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# DEVELOPING A STRATEGY FOR IMPROVING MAYONNAISE WITH DIFFERENT PROPORTIONS OF VEGETABLE OILS

*The object of research is the process of forming a strategy for the improvement of mayonnaise. Based on the SWOT analysis, a strategy for improving mayonnaise with a different ratio of sunflower, linseed and hemp oils was formed in order to increase the content of polyunsaturated fatty acids, in particular the Omega-3 family, reduce its calorie content, and develop a strategy for bringing the product to the market.*

*During the research, the following methods were used: economic-statistical, SWOT analysis method, expert method, analytical, program-targeted, as well as statistical methods of experimental data processing.*

*The work solves the task of forming a strategy for improving the recipe composition of industrially produced mayonnaise and bringing it to the market. Today, the market offers a huge number of mayonnaises with different compositions and different quality, with low, medium and high fat content, with the addition of various additives that are undesirable for the human body. Based on the broad possibilities of using mayonnaise as an additional food product, the task arose to make changes in its composition, improving the biological and nutritional value of mayonnaise with an increased content of polyunsaturated fatty acids, in particular of the Omega-3 family. Such a modified food product can be considered functional because, on the one hand, polyunsaturated fatty acids (PUFAs) of the Omega-3 family are in short supply in the diet of the average Ukrainian, and on the other hand, they play an important role in the prevention of diseases of the cardiovascular, nervous, and immune systems of the body. The conducted analysis of economic, social and technological factors characterizing the products offered on the mayonnaise market made it possible to formulate a strategy for improving mayonnaise with different proportions of sunflower, linseed and hemp oils, as well as bringing it to the market using marketing tools.*

*The practical implementation of these proposals will make it possible to bring mayonnaise with reduced calorie content to the market, which will contain a significantly higher content of PUFAs of the Omega-3, Omega-6 and Omega-9 family, which are useful for the human body. Therefore, the use of linseed and hemp oils is recommended for supporters of healthy food, which makes it popular among the main groups of consumers.*

**Keywords:** *mayonnaise, polyunsaturated fatty acids, linseed oil, hemp oil, SWOT analysis, product launch strategy.*

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## 1. Introduction

Healthy nutrition is one of the most important factors in ensuring a person's vital activities, which directly affects its health and physiological development. To date, emulsion oil-fat products (sauces and mayonnaise) are actively used in the daily diet of the population to improve the taste properties of the main dishes [1, 2]. The composition of traditional mayonnaise includes refined sunflower oil, which is a source of energy and provides the body with physiologically necessary unsaturated fatty acids, phospholipids and vitamins. However, sunflower oil is rich in ω-6 fatty acids and contains a small amount of ω-3 acids, and products based on it are not balanced in fatty acid composition [3–6]. Considering that mayonnaise is the most popular sauce in the world, it is consumed by more than 85 % of the population as an additional food product, the task was to make changes in its composition in order to improve its biological and nutritional value. To do this, it is suggested to increase the content of polyunsaturated fatty acids (PUFA) of the omega-3 family, which play an important role in the prevention of the body's immune system. Therefore, the development of strategies for improving the composition and production technology of mayonnaise with the content of non-traditional oils rich in ω-3 fatty acids, based on scientifically based approaches, is a relevant direction in the technology of production of functional products [5, 7].

The analysis of recent studies has shown that a feature of mayonnaise is the possibility of adjusting its recipe composition to meet the physiological needs of the body. Scientists have developed a large number of mayonnaise recipes based on the use of blended oil, which includes refined

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olive, pumpkin, soybean and sunflower oils in various ratios. This makes it possible to achieve a balance in the content and ratio of PUFA Omega-3 and Omega-6 groups in the oil [8, 9]. Based on the research [10], linseed oil can be recommended as a source of Omega-3 fatty acids. Its content of linolenic acid significantly exceeds the recommended amount. And the content of Omega-3 and Omega-6 in hemp oil is in the ratio of 1 to 3÷5, which is recommended by experts of the World Health Organization (Table 1). These acids are extremely necessary for preserving and protecting the functions of various cells of the human body and are recommended for inclusion in the daily diet.

**Table 1**

PUFA composition in vegetable oils

| No. | Oil | Acid content, % | | | PUFA ratio ω-9/ω-6/ω-3 |
|---|---|---|---|---|---|
| | | ω-9 | ω-6 | ω-3 | |
| 1 | Sunflower | 21.2±0.7 | 66.3±0.1 | 0.12±0.01 | 177:553:1 |
| 2 | Linseed | 22.3±0.8 | 16.2±0.7 | 52.0±1.0 | 1.4:1:3.2 |
| 3 | Hemp | 13.2±0.8 | 55.7±2.3 | 18.2±0.6 | 1.4:4.5:1 |

At the same time, the adjustment of the composition of mayonnaise, its enrichment with vitamins and macro- and microelements, should take place in compliance with the requirements of physical and chemical indicators of normative documents and the requirements of DSTU 4487:2005 «Mayonnaise».

Thus, *the purpose of the work* is to form a strategy for improving mayonnaise with different proportions of sunflower, linseed and hemp oils based on a SWOT analysis in order to increase the content of polyunsaturated fatty acids, in particular the omega-3 family, reduce its calorie content and develop a strategy for bringing the product to the market.

## 2. Materials and Methods

During the research, the following methods were used: economic-statistical, SWOT-analysis method, expert method, analytical, program-targeted, as well as statistical methods of experimental data processing.

Conducting this research involves the following stages:

– Study of the subject area and determination of factors that influence the formation of a strategy for improving the recipe of mayonnaise and bringing it to the market.

– Grouping of factors (economic, social and technological).

– Determination of weighting coefficients for each group of factors.

– Carrying out a SWOT analysis and determining internal (strong (*S*) and weak (*W*) sides of the product) and external (potential opportunities (*O*) and threats (*T*) for the product) factors [11].

– Formation of strategies for improving the recipe and technology of making mayonnaise and bringing it to the market.

– Evaluation and selection of implementation strategies.

## 3. Results and Discussion

Experimental research was carried out in the scientific laboratory of the Department of Food Biotechnology and Chemistry of Ternopil Ivan Puluj National Technical University (Ukraine). Formulation of test samples of mayonnaise with different ratios of vegetable oils was developed; Provencal mayonnaise (Table 2) was used as a control sample, and microbiological studies of mayonnaise test samples during storage were carried out to determine the expiration date.

**Table 2**

Recipe composition of experimental and control samples of mayonnaise

| No. | Raw material | Control sample | Research samples | | |
|---|---|---|---|---|---|
| | | | No. 1 | No. 2 | No. 3 |
| 1 | Sunflower oil, g | 71.78 | 35.03 | 35.03 | 23.90 |
| 2 | Linseed oil, g | – | – | 35.03 | 23.33 |
| 3 | Hemp oil, g | – | 35.03 | – | 23.33 |
| 4 | Chicken egg, g | 20.25 | 19.76 | 19.76 | 20.25 |
| 5 | Table salt, g | 1.18 | 1.14 | 1.14 | 1.18 |
| 6 | Sugar-sand, g | 1.39 | 1.34 | 1.34 | 1.39 |
| 7 | Mustard, g | 5.78 | 5.60 | 5.60 | 5.78 |
| 8 | Citric acid, g | 5.78 | 5.60 | 5.60 | 5.78 |

**Note:** compiled by the authors based on [9]

The analysis of the functioning of food industry enterprises allows to identify the most important factors that directly affect production and technological processes, which must be taken into account when creating a new product and promoting it on the market. Grouping of these factors was carried out with the help of a group of experts:

– *economic factors*: product cost, production profitability, product price, product competitiveness;

– *social factors*: quality, consumer physico-chemical and organoleptic characteristics of the product, support of healthy nutrition, providing consumers with an additional source of Omega-3 fatty acids;

– *technological factors*: the complexity of production changes, the use and storage conditions of new ingredients, degree.

Based on the analysis of the results of the evaluation of factors by experts, the weighting factor of each factor was calculated according to the formula:

$$w_i = \frac{k_i}{\sum_{i=1}^{n} k_i}, \quad (1)$$

where $w_i$ – the weighting factor of the $i$-th factor; $k_i$ – the score given by the expert for the $i$-th factor; $n$ – the number of factors.

Of the economic factors, the price of the product for consumers is the most important ($w$=0.36), and the competitiveness of the product is the least important ($w$=0.281).

Of the social factors, consumer physico-chemical and product characteristics have a weighting factor ($w$=0.522), and support for the concept of healthy eating ($w$=0.478).

Of the technological factors, the greatest weighting coefficient $w$=0.46 has the complexity of production change, and the lowest is the complexity of production change ($w$=0.21).

The statistical analysis of the obtained data provided for the determination of the mean square deviation $S$ and the coefficient of variation $V$. At the same time, the agreement of experts' opinions for the group of economic factors was $V$=17 % – above the average; for social factors – average ($V$=15 %); for technological factors – above average ($V$=22 %).

At the same time, the difference between the largest and the smallest value of the weighting factor in all groups

does not exceed 0.05. This means that all the considered factors should be taken into account during the formation of strategies for improving the composition of mayonnaise and bringing it to the market.

At the next stage, the strengths and weaknesses of the new product are determined, as well as potential opportunities and threats to the market, and a basic matrix is formed for conducting a SWOT analysis (Table 3).

**Table 3**

Basic matrix of SWOT analysis

| Strengths (*S*) | Weaknesses (*W*) |
|---|---|
| *Economical*:<br>– Cheap raw materials.<br>– Low price.<br>– Demand for the product in the market due to its uniqueness.<br>*Social*:<br>– The physical and chemical parameters of the product do not change.<br>– The product provides consumers with an additional source of Omega-3.<br>*Technological*:<br>– Ease of changing the production technology.<br>– Minor changes in the product formulation | *Economical*:<br>– Additional product advertising is required.<br>– Low competitiveness due to lack of changes in physical indicators.<br>*Social*:<br>– Corresponds to the concept of healthy nutrition.<br>*Technological*:<br>– The use of new ingredients requires additional costs for their use.<br>– Less viscosity of the product, compared to traditional mayonnaises |
| **Opportunities (*O*)** | **Threats (*T*)** |
| *Economical*:<br>– Increase in production profitability due to volume growth.<br>– Low cost.<br>– Expansion of sales markets.<br>– Growing popularity of the product.<br>*Social*:<br>– Popularization of the concept of healthy food.<br>*Technological*:<br>– Easy possibility to improve the formulation.<br>– Use of vegetable proteins.<br>– The possibility of expanding the assortment | *Economical*:<br>– Cost of new ingredients.<br>– Advertising expenses.<br>– Appearance of competing products on the market.<br>*Social*:<br>– Return of consumers to traditional products.<br>– Difficult socio-economic situation in the country.<br>– Use of artificial flavors, dyes, flavorings, etc. to make the product cheaper.<br>*Technological*:<br>– Complication of the production technology of new types of products.<br>– Increasing costs due to the complexity of the technology |

The analysis of the factors of the basic matrix allows forming strategic directions for the improvement of mayonnaise and bringing it to the market:

1. Using strengths to get the most out of potential opportunities:
   – the cheap cost of raw materials contributes to the growth of production volumes and its profitability (*S1*);
   – the affordable price of mayonnaise will allow to capture new sales markets (*S2*);
   – the uniqueness of the product (increase in the content of Omega-3) will ensure an increase in demand (*S3*).
2. Using opportunities to overcome weaknesses:
   – growing popularity of the product will increase its sales (*S4*);
   – improvement of the recipe will improve the physicochemical properties and increase its competitiveness (*S5*).
3. Overcoming threats at the expense of strengths:
   – a simple change in production technology will reduce the impact of the increase in the cost of raw materials (*S6*);
   – the uniqueness of the product (increase in Omega-3 content) will ensure an increase in demand (*S7*);
   – changes in the recipe will minimize the loss of useful substances (*S8*).
4. Strengthening weaknesses to prevent threats:
   – conducting marketing activities (*S9*);
   – lowering the price of the product due to the use of renewable resources (*S10*);
   – reduction of production waste (*S11*).

Thus, on the basis of the defined strategic directions, after receiving expert evaluations, let's determine the average arithmetic values of the importance of the strategy ($K_c$) and the probability of implementation of this strategy ($P_c$) and calculate the priority of the implementation of the strategy, taking into account the consistency of the opinions of experts (Table 4):

$$R = K_c \cdot P_c. \quad (2)$$

Therefore, after analyzing the priority of strategy implementation, in view of the recommended strategies for improving the recipe of mayonnaise with different proportions of sunflower, linseed and hemp oils, it is advisable to implement the production of new types of products with minor changes in technological processes on the basis of existing production capacities. Due to the use of new ingredients of linseed and hemp oil, without complicating the production technology, it is possible to reduce the caloric content of the final product and improve the physicochemical properties and organoleptic indicators, which will increase the competitiveness of this type of mayonnaise on the market. Reducing the cost of the product can also be achieved by using renewable resources and reducing production costs, which in difficult socio-economic conditions will ensure the growth of production volumes and profitability.

**Table 4**

Calculation of the priority of strategy implementation

| Strategies | The average value of the weight of the strategies | The average value of the probability of strategy implementation | Priority of strategy implementation |
|---|---|---|---|
| *S1* | 7.00 | 7.70 | 53.9 |
| *S2* | 7.50 | 7.25 | 54.375 |
| *S3* | 8.50 | 8.75 | 74.375 |
| *S4* | 6.75 | 7.55 | 50.9625 |
| *S5* | 7.00 | 6.75 | 47.25 |
| *S6* | 7.75 | 8.00 | 62 |
| *S7* | 7.50 | 6.50 | 48.75 |
| *S8* | 6.50 | 7.50 | 48.75 |
| *S9* | 8.00 | 7.75 | 62 |
| *S10* | 7.00 | 7.50 | 52.5 |
| *S11* | 6.50 | 7.50 | 48.75 |

In order to ensure the strategy of the product's entry into the market, it is necessary to implement an aggressive marketing policy. In particular: implementation of targeted advertising of restaurants, health food stores, conducting an active advertising campaign in social networks, using elements of outdoor advertising at sports events that support a healthy lifestyle. And also focus on its unique properties of the composition, which contains PUFAs of the Omega-3, Omega-6 and Omega-9 family, which are useful for the human body. The popularization of healthy food and the possibility of improving the recipe in comparison with traditional

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mayonnaise will allow advertising to capture new segments of the sales market.

Thus, it can be concluded that the development of new recipe components of mayonnaise based on different ratios of vegetable oils is a promising type of activity that is capable of ensuring rapid growth of production volumes with small costs for technological re-equipment. The practical significance of the conducted research lies in the development and implementation of recommendations for the improvement of the mayonnaise recipe and the mechanism of strategic planning at the food industry enterprise. The implementation of proposals for the implementation of a strategy for improving mayonnaise with different proportions of sunflower, linseed and hemp oils will allow to increase the content of polyunsaturated fatty acids and improve the physicochemical properties of the product. And the development of a strategy for bringing the product to the market will allow the enterprise to increase the efficiency of management based on the clear implementation of strategic goals. The provisions formulated in the work can be the basis for further scientific and practical developments in the field of strategic planning at the enterprise.

In the conditions of martial law, the change in the organization of production and technological processes at the enterprise has certain limitations, which are directly related to the unpredictability of economic indicators and directions of strategic development of the enterprise.

## 4. Conclusions

In this work, using a SWOT analysis and taking into account the opinions of experts, priority strategies for improving the recipe of mayonnaise with different proportions of sunflower, linseed and hemp oil, its production technology and strategies for bringing the product to the market were formed. The practical implementation of the proposed proposals will make it possible to bring to the market mayonnaise with reduced calories, which will contain a significantly higher content of PUFAs of the Omega-3, Omega-6 and Omega-9 families, which play an important role in the prevention of diseases of the cardiovascular, nervous, and immune systems of the human body.

The algorithm of the conducted research included the following stages:

– Study of the subject area and determination of influencing factors.
– Combining factors into groups: economic, social and technological.
– Using an expert method to determine weighting factors.
– Carrying out a SWOT analysis.
– Formation of strategies for improving the recipe and technology of making mayonnaise and bringing it to the market.
– Determining the priority of strategy implementation.

Therefore, the developed experimental samples of mayonnaise with different ratios of vegetable oils to improve its fatty acid composition meet the requirements of DSTU 4487:2005 «Mayonnaise». Their introduction into production is a promising type of improvement of the company's activity to ensure a rapid increase in efficiency and competitiveness with insignificant costs for technological re-equipment.

## Conflict of interest

The authors declare that they have no conflict of interest in relation to this research, whether financial, personal, authorship or otherwise, that could affect the research and its results presented in this paper.

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## Data availability

The manuscript has no associated data.

### References

1. Helikh, A., Prymenko, V., Vasylenko, O., Prikhodko, I. (2021). The Study of Quality and Safety Indicators of Mayonnaise on the Basis of Hemp Oil. *Restaurant and Hotel Consulting. Innovations, 4 (2),* 345–360. doi: https://doi.org/10.31866/2616-7468.4.2.2021.249104
2. *DSTU 4487:2005. Maionezy*. (2006). Kyiv: Derzhspozhyvstandart Ukrainy, 16.
3. Sova, N., Lutsenko, M., Lobanova, A., Hrekova, N. (2019). Use of hemp oil in mayonnaise technology. *Bulletin of the National Technical University «KhPI» Series: New Solutions in Modern Technologies, 5 (1330),* 152–159. doi: https://doi.org/10.20998/2413-4295.2019.05.20
4. Gogus, U., Smith, C. (2010). n-3 Omega fatty acids: a review of current knowledge. *International Journal of Food Science & Technology, 45 (3),* 417–436. doi: https://doi.org/10.1111/j.1365-2621.2009.02151.x
5. Goyal, A., Sharma, V., Upadhyay, N., Gill, S., Sihag, M. (2014). Flax and flaxseed oil: an ancient medicine & modern functional food. *Journal of Food Science and Technology, 51 (9),* 1633–1653. doi: https://doi.org/10.1007/s13197-013-1247-9
6. Smoliar, V. I. (2006). Kontseptsiia idealnoho zhyrovoho kharchuvannia. *Problemy kharchuvannia, 4,* 14–24.
7. Chen, D. K., Metherel, A. H., Rezaei, K., Parzanini, C., Chen, C. T., Ramsden, C. E. et al. (2023). Analysis of omega-3 and omega-6 polyunsaturated fatty acid metabolism by compound-specific isotope analysis in humans. *Journal of Lipid Research, 100424.* doi: https://doi.org/10.1016/j.jlr.2023.100424
8. Shubravska, O. V., Sokolska, T. V. (2013). Rozvytok rynku maionezu: svitovi tendentsii i vitchyzniani perspektyvy. *Ekonomika i prohnozuvannia, 2,* 80–93.
9. Lewinska, A., Zebrowski, J., Duda, M., Gorka, A., Wnuk, M. (2015). Fatty Acid Profile and Biological Activities of Linseed and Rapeseed Oils. *Molecules, 20 (12),* 22872–22880. doi: https://doi.org/10.3390/molecules201219887
10. Kryskova, L. P., Pokotylo, O. S. (2023). Fatty acid composition of mayonnaise based on sunflower, flax and hemp oil. *Scientific Messenger of LNU of Veterinary Medicine and Biotechnologies, 25 (99),* 99–103. doi: https://doi.org/10.32718/nvlvet-f9917
11. Blanco-Gutiérrez, I., Varela-Ortega, C., Manners, R. (2020). Evaluating Animal-Based Foods and Plant-Based Alternatives Using Multi-Criteria and SWOT Analyses. *International Journal of Environmental Research and Public Health, 17 (21),* 7969. doi: https://doi.org/10.3390/ijerph17217969

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