

ХАРЧОВІ ТЕХНОЛОГІЇ

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IMPROVEMENT OF MAYONNAISE SAUCE TECHNOLOGY USING DIETARY ADDITIVES

The article considers the feasibility of using vegetable oil blends to correct the deficiency of PUFA and plant raw materials in the technology of mayonnaise sauce production. The conducted analytical studies confirm the need to develop new types of products of high biological value, which can be obtained as a result of combining non-traditional raw materials and create sauces with new properties based on them. The relevance of developing new functional products is increasing due to comprehensive studies that confirm the direct impact of functional food components, such as polyunsaturated fatty acids, antioxidants, vitamins, minerals, dietary fiber, on human health. The use of blended oil, balanced in fatty acid composition, gum arabic and carrot powder is justified. The article investigates the combination of the proposed ratios of all components, which provides original organoleptic indicators of mayonnaise at the level of traditional technology. The article substantiates and develops the technology of mayonnaise sauce enriched with beta-carotene, proves its functional properties, increased nutritional and biological value. The developed technology of mayonnaise sauce based on a blend of corn-olive oil and carrot powder has a better balanced fatty acid composition. The advantages of using mixtures of vegetable oils to correct PUFA deficiency over dietary supplements and drugs are that vegetable oils are traditional foods, do not cause complications and adverse reactions in the body, and are also much cheaper than dietary supplements. The use of blended oil, balanced in fatty acid composition, gum arabic and carrot powder, the combination of the proposed ratios of all components provide original organoleptic indicators of mayonnaise and at the same time give it functional properties, increase nutritional and biological value. This allows you to get high-quality and safe products enriched with physiologically important nutrients for the human body. The developed sauce meets the established requirements in terms of quality indicators and can be recommended for nutrition of people living in environmentally polluted areas, working in harmful industries and all segments of the population.

Keywords: mayonnaise, oil, gum arabic, carrot powder, sauce, polyunsaturated fatty acids (PUFA), technology, functional product, dietary supplements.

Statement of the problem and its relevance. The transition to market relations, the expansion of consumer markets, the introduction of new forms of management have been reflected in all spheres of economic life, including the restaurant business. Today, only those establishments that have managed to satisfy the desires of consumers in the best way and at the same time constantly improve their restaurant product to maintain its proper level in accordance with the ever-growing demands of consumers are successfully operating in the restaurant industry. To improve demand, restaurant enterprises use the latest production technologies.

It is known that among restaurant products, a separate segment is made up of sauces that contribute to better absorption of food nutrients by the human body, diversify the range and increase the nutritional value of dishes. About 70% of dishes served in restaurant establishments are served with sauce, which allows not only to improve the aroma, appearance and taste of the finished dish, but also to increase the content of essential substances. However, most of them have an unbalanced chemical composition, in particular, an increased content of saturated fatty acids, and the carbohydrate composition is represented mainly by wheat flour starch [1–3].

Analysis of recent research and publications. Analysis of scientific literature indicates a significant interest

in the use of various dietary supplements in mayonnaise technology [1–4].

Ukrainian scientists Vasylenko S.V., Kravchenko O.O., Sydorenko V.M., and Kovalchuk L.A. are actively investigating the possibility of partial or complete replacement of vegetable oil with hydrocolloids (pectins, starches, gums), dietary fibers (oat, beet, apple), protein preparations (soy, milk) and other low-calorie ingredients. These additives contribute to the creation of emulsions with a reduced fat content, while maintaining the desired consistency and organoleptic properties of mayonnaise [5; 6].

Lysenko V.P. and Romanenko T.V. pay significant attention to the use of dietary supplements that have a positive effect on the health of consumers. Such additives include antioxidants (herbal extracts, vitamins), prebiotics and probiotics (inulin, lactulose, bacterial starter cultures), polyunsaturated fatty acids (omega-3 from linseed oil, fish oil), minerals and vitamins. The introduction of these additives allows the creation of functional mayonnaises [7].

Goncharova N.P., Tkachenko I.M., Savchenko O.P. and Melnyk I.V. believe that dietary additives, especially hydrocolloids and protein preparations, can act as emulsifiers and stabilizers, improving the stability of mayon-

naise emulsions during storage and at different temperature regimes. This is an important aspect for ensuring a long shelf life of the product [8; 9].

Oliynyk O.S. and Shevchenko N.I. believe that the use of certain dietary additives allows the viscosity, consistency and other rheological characteristics of mayonnaise to be regulated, satisfying various consumer preferences [10].

Zakharchenko M.I. and Ponomarenko G.V. investigate the possibility of using non-traditional oil-containing raw materials (milk thistle oil, grape seed oil, pumpkin oil) in combination with dietary supplements to create mayonnaises with improved fatty acid composition [11].

Zayas J.F. investigates the potential of various vegetable proteins (soy, pea, rice, sunflower) as emulsifiers, stabilizers and fat substitutes in mayonnaise. These studies are aimed at creating products with improved amino acid composition and reduced allergen content [12].

To increase the shelf life and provide mayonnaise with functional properties, Pokorný J., Yanishlieva N. and Gordon M.H. use natural antioxidants, such as extracts of rosemary, green tea, tomatoes, as well as carotenoids and tocopherols. Their influence on lipid stability and organoleptic characteristics of mayonnaise is being investigated [13].

Foreign studies often include comprehensive analyses of physicochemical properties, rheological characteristics, microstructure and sensory evaluation of modified mayonnaises. Studies are also being conducted on the influence of dietary supplements on shelf life and product safety.

Objectives of the article. The aim is to substantiate and develop a technology for the production of mayonnaise sauce enriched with beta-carotene, with a balanced content of polyunsaturated fatty acids of the ω -3 and ω -6 groups.

The work used: carrot powder according to DSTU 8654:2016; gum arabic, a model emulsion system prepared using traditional technology; model emulsion systems prepared using carrot powder; basic mayonnaise as a control sample; corn-olive oil mayonnaise with the addition of carrot powder as a test sample.

Research methods – organoleptic, physicochemical, structural-mechanical, statistical. The methodological basis of the study is the nutritional and biological value and indicators of the organoleptic level and safety of culinary products.

Research information base – monographs, scientific articles, materials of scientific and practical conferences, regulatory and technical documentation.

Summary of the main research material. The conducted analytical studies confirm the need to develop new types of products of high biological value, which can be obtained as a result of combining non-traditional raw materials and creating a sauce with new properties based on them.

Corn oil is recommended for diabetics, as it significantly reduces blood sugar levels. It helps obese patients, because it improves metabolism and removes harmful toxins from the body. It is a prevention of cancer. It fights caries and treats gum inflammation. Also, phosphatides (lecithin) of corn oil are part of cell membranes and play an important role in ensuring the functions of brain tissue.

Olive oil reduces the level of bad cholesterol in the blood, its moderate use serves as a prevention of diabetes, obesity, cardiovascular diseases. Vitamin E, which is part of it, is a highly active antioxidant that helps the body fight skin aging, improves hair growth and nail condition, and prevents the development of cancer. Vitamins A, K, D in combination with vitamin E help strengthen tissues, intestinal muscles, and the skeletal system. Phenols, which are present in the oil, strengthen immunity and slow down the aging process. Linoleic acid has a very positive effect on vision, helps improve coordination of movements, tissue regeneration, and the rapid healing of wounds and burns.

Gum arabic is a natural thickener and stabilizer used in the food industry, in particular in the production of mayonnaise. Gum arabic helps to achieve the desired consistency of mayonnaise, giving it a creamy texture, prevents the ingredients from separating, maintaining the homogeneity of the product. As a natural polymer, gum arabic is considered a healthier alternative to synthetic additives. The use of gum arabic can extend the shelf life of mayonnaise. Gum arabic has practically no taste, which allows you to preserve the original taste of mayonnaise and is able to improve the creaminess and visual appeal of the product. Gum arabic is usually added at the emulsification stage, when oil and water are mixed. This ensures uniform distribution and improves the stability of the emulsion.

To reduce the energy value and increase the biological value of the sauce, it is advisable to use carrot powder (DSTU 8654:2016), which is a source of dietary fiber, pectin substances and organic acids. Carrot powder in concentrated form retains the maximum amount of carotenoids, vitamins C and E, which act as antioxidants. Carrot powder is very useful for the body due to its solid reserves of potassium, phosphorus, calcium and sodium. Due to this combination, it strengthens both the digestive and circulatory systems, as well as bones, teeth, and hair. It also contains other important elements (iron, magnesium, chlorine, sulfur).

The study of the functional properties of carrot powder is important for developing recipes and choosing technological modes for preparing sauce. The most important functional properties include moisture-binding, emulsifying, and fat-retaining abilities. The moisture-binding (MBA), emulsifying (EBA), and fat-retaining (FRB) abilities of carrot powder were determined depending on the amount added to the sauce.

Moisture-binding (MB) capacity is an important characteristic of carrot powder, which affects the formation of sauce of the desired consistency. The moisture retention processes of different types of samples with different amounts of powder reveal special moisture-holding capacities, which increase with the amount of powder in the samples. This indicates the need to regulate moisture to ensure the necessary structural and mechanical properties in finished products.

The behavior of carrot powder in these emulsions characterizes their emulsifying ability (EA). The increase in the stability of emulsions occurs due to the increase in the viscosity of the dispersion medium.

Fat-holding capacity (FHCA) characterizes the ability to absorb and retain fat. The high fat-holding capacity of carrot powder affects the formation of a delicate and homogeneous sauce texture and eliminates the separation of fat.

The study of technological properties – water-binding, emulsifying and fat-binding abilities of carrot powder – showed that, in addition to the positive physiological effect, the powder will provide increased water-binding (WBB), emulsifying (EA) and fat-binding (FBB) abilities compared to the control sample.

To study the physicochemical parameters of mayonnaise sauces, moisture (dry matter content) was determined by the drying method and the mass fraction of fat was determined according to DSTU 4560:2006 “Mayonnaise. Acceptance rules and test methods”. The study of acidity, density and emulsion stability is given in Table 1.

Mathematical processing of experimental data, assessment of the error of experimental data and measured values was carried out according to generally accepted methods.

Analyzing the data by physicochemical quality indicators, the experimental and control samples, regardless of the content of carrot powder, meet the requirements of regulatory documentation. The values of acidity, density and emulsion stability are close to the values with the control sample.

It can be concluded that the rational mass fraction of carrot powder is 5 g, which contributes to the formation of the appropriate quality of mayonnaise. It is proposed to prepare mayonnaise with the introduction of blended corn-olive oil (59.5–55.8 %), gum arabic (5–6 %) and carrot powder (3.5–4.5 %), which allows to obtain a product enriched with dietary fiber, biologically active substances, in particular beta-carotene and improved fatty acid composition. In Table. 2 shows the chemical composition of mayonnaise made from a blend of corn and olive oil with the addition of carrot powder of an improved recipe. The presence of vegetable oils in this product provides biological value due to polyunsaturated fatty acids, and energy value due to fatty acids.

A study of the organoleptic quality indicators of mayonnaise and a score assessment of consumer properties were conducted. When determining the organoleptic assessment, an analysis of mayonnaises was conducted: the control sample was mayonnaise of the traditional recipe and mayonnaise with increased biological value. The organoleptic quality indicators of the sauce were converted using the Harington scale into relative units.

Mayonnaise in the amount of corn-olive oil 59.5–55.8%, gum arabic 5% and carrot powder 3.5–4.5% has the best organoleptic indicators, compared to other samples. At the same time, it has a homogeneous consistency of medium density, a pleasant, well-pronounced characteristic taste (Table 3).

The analysis showed that the mayonnaise sample with increased biological value had a higher score compared to the control sample. This indicates its suitability for introduction into production and sale in restaurant establishments.

Table 1 – Physio-chemical parameters of the quality of prototypes of mayonnaise

Indicator	Requirements of DSTU 4487:2005	Mayonnaise control	Corn-olive oil mayonnaise with varying contents of carrot powder, g		
			2,5	5,0	7,5
Acidity, T	There is no norm	0,612	0,615	0,624	0,635
Density, g/cm ³	According to TO	0,90	0,91	0,93	0,95
Emulsion stability, %	Not less than 97%	98	97	99	98

Source: developed by the author based on the research of A.V. Antonenko

Table 2 – Chemical composition of mayonnaise made from a blend of corn and olive oil with the addition of gum arabic and carrot powder

Components	Amount
Proteins, %	2,8
Fat, %	67,0
Unsaturated fatty acids, %	5,8–13
Polyunsaturated fatty acids, %	36,9–60
Cholesterol, mg %	0,1
Mono- and disaccharides, %	3,7
Vitamin B4, mg %	14,3
Vitamin E, mcg %	30,0
Vitamin B6, mcg %	0,1
Vitamin B2, mcg %	0,5
Vitamin B1, mg %	0,01
Vitamin PP, mg %	0,1
Beta-carotene, mcg %	0,7
Retinol equivalent, mcg %	20,0
Niacin equivalent, mg %	0,5
Phosphorus (P), mg %	54,0
Potassium (K), mg %	38,0
Sodium (Na), mg %	508,0
Magnesium (Mg), mg %	13,0
Calcium (Ca), mg %	33,0
Iron (Fe), mg %	1,0

Source: developed by the author based on the research of A.V. Antonenko

Table 3 – Organoleptic evaluation of mayonnaise

Indicator name	Product characteristics	
	Traditional recipe mayonnaise (DSTU4487:2005) “Mayonnaise. General technical conditions”	Corn-olive mayonnaise with gum arabic and carrot powder
Appearance and consistency	Homogeneous creamy mixture	A homogeneous, sour cream-like mixture with carrot powder evenly distributed throughout the mass
Taste and smell	The taste is vaguely pronounced, slightly sharp, sour.	The smell is pleasant with a light carrot aroma, a light aftertaste
Color	Light cream	Yellow-olive

Source: developed by the author based on the research of A.V. Antonenko

Conclusions. The use of blended oil, balanced in fatty acid composition, gum arabic and carrot powder, the combination of the proposed ratios of all components provide original organoleptic indicators of mayonnaise and at the same time give it functional properties, increase nutritional

and biological value. The developed sauce meets the established requirements in terms of quality indicators and can be recommended for nutrition of people living in environmentally polluted areas, working in harmful industries and all segments of the population.

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УДОСКОНАЛЕННЯ ТЕХНОЛОГІЇ СОУСУ МАЙОНЕЗУ З ВИКОРИСТАННЯМ ДІЄТИЧНИХ ДОБАВОК

У статті розглянуто доцільність використання купажів рослинних олій для корекції недостатності ПНЖК та рослинної сировини у технології виробництва соусів майонезів. Проведені аналітичні дослідження підтверджують необхідність розробки нових видів продукції високої біологічної цінності, яку можна отримати в результаті поєднання нетрадиційної сировини та створити на їх основі соуси із новими властивостями. Актуальність розробки нових функціональних продуктів зростає через комплексні дослідження, які підтверджують безпосередній вплив функціональних компонентів харчування, таких як поліненасичені жирні кислоти, антиоксиданти, вітаміни, мінерали, харчові волокна, на здоров'я людини. Обґрунтовано використання купажованої олії, збалансованої за жирнокислотним складом, гуміарабіка та морквяного порошку. У статті досліджено поєднання запропонованих співвідношень усіх компонентів, що забезпечує оригінальні органолептичні показники майонезу на рівні традиційної технології. У статті обґрунтовано та розроблено технологію соусу майонезу збагаченого бета-каротином, доведено його функціональні властивості, підвищену харчову та біологічну цінність. Розроблена технологія соусу майонезу на основі купажу кукурудзяно-оливкової олії та морквяного порошку має краще збалансований жирнокислотний склад. Переваги використання сумішей рослинних олій для корекції дефіциту ПНЖК перед біологічно активними добавками та ліками полягають у тому, що рослинні олії є традиційними продуктами харчування, не викликають ускладнень та побічних реакцій в організмі, а також коштують набагато дешевше біологічно активних добавок. Використання купажованої олії, збалансованої за жирнокислотним складом, гуміарабіка та морквяного порошку, поєднання запропонованих співвідношень усіх компонентів забезпечують оригінальні органолептичні показники майонезу та водночас надають йому функціональних властивостей, підвищують харчову та біологічну цінність. Це дозволяє отримати якісну та безпечну продукцію, збагачену фізіологічно важливими для людського організму поживними речовинами. Розроблений соус за показниками якості відповідає встановленим вимогам і може бути рекомендований для харчування людей які проживають на екологічно забруднених територіях, працюють на шкідливих виробництвах та всіх верств населення.

Ключові слова: майонез, олія, гуміарабік, порошок із моркви, соус, поліненасичені жирні кислоти (ПНЖК), технологія, функціональний продукт, дієтичні добавки.

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