of the mayonnaise and acts as a preservative (Gomes et al., 2017).

Customers who have health issues such as lactose intolerance or a milk allergy, or who follow a healthy lifestyle, are increasingly choosing products that contain plant-based dairy analogs, which are affordable, have high nutritional value, and are easy to produce (M K, 2021). Different types of plant-based milk are known, such as soy, oat, hemp, coconut, rice, and nut milk (Chalupa-Krebzdak et al., 2018). Oat milk is now one of the most popular types of plant-based dairy product. Following this global trend, new types of products containing oat milk (e.g. lactose-free sauce) are being developed (Khrundin et al., 2022).

The nutrient content of oat milk is as follows: carbohydrate 34.03%, protein 0.966%, fat 0.36%, dietary fibers 3.2% beta glucan 0.54% (Syed et al., 2020). The mineral content of oat milk is as follows (mg/100 g): iron (Fe) 6.4–7.4, calcium (Ca) 84.3–85.6, potassium (K) 669.2–671.6, sodium (Na) 3.11–3.21, phosphorus (P) 672.3–816.32 (Paul, 2020). Oat milk also contains a high percentage of vitamins A, D, E and B1; therefore, oat milk adds more functionality to food (Ismail, 2015).

Taking into account trends in the food industry, the development of mayonnaise sauce containing plant-based milk with reduced fat content and improved nutritional properties is much needed. Therefore, the aim of this study was to formulate homemade mayonnaise sauce containing oat milk and analyze its sensory, physicochemical, and rheological properties.

MATERIALS AND METHODS

Oat milk preparation

The oat milk was prepared from oatmeal and boiled water, which was cooled to 20°C. The ratio of oatmeal to water for soaking was 1:2. The oatmeal was soaked for 2 hours. The soaked oatmeal was then filtered using a flour sieve. Before being used, the oat milk was mixed with a spoon.

Mayonnaise sauce preparation

In the study, six mayonnaise sauce samples were examined. 250 g of each mayonnaise sauce sample were prepared. The control sample of mayonnaise sauce (SMS1) did not contain oat milk, and all the other samples (SMS2, SMS3, SMS4, SMS5, SMS6) contained oat milk in different percentages of their weight. The recipe to prepare samples of homemade mayonnaise sauce contained the ingredients in percentage weight, as presented in Table 1. The chemical composition analysis and caloric values of the mayonnaise sauce ingredients are presented in Table 2.

Table 1. Recipes of mayonnaise sauce samples

Ingredients of mayonnaise sauce	Ingredients in percentage weight (wt.%) in the control sample of mayonnaise sauce and samples containing oat milk					
	SMS1 (control)	SMS2	SMS3	SMS4	SMS5	SMS6
Sunflower oil	74.3	63.9	62.9	59.5	58.2	53.9
Eggs	19.3	19.4	16.0	17.5	16.3	17.3
Sugar	1.9	1.6	1.6	1.5	1.5	1.3
Salt	1.1	1.0	0.9	0.9	0.9	0.8
Vinegar 9%	1.9	1.6	1.6	1.5	1.5	1.3
Mustard seeds	1.1	1.0	0.9	0.9	0.9	0.8
Dried dill	0.4	0.3	0.3	0.3	0.3	0.3
Oat milk	–	11.2	15.8	17.9	20.4	24.3

Table 2. Chemical composition analysis and caloric values of mayonnaise sauce ingredients (information provided by the manufacturers)

Ingredients of mayonnaise sauce	Chemical composition, g/100 g			Caloric values kcal/100 g
	Protein	Fat	Carbohydrate	
Sunflower oil	0.0	99.9	0.0	900.0
Eggs	11.0	9.0	0.7	150.0
Sugar	0.0	0.0	99.8	398.0
Salt	0.0	0.0	0.0	0.0
Vinegar 9%	0.0	0.0	0.0	0.0
Mustard seeds	25.8	30.8	23.4	474.0
Dried dill	23.9	5.0	19.3	218.0
Oat milk	1.0	1.5	4.0	30.0

Fresh eggs were purchased locally. The shells of the eggs were wiped and cracked, and whole egg was harvested into containers. Along with added sugar, salt, mustard seeds and dried dill, the eggs were whisked with an electric hand mixer (Braun Minipimer 3 / MultiQuick 3 MQ 3038), and the oil was added gradually during continuous mixing. After all the oil had been completely mixed, the emulsion was homogenized for 1 min using a hand mixer. Then the emulsion was combined with vinegar and mixed for 1 min. After the semi-finished mayonnaise sauce had been prepared, it was mixed with oat milk for 2 min using a hand mixer. Samples of mayonnaise sauce were dispensed into sterile containers and stored at 4°C until the study began.

Sensory analysis

The sensory analysis took place under conditions specified by the international standard ISO 13299:2016 in a special test room. Mayonnaise was served to seven trained panelists for an evaluation on a 5 point scale (5 points – excellent quality; 1 point – very poor quality). The recommended characteristics for the sauce's sensory properties are presented below.

Consistency and appearance – the mayonnaise sauce should be a homogeneous creamy or thick creamy product with single air bubbles. Spice particle content is allowed. Taste – the mayonnaise sauce should have a delicate taste, slightly spicy or sweet or sour with a taste of mustard and dill. Smell – the mayonnaise sauce should have a slight smell of spices. Color – the color of the mayonnaise sauce should be uniform throughout and should be white or creamy yellow due to the color of the additives.

The sauce samples were presented successively to the experts. The evaluation results for each sensory property were processed and the average value P_i of each sensory indicator was calculated. Sensory profiles of the mayonnaise sauce samples were created.

Quality assessment method

The quality index of mayonnaise sauce samples was determined by an expert method (Pudovkin, 2021), which is based on the knowledge of experts. This method involves the following stages: determination of the value of the weighting coefficient of each sensory property, which indicates the degree of influence of each sensory property on the mayonnaise sauce quality index; determination of the relative value of the sensory indicators; assessment of the experts' consistency using a concordance coefficient; calculation of the quality index.

The weighting coefficient was calculated using the following equation:

$$m_i = t_i / \sum_{i=1}^{n} t_i$$

where

t_i is the rank sum for the i^{th} sensory indicator (the highest rank 4 was assigned to the most important indicator)

n is the number of sensory indicators.

The relative value of each sensory indicator was calculated using the equation:

$$q_i = P_i / P_{ibas}$$

where

P_i is the average value of the i^{th} sensory indicator

P_{ibas} is the average value of the i^{th} sensory indicator of the base (control) mayonnaise sauce sample.

The concordance coefficient was calculated using the equation:

$$W = \frac{12S}{l^2(n^3 - n)}$$

where

$S = \sum_{i=1}^{n} \Delta_i^2$; $\Delta_i = t_i - T$ is the difference between the rank sum t_i of each organoleptic indicator and the average rank sum $T = \sum_{i=1}^{n} t_i / n$

l is the number of experts; and n is the number of organoleptic indicators.

If the concordance coefficient value is more than 0.7, the expert opinions are sufficiently consistent.

The quality index of mayonnaise sauce samples was calculated using the equation:

$$Q = \sum_{i=1}^{n} m_i q_i$$

Measurement of the physical and chemical properties of the mayonnaise sauce

Fat content was determined by the Soxhlet method (Carpenter, 2010). Moisture content and titratable acidity were determined by AOAC Official Methods (AOAC, 1995). All experiments were replicated three times. All the statistical analysis was conducted using Mathcad 14.

The caloric content was calculated using the equation:

$$E = k_p P + k_f F + k_c C,$$

where

E is the caloric content of the ingredient, kcal/100 g

k_p, k_f, k_c are the caloric contents per 1 g of protein, fat and carbohydrates (k_p = 4 kcal; k_f = 9 kcal; k_c = 3,75 kcal), kcal

P, F, C are the contents of protein, fat and carbohydrates per 100 g of the ingredient, %.

Emulsion stability determination. The test tube was filled up to the upper division with mayonnaise sauce and placed in the centrifuge (rotation speed about 1500 min^{-1}) for 5 min. Then, the test tube was placed in boiling water for 3 min and centrifuged again for

5 min. The emulsion stability was calculated using the equation:

$$X_5 = V \cdot 100/10$$

where

X_5 is emulsion stability, %

V is the volume of unbroken emulsion, cm^3

and 10 is the initial volume of mayonnaise sauce in the test tube, cm^3.

Bostwick consistency measurement. The Bostwick test was used to determine the Bostwick consistency (Bostwick degree) of the mayonnaise sauce samples (Perona, 2005), which characterizes their viscosity. Three measurements were performed and averaged.

Modeling and optimization of the mayonnaise sauce recipe

Modeling and optimization of the mayonnaise sauce recipe was performed using the method of linear programming (Murota, 2020). The mathematical model for the mayonnaise sauce recipe optimization was solved using Mathcad 14.

Statistical analysis and calculations

All the statistical analysis and calculations of the chemical composition and caloric values of the mayonnaise sauce samples were conducted using Mathcad 14. Statistical analyses were performed in triplicate and data are reported as mean ± standard deviation (SD).

RESULTS AND DISCUSSION

The sensory properties of the sauce samples are presented in Table 3. The mayonnaise sauce samples with oat milk (except SMS6) received a higher score for consistency and appearance than the control sample (SMS1). The highest score (5 points) for consistency and appearance was obtained by sample SMS4, with an oat milk content of 17.9%. The consistency of mayonnaise sauce with oat milk was creamy with splashes of mustard and dill, and the consistency of the control sample was thick and creamy. The consistency of the sample SMS6 was too thin.

The taste of the mayonnaise sauce samples was rated in the range 3.00–4.29 points. The highest score (4.29 points) was obtained by sauce sample SMS4. Sauce samples containing oat milk had a delicate sweet taste with a slight hint of mustard and dill, while the control sauce sample had a slightly salty taste.

The smell of the sauce samples was rated in the range 3.86–4.43 points. The highest score (4.43 points) was obtained by sauce sample SMS3. All the sauce samples had a faint sour smell with a slight aroma of mustard and dill.

For color, the lowest score (3.0 points) was obtained by the control sample SMS1, and the highest score (4.86 points) was obtained by sauce sample SMS5. The control sample had a white-yellow color (Fig. 1). The mayonnaise sauce samples containing oat milk had a color ranging from white to white-cream with a grayish tinge. Analysis of the sensory profiles of the

Table 3. Sensory properties of the sauce samples

Sauce sensory properties and quality index	Values of mayonnaise sauce samples (points)					
	SMS1 (control)	SMS2	SMS3	SMS4	SMS5	SMS6
Consistency and appearance	3.57 ±0.49	3.86 ±0.35	4.14 ±0.35	5.00 ±0.00	4.71 ±0.45	2.00 ±0.00
Taste	3.00 ±0.00	3.00 ±0.53	4.14 ±0.35	4.29 ±0.45	3.57 ±0.49	3.00 ±0.53
Smell	4.14 ±0.35	3.86 ±0.35	4.43 ±0.49	4.29 ±0.45	4.29 ±0.45	3.86 ±0.35
Color	3.00 ±0.53	4.14 ±0.35	4.57 ±0.49	4.57 ±0.49	4.86 ±0.35	4.43 ±0.49
Quality index, Q	1.000	1.054	1.253	1.350	1.249	0.876

Results are expressed as mean ±standard deviation.

Fig. 1. Mayonnaise sauce samples

sauce samples indicates that all the sensory properties of sauce samples SMS3, SMS4 and SMS5 were better than those of the control sample SMS1.

Using the expert method, the weighting coefficients of each of the sensory properties of mayonnaise sauce were determined. They were: consistency and appearance – m_1 = 0.36 (according to the experts, it is the most important organoleptic property of mayonnaise sauce); taste – m_2 = 0.34; smell – m_3 = 0.2; color – m_4 = 0.1 (according to the experts, it is the least important organoleptic property of mayonnaise sauce). The value of the concordance coefficient was W = 0.9, which indicates that the opinions of the experts regarding the importance of the various sensory properties of mayonnaise sauce were sufficiently consistent.

The calculated quality indices of the mayonnaise sauce samples are presented in Table 3. The mayonnaise sauce sample SMS4 had the highest quality index, which is Q = 1.35. And the mayonnaise sauce sample SMS6 had the lowest quality index, which is Q = 0.876. Mayonnaise sauce samples which have a quality index Q higher than 1.0 are better in terms of sensory properties than the base (control) sample SMS1.

The physical and chemical properties of the mayonnaise sauce samples are presented in Table 4. The titratable acidity of mayonnaise sauce samples containing oat milk varied between 0.17 and 0.25% (Table 4). These were all less than the titratable acidity of the control sample SMS1, which was 0.27 ±0.01%. Moreover, mayonnaise sauce samples which contained less oat milk had a higher titratable acidity.

The results of the moisture content measurements, which are presented in Table 4, indicate that increasing the oat milk content of the sauce from 11.2% (SMS2) to 24.3% (SMS6) led to an increase in the moisture content from 26.8 ±0.06% (SMS2) to 35.98 ±0.1% (SMS6). In the control sample SMS1, the moisture content was 15.15 ±0.22%.

The analysis of the fat content showed that increasing the oat milk content from 11.2% (SMS2) to 24.3% (SMS6) led to a decrease in the fat content from 66.07 ±0.1% (MK2) to 55.69 ±0.39% (MK6) (Table 4). In the control sample SMS1, the fat content was 77.9 ±0.12%.

For all mayonnaise sauce samples, the emulsion stability was 100% (Table 4).When the oat milk content of mayonnaise sauce was increased from 11.2% (SMS2)

Table 4. Physical and chemical properties of mayonnaise sauce samples

Physical and chemical properties	Values of mayonnaise sauce samples					
	SMS1 (control)	SMS2	SMS3	SMS4	SMS5	SMS6
Titratable acidity in terms of acetic acid, %	0.27 ±0.01	0.25 ±0.01	0.24 ±0.01	0.24 ±0.01	0.23 ±0.01	0.17 ±0.01
Moisture content, %	15.15 ±0.22	26.80 ±0.06	28.40 ±0.17	31.90 ±0.01	33.03 ±0.19	35.98 ±0.10
Fat content, %	77.90 ±0.12	66.07 ±0.10	64.30 ±0.27	60.43 ±0.16	59.44 ±0.32	55.69 ±0.39
Emulsion stability, %	100.0	100.0	100.0	100.0	100.0	100.0
Bostwick viscosity, cm/30 s	0.35 ±0.05	5.40 ±0.10	6.15 ±0.15	8.30 ±0.10	8.45 ±0.05	11.70 ±0.05

Results are expressed as mean ±standard deviation.

Table 5. Chemical composition analysis and caloric values of mayonnaise sauce samples

Nutrients and caloric values	Mayonnaise sauce samples					
	SMS1	SMS2	SMS3	SMS4	SMS5	SMS6
Protein, g/100 g	2.5	2.6	2.2	2.4	2.3	2.4
Fat, g/100 g	76.3	66.1	64.8	61.6	60.2	56.0
Carbohydrate, g/100 g	2.4	2.5	2.6	2.6	2.7	2.6
Caloric values, kcal/100 g	705.8	614.2	601.9	573.6	561.2	523.8

to 24.3% (SMS6), the Bostwick consistency of the sauce samples increased from 5.4 ±0.1 cm/30 s (SMS2) to 11.7 ±0.05 cm/30 s (SMS6). Thus, increasing the oat milk content led to a decrease in viscosity. This effect of increasing the oat milk content on the viscosity of the sauce is associated with an increase in the moisture content of the sauce. The Bostwick consistency of the control sample (SMS1) was 0.35 ±0.05 cm/30 s.

The calculated nutritional and caloric values of the mayonnaise sauce samples are presented in Table 5.

Taking into account the obtained sensory and physical and chemical properties of the mayonnaise sauce samples, it was determined that samples SMS3, SMS4 and SMS5 were the most promising. Therefore, the sauce recipe was optimized by taking into account the ingredient content of these samples. The caloric values of the mayonnaise sauce had to be as low as possible, so the objective function which was used to solve the optimization problem in linear programming was determined by the equation:

$$Z = 9000 \cdot x_1 + 1500 \cdot x_2 + 3980 \cdot x_3 + 0 \cdot x_4 + 0 \cdot x_5 + 4740 \cdot x_6 + 2180 \cdot x_7 + 300 \cdot x_8$$

where

z is the caloric value of 1 kg mayonnaise sauce, kcal

9000, 1500, 3980, 0, 0, 4740, 2180, 300 are coefficients characterizing the caloric value of 1 kg of sauce ingredients, (respectively, sunflower oil, eggs, sugar, salt, vinegar, mustard seeds, dried dill, oat milk; Table 2)

$x_1, x_2, x_3, x_4, x_5, x_6, x_7, x_8$ are the amounts of each ingredient for 1 kg of mayonnaise sauce (respectively, sunflower oil, eggs, sugar, salt, vinegar, mustard seeds, dried dill, oat milk, kg).

The constraints used to optimize the sauce recipe were accepted. The weight of all the sauce ingredients had to be equal to 1 kg. The content (kg) of each sauce ingredient had to be within the range in which the

Table 6. Nutrient content of control sauce sample and developed mayonnaise sauce

Nutrients	Nutrient content of the mayonnaise sauce, g/100 g		Percentage increase (+) / decrease (–), %
	SMS1	Developed mayonnaise sauce (sunflower oil 582 g; eggs 163 g; sugar 15 g; salt 9.1 g; vinegar 16 g; mustard seeds 8.9 g; dried dill 3 g; oat milk 203 g)	
Protein, g/100 g	2.5	2.3	–8.0
Fat, g/100 g	76.3	60.2	–21.1
Carbohydrate, g/100 g	2.4	2.7	+12.5
Caloric value, kcal/100 g	705.8	565.2	–19.9

ingredients were found in the sauce samples SMS3, SMS4 and SMS5 (Table 1) (except for the mustard content, which had to be 8.9–9.1 g for 1 kg of sauce, and dried dill, which had to be about 3 g for 1 kg of sauce), i.e.:

$$x_1 + x_2 + x_3 + x_4 + x_5 + x_6 + x_7 + x_8 = 1;$$

$$x_1 \geq 0.582; \quad x_3 \geq 0.015; \quad x_5 \geq 0.015; \quad x_7 \geq 0.003;$$
$$x_1 \leq 0.629; \quad x_3 \leq 0.016; \quad x_5 \leq 0.016;$$
$$x_2 \geq 0.160; \quad x_4 \geq 0.0089; \quad x_6 \geq 0.0089; \quad x_8 \geq 0.158;$$
$$x_2 \leq 0.175; \quad x_4 \leq 0.0091; \quad x_6 \leq 0.0091; \quad x_8 \leq 0.204.$$

Taking into account the protein, fat and carbohydrate content in the sauce ingredients (Table 2), the inequality constraints on their content in the sauce were accepted. The protein and carbohydrate content had to be higher than their average content in sauce samples SMS3, SMS4 and SMS5 (Table 4), and the fat content had to be less than its average content in these sauce samples:

for protein: $11 \cdot x_2 + 25.8 \cdot x_6 + 23.9 \cdot x_7 + 1 \cdot x_8 \geq 2.3 \cdot 1$;
for fat: $99.9 \cdot x_1 + 9 \cdot x_2 + 30.8 \cdot x_6 + 5 \cdot x_7 + 1.5 \cdot x_8 \leq 62.5 \cdot 1$;
for carbohydrate: $0.7 \cdot x_2 + 99.8 \cdot x_3 + 23.4 \cdot x_6 + 19.3 \cdot x_7 + 4 \cdot x_8 \geq 2.65 \cdot 1$.

According to the results of the sauce recipe optimization, the optimal ingredient quantities for 1,000 g of mayonnaise sauce were: sunflower oil $x_1 = 582$ g; eggs $x_2 = 163$ g; sugar $x_3 = 15$ g; salt $x_4 = 9.1$ g; vinegar $x_5 = 16$ g; mustard seeds $x_6 = 8.9$ g; dried dill $x_7 = 3$ g; oat milk $x_8 = 203$ g. In this case, the developed mayonnaise sauce had a minimum caloric value (under the established restriction conditions), which was $Z = 565.2$ kcal/100 g.

The nutrient content for the optimal mayonnaise sauce recipe was calculated. It is presented in Table 6 and compared with the nutrient content of the control sauce sample (SMS1).

The data analysis, which is presented in Table 6, indicates that compared to the control sauce sample SMS1, the optimized recipe reduces the sauce's calorie content by 19.9%, its fat content by 21.1% and its protein content by 8.0%. In addition, the developed sauce recipe provides a 12.5% increase in carbohydrate content.

CONCLUSIONS

The optimal ratio of mayonnaise sauce ingredients to reduce its caloric value compared to traditional homemade mayonnaise was determined. The developed mayonnaise sauce containing 20.3% oat milk had 21.1% less fat than traditional homemade mayonnaise and can therefore be defined as a functional food.

Adding oat milk to the recipe for mayonnaise sauce improves its sensory properties. This was confirmed by the calculation of the sauce quality indicator. In addition, increasing the oat milk content reduced the titratable acidity and viscosity of the mayonnaise sauce. At the same time, the stability of the developed mayonnaise sauce emulsion was 100%.

Furthermore, the use of oat milk makes it possible to expand the range of mayonnaise sauces, enrich them with useful nutrients contained in plant-based milk, and satisfy the taste preferences of different consumer groups, especially those following a healthy diet. Further research on the influence of different types of plant milk on the sensory and physicochemical properties of mayonnaise sauce should be undertaken in the future.

DATA AVAILABILITY

Datasets from the current study are available from the corresponding author upon request.

DECLARATIONS

Ethical Approval
Not applicable.

Competing Interests
The authors declare that they have no conflicts of interest.

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