The object of this study is the technology of aerated desserts such as mousse.

There is a problem of public health related to providing people with food products that guarantee an increase in living standards. Analysis of the market for dessert products with a foam-like structure revealed that this segment is represented by a rather narrow assortment. Among producers and consumers, interest in sweet meals such as aerated desserts is growing. Plant and dairy raw materials used in the technology of aerated desserts are mainly aimed at improving their quality properties.

A survey has been conducted among 54 people on the consumption of a sweet group of meals, namely aerated desserts such as mousse. Mousse recipes with a high content of nutrients have been developed, covering the daily consumption rate and containing recipe ingredients with high biological activity. A study was conducted to determine the quality indicators of the resulting mousses, namely sensory ones, in which 50 tasters participated. The optimal and safe storage period of mousses has been established, which is for HoReCa is no more than 2 days, t=(0–4) °C; no more than 1 day, t=(8±2) °C; for industrial production – no more than 5 days, t=(0–4) °C; no more than 3 days, t=(8±2) °C. Sensory analysis revealed that the mousses did not change significantly during storage. These developed mousses could be sold both through HoReCa and through industrial production.

The experimental data obtained could be used in optimizing the production technologies of aerated desserts

Keywords: aerated desserts, marketing research, microbiological, sensory, and commercial parameters, antioxidant activity

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IDENTIFYING THE INFLUENCE OF AERATION ON THE COMMERCIAL AND SENSORY CHARACTERISTICS OF MOUSSES DURING PRODUCTION AT HORECA

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1. Introduction

Human health is one of the important aspects of the socio-economic development of the country. Food security is the main problem of people and depends on the adequate provision of all people with high-quality, affordable, and nutritious food. Scientists are faced with the issue of developing new types of products that could improve the nutrition of people and make it complete.

The modern desire of consumers to receive not only pleasure but also benefits from food products determines the stable and growing demand for "healthy desserts" because of the low quality and poor chemical composition of sweet meals. Mousses are traditionally made on the basis of dairy products, berries; their recipe and technology are a good object of research for fortifying with nutrients and giving them health-improving properties. Various multi-component compositions of mousses have become widespread, which is confirmed by studies [1, 2].

HoReCa has become one of the industries that has been affected by economic changes in recent years. For the HoReCa sector, in a market where product prices are constantly changing, purchasing power is decreasing, analyzing preferences, customer behavior, conducting surveys, and monitoring reviews could help better understand their expectations. Assessing the competition and devising a successful strategy to attract consumers could increase the profitability of establishments.

For food enterprises, it is interesting to expand the range by increasing the variety of food products. Among consumers, there is a tendency to improve the culture of nutrition, and the consumption of sweet meals is gaining special attention. The range of desserts is produced by the food industry in a smaller volume than in HoReCa and is quite diverse and is constantly updated with new types of sweet products.

Desserts with a foamy, light, creamy, stable structure, such as mousses, have a wide range of consumers, especially in summer or resort periods and are preferred by the young population. Aerated desserts such as mousse, made on the basis of dairy products, as well as using natural plant ingredients, improve the general condition of the human body.

Aerated desserts are mostly either imported into the country or produced on equipment expensive for many enterprises. Therefore, manufacturers are interested in universal equipment and technologies for developing aerated desserts.

New and improved traditional technologies in the food industry are relevant. All this gives grounds to argue about the feasibility of conducting research aimed at analyzing the production technologies of aerated mousse-type desserts fortified with necessary macro- and micronutrients, vitamins, which can be sold through HoReCa and food enterprises.

2. Literature review and problem statement

The interest of scientists in food products with health-improving properties has led to the development of products that contain biologically active and essential substances that can improve physiological processes in the human body. The range of sweet meals is diverse and quite large, and to encourage consumers, food companies are developing new recipes and trying to offer innovative products. The development of aerated desserts with protein products solves the problem of protein deficiency in the human diet, and the addition of plant raw materials increases the efficiency of their assimilation. Due to the benefits of aerated desserts, they can be consumed by different age groups of people and have the appearance of ordinary food. They can and should be consumed regularly as part of a normal diet [3]. At the same time, the issue of studying consumer preferences of different age groups of people remains unresolved.

Aerated desserts are saturated with air using various methods. Despite the lack of research on aerated desserts, their development continues to grow, as manufacturers strive to introduce the novelty and versatility of air bubbles into the food industry. Bubbles change taste sensations, rheological characteristics, and the stability of the food system and the formation of the sensory profile of aerated desserts largely depend on the uniformity of their distribution and foam stability. Work [4] investigated the rheological parameters of the product depending on the ratio of protein and gum. However, no study was conducted on the sensory parameters of the developed product.

Dairy-based desserts have different structures and textures and determine their consistency, which is an important characteristic of their quality. Consistency is one of the most complex sensory properties of sweet meals. Since the perception of this characteristic depends on individual sensations and is difficult to accurately measure, the interpretation of consistency can be ambiguous. The sensory perception of consistency is formed through the sensations that arise when consuming the product. The set of these sensations, or sensory indicators, determines whether the consumer will prefer or reject a particular product. Therefore, for the production of high-quality sweet meals such as mousse, it is important to specifically consider their sensory characteristics [5]. An unresolved issue is the expansion of sensory indicators for assessing the quality of aerated products.

There are not many companies producing aerated desserts in the market, and the volume of imports of products in the studied segment is quite high. The sweet food market requires constant updating of the assortment due to new technologies and flavor combinations, etc. Aerated desserts based on dairy products belong to the «Premium" group, they are much easier for the human body to digest, have a delicate consistency [6]. The issue of developing aerated desserts with a high content of nutrients remains.

This group of sweet meals is a profitable and new direction in the modern market. During the aeration process, the volume of the mass increases several times while its structure and ability to maintain shape for a long time improve. At the same time, the calorie content of the product decreases, and its taste becomes lighter and more delicate, which significantly exceeds the sensory and physical characteristics of non-aerated desserts [7]. But the issue of developing aerated desserts with a long shelf life, during which quality indicators will not change significantly, remains.

The largest producer of aerated desserts, namely mousses, is the company Lactel "Dolce"; the price per 170 g portion is UAH 40.59 [8]. The segment of aerated desserts is supplemented by the manufacturer "KOMO" – the elite class "Gurmanika-Premium", which produces aerated desserts with the following flavors: "Cherry-punch", "Strawberry", "Caramel", "Strawberry-vanilla" [9].

The introduction of new technologies based on the use of dairy and plant raw materials makes it possible to satisfy the needs of the human body in full nutrition, expand the range of sweet meals and increase their competitiveness in the market.

Using mathematical modeling, a recipe for an aerated smoothie based on whey, fruit juice, apple pectin, and collagen hydrolysate with a high content of macronutrients was designed [10]. It was shown that the tasting evaluation of the sensory indicators of the developed smoothie, manufactured at production facilities, had high quality characteristics. The overall score for sensory indicators was 33.8 points out of 35 possible. The implementation of the developed composition at restaurant establishments is promising. However, issues related to the marketing research into aerated desserts remain unresolved.

According to the results of research in [11], the most popular flavor of mousse is chocolate, followed by orange, lemon, and strawberry. The results of the study on the development of a new type of mousse, to the recipe of which a local, natural plant ingredient, namely licorice, was added. One of the distinctive features of licorice is the presence of saponins, which provide stable foam and are used to regulate foam in desserts and give a sweet specific taste and aroma to the finished product. From the point of view of potential health benefits for consumers and improving the textural perception of desserts, replacing part of the foaming agents of protein origin, including egg white, with licorice as a plant-based alternative is promising. However, the balance of the nutrient composition of the mousse has not been studied.

In work [12], the effect of ovalbumin on the rheological and organoleptic characteristics of the product, namely yogurt mousse, was studied. The results of the study showed that ovalbumin could be used in the technology of yogurt mousse production without any textural and organoleptic changes in the final product. The study was conducted to select the optimal amount of ovalbumin. The selected percentage of ovalbumin does not have a negative effect on the taste of the finished product and its content is economically profitable. But research related to the variation of protein percentages to understand its rheological and organoleptic behavior remains unresolved.

Work [13] is aimed at optimizing the amount of skimmed milk powder and whey protein concentrate to obtain a quality product – yogurt mousse in terms of rheological, sensory, and microstructural properties. Overcoming the relevant tasks was carried out by sensory analysis of samples, which showed changes in aromas and tastes, and this is the result of the fermentation process and fluctuations in the dry matter content. The sample with the best aerated and creamy texture was selected in comparison with other samples. Since creaminess is directly related to the viscosity of dairy products and foaming ability is associated with partial unfolding of the protein during heat treatment, it was concluded that whey protein concentrate gives the product an airy, light texture. All this allows us to state that it is advisable to conduct research related to the variation of other dairy ingredients and changes in the technological process of preparing the dessert to improve the rheology and sensory parameters of the finished product.

In [14], the results of studies on the inclusion of *Lactobacillus acidophilus* La-5, fructooligosaccharides, and inulin in

the mousse formulation, which helps regulate the intestinal microbiota, deactivate harmful bacteria, and have an immunostimulating effect, were reported. Sensory parameters such as texture, appearance, smell, and taste were studied. The lower content of skim milk and the simultaneous presence of a probiotic and two prebiotics in the synbiotic dietary mousse improved the texture and sensory properties. However, the effect of probiotics and prebiotics on obtaining the rheological parameters of the dessert was not studied in the work.

The effect of bacteria on the sensory parameters of the mousse is shown in [15]. Soy milk was used in probiotic chocolate mousse and a multifunctional dessert was obtained that improves the viability of three probiotic bacteria such as: *L. acidophilus*, *L. paracasei*, *B. lactis*. The use of cow's milk/soy milk in a 1:1 ratio improves the organoleptic properties of chocolate mousse. The developed product was investigated as a model carrier for probiotic bacteria that survived for 21 days at low storage temperatures. However, no additional studies were conducted to extend the shelf life of probiotic chocolate mousse.

In [16], oats were used as a milk substitute, as well as xanthan gum. It was found that the sensory and rheological properties of frozen desserts improve with increasing xanthan gum concentration. Frozen desserts containing 20 % oats and 0.5 % xanthan gum had higher sensory parameters than those samples containing 40 % oats and 0.3 % xanthan gum. It is promising to study alternative sources of dairy raw material replacement in lactose-free desserts. However, the work does not provide data on the study of microbiological parameters of the developed product during storage.

In study [17], the selection of protein and carbohydrate recipe ingredient complexes that improve the technological process of preparing dairy desserts with optimal structural, mechanical, and sensory properties is scientifically substantiated. The studied recipe ingredients made it possible to obtain low-calorie desserts based on dairy raw materials, namely buttermilk with a high protein content and a low fat content compared to classic recipe compositions of dairy desserts. The use of buttermilk in the production of dairy desserts is promising from the point of view of the nutritional composition of the raw materials. The study does not provide an opportunity to understand the changes in sensory, microbiological indicators, and structural and mechanical properties during storage.

In [18], the replacement of fat with inulin and fortifying with microencapsulated calcium carbonate were investigated to improve the rheological properties of yogurt mousse. Inulin has an important effect on rheological parameters and provides a creamy structure, and calcium microcapsules have a significant effect on such characteristics as viscoelasticity and flow index. The interaction between inulin and calcium microcapsules improves the texture of yogurt mousses even with a low fat content. The reported research results could be useful for the food industry in developing products with reduced fat content, fortified with minerals, and expanding the range of aerated desserts. However, issues related to the study of sensory parameters of the developed product remain unresolved.

The physicochemical and sensory characteristics of chocolate mousse using canned liquids from green peas, lentils, chickpeas, and mushrooms were investigated in [19]. According to the results of the study, the liquid from green peas had a significant effect on the texture and viscosity, on the sensory profile, namely the color and taste of the mousse. Replacing it with alternative ingredients of plant origin would expand the range of aerated desserts and knowledge about the technological process of production of this group of products. However, the combination of liquids given in the work was not investigated.

Our review of the literature demonstrates that the problem area is the lack of a comprehensive technological approach to determining the sensory, microbiological indicators, and nutrient composition of new types of aerated desserts with non-traditional recipe ingredients. The issues of determining their sensory and microbiological indicators during storage also remain open. Therefore, it is a relevant task to carry out studies on determining the effect of aeration on obtaining an aerated dessert with a high content of nutrients and consumer characteristics.

3. The aim and objectives of the study

The purpose of our study is to determine the commercial and sensory indicators in the production of new types of aerated desserts of the mousse type. This will make it possible to improve the technological and consumer characteristics of the finished product.

To achieve the goal, the following tasks were set:

– to conduct a marketing study on consumer preferences for sweet meals, including aerated desserts of the mousse type;

– to devise mousse recipes with a high content of nutrients;

– to analyze consumer characteristics and microbiological indicators of the developed mousses.

4. The study materials and methods

The object of our study is the technology of aerated desserts of the mousse type.

The subject of the study is the influence of aeration on obtaining a dessert with high structural-mechanical and consumer properties.

The hypothesis of the study assumed that by implementing a set of research methods such as marketing, recipe design, and determination of sensory indicators, it would be possible to obtain high-quality products.

The raw materials used for the preparation of mousses met the requirements of current regulatory documentation, namely: sour-milk cheese ("Prostokvashino" ("Prostonashe") DSTU 4554:2006); strawberries (DSTU 7653:2014 Fresh strawberries. Technical conditions); banana (DSTU 4033:2001); sugar (DSTU 4623:2006); cream ("Prostokvashino" ("Prostonashe") DSTU 7519:2014); TU U 15.5-00445771.008-2002; drinking water (SanPin 2.2.4.-171-10), dietary supplement "VitCanGel", the composition of which is given in previous studies [3].

Marketing research was conducted by surveying potential consumers and a questionnaire form was formed – a Google form, which included questions that helped determine the relevance of the production of an aerated dessert, namely mousse.

To determine the biological activity of extracts of recipe ingredients of the developed mousses, an express method was used, based on the catalytic reaction of electron transfer by the product in the system: nicotinamide adenine dinucleotide reduced by NAD·H2–$K_3[2Fe(CN)_6]$ potassium ferricyanide.

Conducting the test: Control experiment: 3 cm^3 of potassium ferricyanide solution were placed in a dry test tube; as well as 6 cm^3 of buffer solution with pH=7; and 1 cm^3 of NAD·H2 solution. The mixture was quickly stirred; then the optical density was measured. Distilled water was used as the reference solution.

The value of ΔAK (control) is found from (1):

$$\Delta AK = AK_1 - AK_2, \quad (1)$$

where ΔAK is the change in the density of the control system as a result of direct oxidation of NAD·H2 potassium ferricyanide;

AK_1 – initial optical density;

AK_2 – optical density after 180 sec.

Sample study. In a dry test tube, 3 cm^3 of potassium ferricyanide were placed; as well as 5 cm^3 of buffer solution pH=7; 1 cm^3 of NAD·H2; 1 cm^3 of the test sample. The mixture was quickly stirred; then the optical density was measured at λ=325 nm. The solution was a mixture of 9 cm^3 of distilled water and 1 cm^3 of the test sample:

$$\Delta A_{sample} = A_{1sample} - A_{2sample}, \quad (2)$$

where ΔA_{sample} is the change in optical density of the system in the presence of the sample;

$A_{1sample}$ – initial optical density;

$A_{2sample}$ – optical density after 180 sec.

Results processing. Biological activity η is calculated from formula (3):

$$\eta = \frac{\Delta A_{sample}}{\Delta AK} \times K, \text{ (a.u.)}, \quad (3)$$

where ΔA_{sample} is the change in optical density of the system in the presence of the sample;

ΔAK – change in optical density of the control system as a result of direct oxidation of NAD·H2 potassium ferricyanide;

K – sample dilution factor [20].

Sensory analysis of the developed products was carried out according to the indicators provided by the standards DSTU 4503:2005. «Cheese products. General technical conditions" and «DSTU 3718:2007 Food concentrates. Sweet meals. Jellies, mousses, puddings, milk concentrates. General technical conditions", namely: surface, color, cross-sectional appearance, consistency, smell, taste, and degree of the dietary supplement [21, 22]. A new indicator was added: «appearance". The assessment was carried out according to the gradation of a four-point scale of indicators: «excellent", «good", «satisfactory", and «unsatisfactory". Each quality indicator has a maximum score of 5 points and weighting factors have been determined for them. The quality level according to sensory indicators was determined from the following formula:

$$X = a_1B_1 + a_2B_2 + ... + a_nB_n, \quad (4)$$

where a is the weighting factor of a single indicator;

B – score in points of a separate indicator.

Demand research was conducted using a questionnaire survey method. The number of tasters was 50 people.

The qualitative and quantitative composition of the microbiota of mousses was assessed in accordance with the standards DSTU 4503:2005. «Curd products. General technical conditions" and «DSTU 3718:2007 Food concentrates. Sweet meals. Jellies, mousses, puddings, milk concentrates. Microbiological indicators of mousses according to the standard are given in Table 1.

The scheme of seeding mousses over time is given in Table 2.

Table 1

Microbiological indicators of mousses according to the standard "DSTU 4503:2005. Curd products. General technical conditions" and "DSTU 3718:2007 Food concentrates. Sweet meals. Jellies, mousses, puddings, milk concentrates. General technical conditions"

Indicator	Norm for aerated desserts
QMAFAnM, CFU in 1 g, not more than	$5 \cdot 10^4$
BGKP (coliforms) in 0.001 g of product	Not allowed
E. coli in 1.0 g of product	Not allowed
Pathogenic microorganisms, including *Salmonella* in 25 g of product	Not allowed
Mold fungi, CFU in 1 g, not more	50
Number of yeasts in 1 g of product, CFU, not more	100
Lactic acid bacteria, CFU in 1 g, not less	$1.0 \cdot 10^6$
Staphylococcus aureus, CFU in 0.01 g	Not allowed

Table 2

Aerated dessert seeding schedule by time

Sample	Indicator		
	Day 1	Day 2	Day 5
Mousse	QMAFAnM, molds and yeasts, pathogenic microorganisms of the genus *Salmonella*, *Staphylococcus aureus*, lactic acid bacteria	QMAFAnM, lactic acid bacteria	QMAFAnM, lactic acid bacteria

The results of quantitative accounting were expressed in CFU/g (colony-forming units per gram).

5. Results of investigating consumer characteristics of mousses

5. 1. Determining preferences for sweet meals through marketing research

Studying the assortment of sweet meals allowed us to obtain percentage ratios of consumer preferences. An analysis of consumer preferences of potential consumers was conducted.

54 potential consumers took part in the study, among them 62.3 % were women, 37.7 % were men. The age of the respondents was: 18–25 years – 43.1 %, 26–35 years – 32.1 %, 36–45 years – 14.0 %, 45–55 years – 10.8 %.

Consumer surveys on the most frequently consumed meals are shown in Fig. 1.

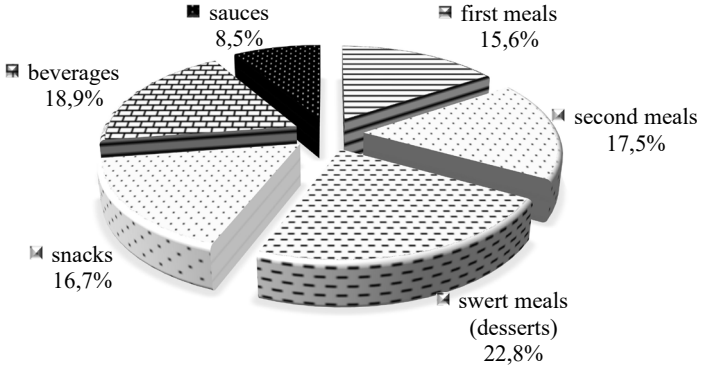

Fig. 1. The most consumed meals at HoReCa

The results of the survey on the choice of meals by HoReCa consumers are as follows: 22.8 % preferred sweet meals – desserts (Fig. 1).

The survey of consumers on the most frequently consumed desserts is shown in Fig. 2.

The survey results (Fig. 2) showed that 43.5 % of consumers preferred the dairy group of desserts, which include mousses, soufflés, puddings, sambucas, and creams. 11.3 % confirmed that they consume pancakes, 18.6 % of consumers indicated that they prefer frozen desserts, and 26.6 % preferred baked desserts.

Consumer preferences for different types of aerated desserts are shown in Fig. 3.

As can be seen from Fig. 3, mousses are the most consumed sweet meal, the percentage of which is 24.2 %, and for sambuca – 8.3 %. Puddings and blancmange are the least consumed – 10.2 % and 8.9 %, respectively. Ice cream is consumed by 20.5 %, creams and soufflés are consumed by 10.7 % and 17.2 %, respectively.

The distribution of taste preferences among consumers was determined from the most common flavors used in the production of mousses. The survey results are shown in Fig. 4.

Based on average prices for desserts, a survey was conducted at HoReCa regarding the price per 100 g portion of mousse (Fig. 5).

According to the survey results, it was found that the price for 1 serving of aerated mousse-type dessert should not exceed 69 UAH.

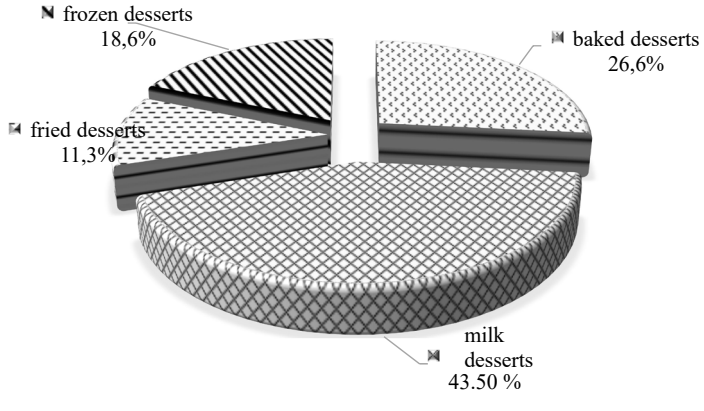

Fig. 2. Most consumed desserts

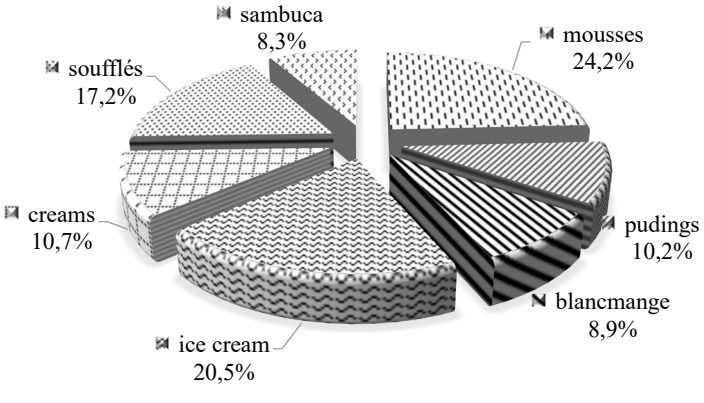

Fig. 3. Consumer preferences among different types of aerated desserts

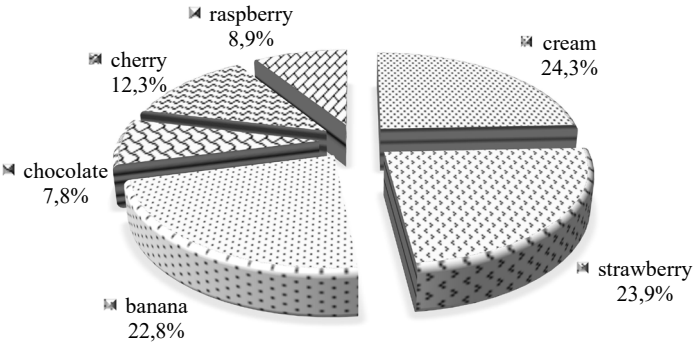

Fig. 4. Consumers' taste preferences for a dairy-vegetable-based aerated dessert

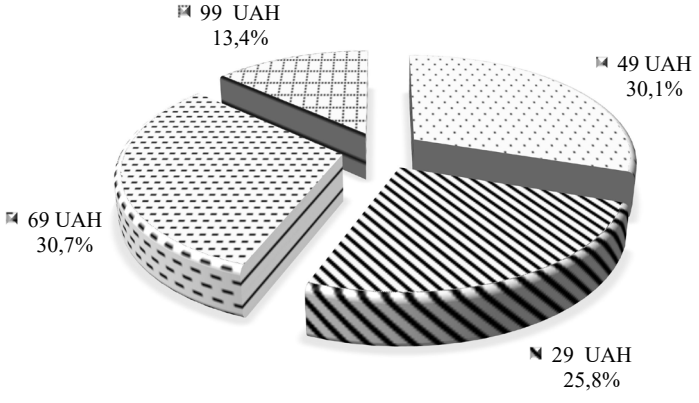

Fig. 5. Average price of aerated desserts

5. 2. Development of recipes for mousses with a high content of nutrients

The results of the study on the effect of a dietary supplement on the aerated structure are reported in [3]. Due to the fact that the dietary supplement contains a complex of prescription ingredients, the list of which is collagen hydrolysate, gelatin, juice, and L-ascorbic acid, the supplement gives better results in terms of the effect on the aerated structure than alternative mono-ingredient options, such as: egg white, carrageenan, modified starches, alginates, agaroid, pectin, etc.

Since dairy and vegetable raw materials in the technologies of aerated desserts are used mainly to improve their quality characteristics, including fortifying with protein components, micro- and macroelements, vitamins, etc., therefore, based on previous studies and taking into account the daily norm of macronutrient consumption, recipes were developed for the preparation of aerated desserts of the mousse type, namely: "Cream and cheese mousse", "Strawberry mousse" (Tables 3, 4, respectively). Losses were determined by the ratio of the difference between the gross mass and the net mass to the gross mass and were expressed in percent.

The results of the analysis of the nutritional composition of mousses are given in Table 5 and show a high protein content.

According to the recommendations of the World Health Organization, the minimum daily protein intake for an adult is from 0.83 g to 1.0 g per 1 kg of body weight [23]. For a person weighing 70 kg, it is necessary to consume at least 58.1 g of protein per day, the use of "Cream-Cheese" and "Strawberry" mousses

covers the daily protein intake by 12.3 % and 5.04 %, respectively.

Table 3

Recipe for "Cream and Cheese Mousse" per 100 g serving

Recipe ingredient	Losses, %	Gross, g	Net, g
Sour milk cheese, 5.0 % «Prostokvashino» («Prostonashe»)	4.7	21.0	20.0
Dietary supplement «VitCanGel»	0.0	4.0	4.0
Sugar	16.6	12.0	10.0
Banana	0.5	18.0	17.9
Cream, 33 % «Prostokvashino» («Prostonashe»)	7.0	18.5	17.2
Water	0.0	30.9	30.9
Total	–//–	104.4	100.0

Table 4

Recipe for "Strawberry Mousse" per 100 g serving

Recipe ingredient	Losses, %	Gross, g	Net, g
Strawberries	6.6	45.0	42.0
Dietary supplement «VitCanGel»	0.0	4.0	4.0
Sugar	0.0	10.0	10.0
Cream, 33% «Prostokvashino» («Prostonashe»)	3.5	29.0	28.0
Water	0.0	16.0	16.0
Total	-//-	104.0	100.0

Table 5

Macronutrient composition of mousses (g/100 g)

Macronutrient ID	Macronutrient content	
	«Creamy cheese mousse»	«Strawberry mousse»
Water	69.9	72.4
Protein	7.17	2.93
Fat	6.90	9.53
Carbohydrates	15.7	14.84
Ash	0.33	0.30
Total	100.0	100.0

Determining such processes as antagonism, synergism, and additivity between biological components is an important indicator in the production of high-quality dessert products. In the process of designing and forming the quality of new desserts, it is possible to have effects that have synergistic properties as a result of the interaction of biologically active substances of the recipe ingredients. Table 6 gives the biological activity of the recipe ingredients of mousses.

Table 6

Biological activity of recipe ingredients of mousses, a.u.

Recipe ingredient	Biological activity of recipe ingredients, a.u.	Estimated biological activity of recipe ingredients, a.u. per 100 g of mousse
Strawberry	98.0	41.2
Fermented milk cheese, 5.0 % «Prostokvashino» («Prostonashe»)	90.0	18.0
Dietary supplement «VitCanGel»	234.0	9.36
Banana	256.0	45.8
Cream, 33.0 % «Prostokvashino» («Prostonashe»)	30.0	8.4

According to the results given in Table 6, the highest biological activity is possessed by the dietary supplement "VitCanGel" and banana, the biological activity of which is 234 units of activity and 256 units of activity, respectively. The recipe ingredients strawberries, cottage cheese, and cream have a biological activity of 98 units of activity, 90 and 30 units of activity, respectively.

The biological activity of the finished mousses was determined. The results are shown in Fig. 6, 7.

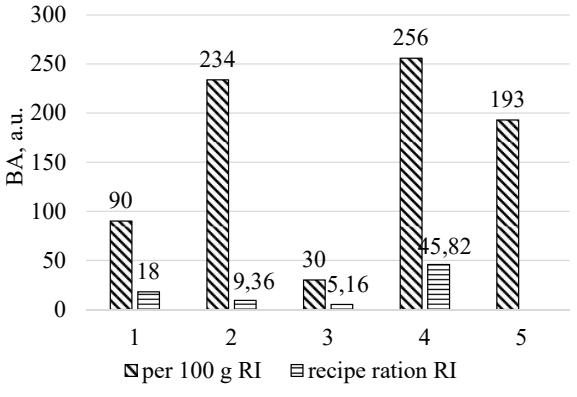

Fig. 6. Biological activity of "Cream-cheese mousse" and its recipe ingredients (PI): 1 – Sour milk cheese, 2 – Dietary supplement "VitCanGel", 3 – Cream, 33 % fat content, 4 – Banana, 5 – "Cream-cheese mousse"

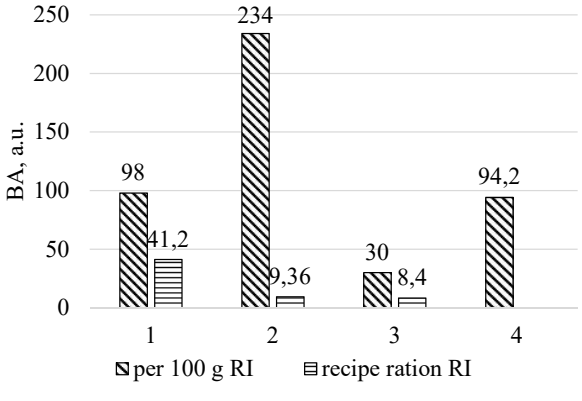

Fig. 7. Biological activity of "Strawberry Mousse" and its recipe ingredients (PI): 1 – Fresh strawberries; 2 – Dietary supplement "VitCanGel"; 3 – Cream, 33 %; 4 – "Strawberry Mousse"

The data above show that ready-made mousses have a synergistic effect of components due to micro- and macronutrients, amino acids.

5. 3. Research on sensory and microbiological indicators of mousses

5. 3. 1. Research on sensory indicators of developed mousses during storage

The dynamics of changes in sensory indicators in the scoring system are shown in Fig. 8. The intervals of changes in the values of the indicators were set equal to 1 to 5 points: 1–2 – unsatisfactory quality;

2–3 – satisfactory quality; 3–4 – good quality; 4–5 – excellent quality.

Sensory analysis of mousses was carried out immediately after production and at a storage temperature of (5±2) °C for 5 days in a glass container with a capacity of 150 ml.

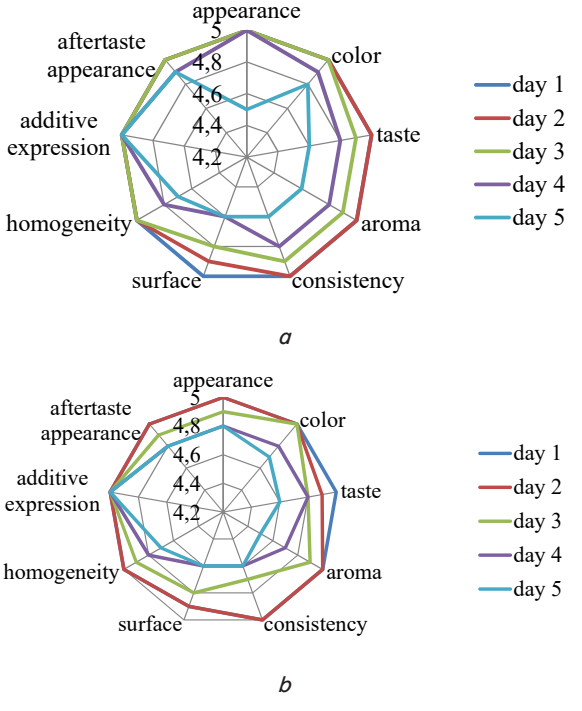

Fig. 8. Dynamics of changes in sensory parameters of mousses during storage at t=(5±2) °C for 5 days: *a* – "Cream and cheese mousse"; *b* – "Strawberry mousse"

Sensory analysis of the developed products during storage at a temperature of (5±2) °C for 5 days compared to the products tested immediately after preparation revealed that the sensory parameters did not change significantly. Due to this storage period, it can be stated that the mousses are suitable for production both at HoReCa and under industrial conditions.

5. 3. 2. Investigating the qualitative and quantitative composition of the microbiota of mousses during storage

In the process of studying the microbiological indicators of mousses, samples were stored at different temperatures: (0–4) °C and (8±2) °C for 5 days as the developed mousses will be sold at HoReCa. Mousse has a shelf life of up to 3 days; however, from the point of view of the scientific approach, it was important to study the dynamics of storage over 5 days.

The study of the composition of the microbiota of "Cream and Cheese Mousse" and "Strawberry Mousse" during their storage to establish safe storage periods was carried out every 24 hours for the presence of sanitary indicator microorganisms provided for by "DSTU 4503:2005. Cheese products. General technical conditions" and "DSTU 3718:2007 Food concentrates. Sweet meals. Jellies, mousses, puddings, milk concentrates. General technical conditions" [21, 22]. The results are given in Tables 7, 8.

According to the results of our study, given in Tables 7, 8, no pathogenic microorganisms were detected.

Table 7

Dynamics of microbiological indicators of "Cream and cheese mousse" when stored in a glass container for 5 days (n=3, P=0.95)

Indicator	day 1	day 2	day 5
When stored at temperature t=(0–4) °C			
QMAFAnM, CFU/g	$1.0\cdot10^4$	$1.0\cdot10^4$	$1.0\cdot10^4$
Mold+yeast	not detected	not detected	not detected
BGCP+*E. coli*	not detected	not detected	not detected
Salmonella, per 25 g product	not detected	not detected	not detected
Staphylococcus aureus	not detected	not detected	not detected
Lactic acid bacteria, CFU/g	$1.0\cdot10^5$	$1.0\cdot10^7$	$1.0\cdot10^7$
When stored at temperature t=(8±2) °C			
QMAFAnM, CFU/g	$1.0\cdot10^4$	$1.0\cdot10^4$	$1.0\cdot10^4$
Mold+yeast	not detected	not detected	not detected
BGCP+*E. Coli*	not detected	not detected	not detected
Salmonella, per 25 g product	not detected	not detected	not detected
Staphylococcus aureus	not detected	not detected	not detected
Lactic acid bacteria, CFU/g	$1.0\cdot10^5$	$1.0\cdot10^7$	$1.0\cdot10^7$

Table 8

Dynamics of microbiological indicators of "Strawberry Mousse" when stored in a glass container for 5 days (n=3, P=0.95)

Indicator	day 1	day 2	day 5
When stored at temperature t=(0–4) °C			
QMAFAnM, CFU/g	$5.0\cdot10^3$	$5.0\cdot10^3$	$5.0\cdot10^3$
Mold+yeast	not detected	not detected	not detected
BGCP+*E. coli*	not detected	not detected	not detected
Salmonella, per 25 g product	not detected	not detected	not detected
Staphylococcus aureus	not detected	not detected	not detected
Lactic acid bacteria, CFU/g	$1.0\cdot10^6$	$1.0\cdot10^7$	$1.0\cdot10^7$
When stored at temperature t=(8±2) °C			
QMAFAnM, CFU/g	$5.0\cdot10^3$	$5.0\cdot10^3$	$5.0\cdot10^3$
Mold+yeast	not detected	not detected	not detected
BGCP+*E. Coli*	not detected	not detected	not detected
Salmonella, per 25 g product	not detected	not detected	not detected
Staphylococcus aureus	not detected	not detected	not detected
Lactic acid bacteria, CFU/g	$1.0\cdot10^7$	$1.0\cdot10^7$	$1.0\cdot10^7$

The shelf life of mousses is determined as follows: for HoReCa – no more than 2 days at a storage temperature of (0–4) °C; no more than 1 day at a storage temperature of (8±2) °C; for industrial production – no more than 5 days at a storage temperature of (0–4) °C; no more than 3 days at a storage temperature not higher than (8±2) °C.

6. Discussion of results based on determining the nutrient and sensory indicators when developing new types of aerated mousse-type desserts

Dairy-based desserts have a variety of textures, tastes, and appearance. This is made possible by combining dairy ingredients and stabilizers. Such desserts are attractive to different groups of consumers, both for the elderly and for children. From the data obtained, shown in Fig. 1, a

significant part of potential consumers chose sweet meals (22.8 %), among this group of meals, the most popular are aerated mousse-type desserts (24.2 %). Among the most common flavors, according to the results of the study, the highest percentages are cream (24.3 %), strawberry (23.9 %), banana (22.8 %). Aerated mousse-type desserts will be in demand among consumers. This is made possible by the characteristic consistency of the aerated food system, the presence of air bubbles in which makes this type of sweet dish more tender, tasty, and easy to eat. The results obtained correlate with the results of other researchers [24, 25].

The value of these marketing studies is great, as they provide an understanding of the feasibility of further development of mousse production, which includes sour milk cheese, cream, strawberries, banana, and a dietary supplement on a protein-vegetable basis.

When developing the composition of mousses, considerable attention was paid to sensory indicators and the study of the nutrient composition of the finished product. The recipes of sweet meals were optimized according to the macronutrient composition, in accordance with the recommended daily intake, taking into account the physiological needs of humans in biologically active substances. Unlike [26], in which the interaction of biologically active substances of dairy and plant ingredients of mousse was not studied. The results of analysis of "Cream-Cheese" and "Strawberry" mousses are given in Table 5 and allow one to develop products with a high protein content, which is quite important for ensuring the nutritional value of the diet of modern humans. The advantages of studying the biological activity of mousses are the study of the intermolecular interaction of components, which allows one to consider in more detail how the components of the dessert can interact with each other and how this can affect their antioxidant properties. This approach takes into account not only individual antioxidants but also their effect on the energy homeostasis of the body, which makes it possible to assess biological activity as one of the methods of a comprehensive approach to the development of new types of aerated desserts.

The results of the biological activity of the mousse recipe ingredients shown in Fig. 6, 7 demonstrated that the recipe components have a synergistic effect in the finished mousses due to micro- and macronutrients, including amino acids. The discrepancy in the values of the biological activity indicator between the selected recipe ingredients can be explained by the different composition of biologically active substances that exhibit antioxidant properties.

Based on the data given in Table 5 and Fig. 6, 7, it can be concluded that potential consumers are interested in the appearance on the market of mousses with local products, knowing about the nutritional value, benefits of raw materials, and the finished product.

A sensory analysis of the developed mousses was carried out, the results of which revealed (Fig. 8, *a*, *b*) that the indicators "Homogeneity", "Consistency" did not change at a temperature of (5±2) °C during 5 days of storage of mousses. The advantage of this study is the production of high-quality mousses without additional technological techniques.

The results of the qualitative and quantitative composition of the microbiota of mousses during storage showed that microorganisms of such groups as BGKP, mold fungi and yeasts, *Salmonella*, *Staphylococcus aureus* were not detected.

Mousse is a product that can be stored for 5 days at low temperatures, under conditions of sale through industrial production, which determines the importance of the stability of all its recipe components during the shelf life. For this reason, the prospect of further work is to conduct a study on the physicochemical characteristics of mousses during long-term storage.

The limitation of the study is that the data presented are limited exclusively to the technology of aerated desserts since the application of the proposed technological solutions to other technologies requires additional research.

Among the potential shortcomings of the study is that the mass fraction of nutrients in the recipe ingredients may vary depending on the batch of raw materials. This may affect the quality indicators of mousses in different ways and therefore should be investigated in each specific sample of raw materials.

An important aspect of further research and development of the technology for preparing sweet meals for the HoReCa sector is the feasibility of using non-traditional regional raw materials in their composition to improve the quality characteristics of aerated desserts.

7. Conclusions

1. Consumer preferences have been studied and, according to the results of a survey of potential consumers of the developed mousses, it can be concluded that, given their taste and health-improving properties, it can be expected that the new aerated dessert on a dairy-vegetable basis will be in demand.

2. Recipes for aerated desserts have been developed with the following composition: sour-milk cheese, 5.0 % "Prostokvashino" ("Prostonashe") – 20 g, dietary supplement "VitCanGel" – 4 g, sugar – 10 g, banana – 17.9 g, cream, 33 % "Prostokvashino" ("Prostonashe") – 17.2 g for "Cream-cheese mousse". Composition of "Strawberry mousse": strawberries – 42 g, dietary supplement "VitCanGel" – 4 g, sugar – 10 g, cream, 33 % "Prostokvashino" ("Prostonashe") – 28 g.

The sum of essential nutrients (g/100 g of product) is for "Cream Cheese Mousse" – 29.77; for "Strawberry Mousse" – 27.32; mass fraction of protein – 7.17 g and 2.93 g, carbohydrates – 15.7 g and 14.84 g, fats 6.90 g and 9.53 g, for "Cream Cheese Mousse" and "Strawberry Mousse", respectively, which makes the mousses nutritious and healthy.

The ability of the recipe ingredients to the process of synergism was studied. The data obtained indicate that due to micro- and macronutrients, including amino acids, the recipe ingredients of mousses have a synergistic effect. The biological activity of the developed mousses is 193 a.u. and 94.2 a.u. for "Cream and Cheese Mousse" and "Strawberry Mousse", respectively.

3. An analysis of the change in sensory indicators during storage of mousses at a temperature of (5±2) °C for 5 days was carried out. Sensory indicators did not change significantly.

The microbiological safety of the developed mousses was proven, and the storage periods were determined,

namely, the development of storage conditions in glass containers was carried out. The devised storage modes make it possible to state that the developed desserts can be sold not only through HoReCa, but also through industrial production.

Conflicts of interest

The authors declare that they have no conflicts of interest in relation to the current study, including financial, personal, authorship, or any other, that could affect the study, as well as the results reported in this paper.

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Data availability

The data will be provided upon reasonable request.

Use of artificial intelligence

The authors confirm that they did not use artificial intelligence technologies when creating the current work.

References

1. Golubtsova, J. (2017). Development of Curd Mousse with Fruit-and-berry Builders. Journal of Pharmaceutical Sciences and Research, 9 (4), 407.
2. Gomes, O. J. S., Leitão, A., Gaspar, M. C., Vitorino, C., Sousa, J. J. S., de Sousa, H. C. et al. (2024). Fortified chocolate mousse with powder and extract from Moringa oleifera leaves for nutritional value improvement. Food Chemistry, 441, 138338. https://doi.org/10.1016/j.foodchem.2023.138338
3. Dzyuba, N., Oliinyk, M., Kalugina, I., Poplavska, S., Bortnykov, Y., Zakharova, S. (2023). Improving the technology of aeration of the food system of mousse at horeca enterprises. Eastern-European Journal of Enterprise Technologies, 2 (11 (122)), 74–82. https://doi.org/10.15587/1729-4061.2023.275615
4. Parseh, S., Mohebbi, M., Mohammadi-Moghaddam, T., Sabbaghi, H. (2022). Optimization of Formulation for Aerated Dessert Containing Whey Protein and Xanthan Gum Concentrate using Response Surface Methodology and Investigation on Rheological and Texture Properties. Research and Innovation in Food Science and Technology, 11 (1), 1–16. http://doi.org/10.22101/JRIFST.2020.254462.1192
5. Rudakova, T. V., Minorova, A. V., Narizhnyi, S. A. (2024). Sensornyi analiz strukturovanykh molochnykh desertiv z kombinovanym skladom syrovyny. Materialy VI Vseukrainskoi naukovopraktychnoi konferentsiyi. Khmelnytskyi, KhNTU, 168–171. Available at: https://rep.btsau.edu.ua/bitstream/BNAU/11693/1/sensornyy_analiz.pdf
6. Analysis of the confectionery market with whipped (aerated) masses in Ukraine. 2021 year. Available at: https://pro-consulting.ua/en/issledovanie-rynka/analiz-rynka-konditerskih-izdelij-so-vzbitymi-aerirovannymi-massami-v-ukraine-2021-god
7. What is aeration? Find out how to produce airy textures. Available at: https://blog.sosa.cat/en/aeration-aerated-textures/
8. Desert syrkovyi Dolche yahidnyi fiuzhn 3,4%, 170h. Available at: https://shop.silpo.ua/product/desert-syrkovyi-dolche-iagidnyi-f-iuzhn-3-4-940380?gad_source=1&gclid=CjwKCAiA8sauBhB3EiwAruTRJi_eSG7KitBmGmznZvI03jDnAUJVpTR_sAgGbTSyVn55oo-n17htbhoC8SoQAvD_BwE
9. Elit novynky vid «KOMO». Available at: https://www.volyn.com.ua/news/9376-elitni-novinki-vid-komo.html
10. Dzyuba, N., Poplavska, S., Palvashova, A., Yemonakova, O., Ivashina, L., Kolisnichenko, T. et al. (2019). Development of a policomponent composition of smuz using biotechnological and mathematical modeling and determination of its food value. Eastern-European Journal of Enterprise Technologies, 5 (11 (101)), 56–65. https://doi.org/10.15587/1729-4061.2019.180755
11. Hanieh, A., Karazhiyan, H. (2019). The effect of substitution of egg white with licorice on some of physicochemical properties of mousse. Iranian Food Science and Technology Research Journal, 15 (1), 121–131. https://doi.org/10.22067/ifstrj.v0i0.71515
12. Menéndez, M., Paredes, B., Iglesias, O., Rendueles, M., Díaz, M. (2006). Rheological Behavior and Organoleptic Effects of Ovalbumin Addition in Yogurt Mousse Production. Journal of Dairy Science, 89 (3), 951–962. https://doi.org/10.3168/jds.s0022-0302(06)72160-9
13. Gomez-Betancur, A. M., Carmona-Tamayo, R., Jaimes-Jaimes, J., Casanova-Yepes, H., Torres-Oquendo, J. D. (2020). Optimisation of yogurt mousse dairy protein levels: a rheological, sensory, and microstructural study. International Food Research Journal, 27 (6), 1076–1086.
14. Xavier-Santos, D., Bedani, R., Perego, P., Converti, A., Saad, S. M. I. (2019). L. acidophilus La-5, fructo-oligosaccharides and inulin may improve sensory acceptance and texture profile of a synbiotic diet mousse. LWT, 105, 329–335. https://doi.org/10.1016/j.lwt.2019.02.011
15. Taghizadeh, G., Jahadi, M., Abbasi, H. (2018). Physicochemical properties of probiotic soy milk chocolate mousse during refrigerated storage. Applied Food Biotechnology, 5 (2), 79–86. https://doi.org/10.22037/afb.v5i2.19155
16. Henden, Y., Gümüş, T., Kamer, D. D. A., Kaynarca, G. B., Yücel, E. (2024). Optimizing vegan frozen dessert: The impact of xanthan gum and oat-based milk substitute on rheological and sensory properties of frozen dessert. Food Chemistry, 460, 140787. https://doi.org/10.1016/j.foodchem.2024.140787
17. Rudakova, T., Minorova, A., Moiseeva, L. Krushelnytska, N., Narizhnyy, S. (2023). Scientific approaches to the creation of technology structured milk desserts with a combined composition of raw materials. Animal Husbandry Products Production and Processing, 2, 128–136. https://doi.org/10.33245/2310-9289-2023-182-2-128-136

18. Gomez-Betancur, A. M., Carmona-Tamayo, R., Martínez-Álvarez, O. L., Casanova-Yepes, H., Torres-Oquendo, J. D. (2020). Effect of fat substitution using long-chain inulin and fortification with microencapsulated calcium in the rheological and sensory properties of yogurt mousse. Journal of Food Process Engineering, 45 (7). https://doi.org/10.1111/jfpe.13433
19. Donatus, F., Sintang, M. D. B., Julmohammad, N., Pindi, W., Ab Wahab, N. (2023). Physicochemical and Sensory Properties of Bahulu and Chocolate Mousse Developed from Canned Pulse and Vegetable Liquids. Applied Sciences, 13 (7), 4469. https://doi.org/10.3390/app13074469
20. Kotliar, Ye., Vikul, S., Sevastyanova, E., Dets, N., Kruchek, O. (2020). Technology of a cosmetic lotion based on hydroalcoholic extract from crushed grape seeds. Scientific Works of National University of Food Technologies, 26 (5), 156–169. https://doi.org/10.24263/2225-2924-2020-26-5-20
21. DSTU 4503:2005. Curd Articles. General Spesifications. Available at: https://online.budstandart.com/ua/catalog/doc-page?id_doc=84633
22. DSTU 3718:2007. Food Concentrates Sweet Dishes Jellies, Mousses, Puddings, Milk Concentrates. General Specifications. Available at: https://online.budstandart.com/ua/catalog/doc-page.html?id_doc=84629
23. Deputat, Y. M., Zhaldak , A. Y. (2021). Hygienic assessment of the average daily diet of the Special Operations Forces of the Armed Forces of Ukraine. Ukrainian Journal of Military Medicine, 2 (4), 60–70. https://doi.org/10.46847/ujmm.2021.4(2)-060
24. Duquenne, B., Vergauwen, B., Capdepon, C., Boone, M. A., De Schryver, T., Van Hoorebeke, L. et al. (2016). Stabilising frozen dairy mousses by low molecular weight gelatin peptides. Food Hydrocolloids, 60, 317–323. https://doi.org/10.1016/j.foodhyd.2016.04.001
25. Bouizar, R., Mouzai, A., Boughellout, H. (2021). Impact of milk substitution by sweet whey on chocolate mousse physicochemical, microstructural and sensory properties. Algerian Journal of Nutrition and Food Sciences, 1 (4), 17–24 Available at: https://fac.umc.edu.dz/inataa/revue/files/ajnfs0104003.pdf
26. Zimbru, R.-O., Padureţ, S., Amariei, S. (2020). Physicochemical and color evaluation of confectionery mousses. Food & Environment Safety, 19 (3), 228–236. Available at: https://fens.usv.ro/index.php/FENS/article/view/732/