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MODELING OF INNOVATIVE TECHNOLOGY OF FRUIT AND BERRY DESSERTS

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The topicality. Scientists in many countries point out that food controls and models various functions of the human body and consequently participates in the maintenance of health and prevents the risk of several diseases. The variety of food in restaurants, along with trade, is the link that connects the food industry with consumers. Besides, the complexity of such dishes, which are offered to consumers by restaurants, are complicated by numerous methods of culinary processing. Only a competent technologist at the enterprise can provide the utility and safety of complex multi-component compositions.

The aim of the work is to create a mathematical model for determining the balance of biologically active substances in prescription compositions of desserts made using blended semi-finished vegetable raw materials. The task of the study is to determine the composition of the blended prescription mixture of a model pair of vegetable puree with the maximum content of biologically active substances. Results. The scientific novelty of the obtained results is that for the first time mathematical models of blended pairs were obtained and physicochemical and organoleptic parameters of innovative desserts were studied. Used modern research methods organoleptic, physicochemical; mathematical processing of experimental data was performed using computer technology. According to the results of organoleptic evaluation, the rating score of apple-dogwood dessert exceeded the control sample on apple puree (97.72 vs. 91.18

points[2]). Conclusions and discussions. The developed technologies of whipped desserts with the introduction of model blends of vegetable raw materials meet the requirements of regulatory documentation and consumer requirements, which allow to expand the range of this group of dishes. The scientific novelty of the obtained results is that for the first time it was proposed to model the composition and use in the technology of whipped desserts such as "Sambuk" dogwood berries, cranberries, kiwis and apples. The practical significance of the obtained results is manifested in the possibility to use the proposed modeling of new technologies and in their implementation in restaurants.

***Keywords**:* restaurant products, blended semi – finished product, mathematical modeling, desserts, quality assessment.

The topicality of problem

Formulation of the problem. It is possible to solve the problem of enriching the diet with traditional nutrients (vitamins, minerals, dietary fiber and other biologically active substances) by increasing the diet of fruits and berries. I. Malezhik, L. Strelchenko (2016), V. Polevik, I. Koretska (2018), E. Dobrydina (2010) recognize that one of the sources of supply of biologically active substances to the human body can be desserts using fruit and berry raw materials Light berry and fruit desserts are traditionally popular. Research in recent years shows that in solving this problem, a great deal of experience has been accumulated in our country and abroad with regard to the use of vegetable raw materials, including non-traditional ones, as additives in food technologies, in particular desserts. The works of domestic and foreign scientists play a significant role in solving the problems of substantiation and development of food technology with herbal supplements.

By the problem of developing desserts with high quality indicators, in particular the storage of vitamins, trace elements, biologically active substances and their enrichment of products based on fruit and berry raw materials deal scientists O. N. Safonova (2001), V. M. Yatsenko (2002), L. M. Telezhenko, A. T. Bezusov, (2004), O. I. Cherevko, M. P. Golovko, M. L. Serik (2010), P. P. Pivovarov, N. G. Grinchenko, R. V. Plotnikova (2012), I. L. Koretskaya, T. V. Zinchenko (2013), G. M. Bandurenko, O. S. Bessarab , I. F. Malezhik, T. M. Levkivska (2016).

However, the analysis of existing dessert recipes showed that, nevertheless, their range remains limited. Expansion of dessert ingredients, in terms of the number of ingredients, in order to enrich the dish BAR, requires the use of matrix mathematical methods of modeling the composition and allows the use of common types of plant materials: fruits, berries and fruits, which have a high biological evaluation.

To optimize the composition of blended pairs, it is advisable at the beginning of the calculation modeling, which allows you to prepare and evaluate the "field of possibilities" to assess the nature of changes in the number of vitamins and trace elements when changing the ratio of ingredients. Calculations are performed using matrix algebra. The quality criterion is the total amount of vitamins and minerals in the sample of an innovative product.

However, the analysis of existing prescription desserts showed that, nevertheless, their range remains limited. Expansion of the components of desserts, by the number of ingredients, by enriching dishes BAR, requires the use of matrix mathematical methods of modeling the composition and allows the use of common types of plant materials – fruits, berries and berries, which, according to complex indicators, have a high biological value.

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Traditionally, apples are used by restaurants to make a Sambuk dessert. Industrial technologies of making modern desserts consist of technological stages that lead to significant losses of biologically active substances, and also do not provide ways for stabilizing unsustainable components of raw materials. The problem area in the development of desserts is the preservation of vitamins, trace elements, biologically active substances and their enrichment of products of this group, using fruit and berry raw materials.

The use of raw materials of different origin allows to obtain products with a wide range of functional properties, which have a direct effect on various aspects of the body. The introduction into practice of new technologies, formulations, compositions, always precedes the study of technological properties of the product, which allows to justify the most acceptable ways of their processing, types of products produced, the possibility of combining with other components.

Recently, there have been appeared new trends in the development of restaurant facilities, one of each is creative cuisine. The principle of its "combination of incompatible" has been offered and used in their works O. N. Safonova, A. V. Bogomolov (2001), Yu. A. Kanushina, I. V. Kister, P. A. Lisin (2011).

Thus, the combination of sweet fruit or sour berry taste in dishes emphasizes the appearance and gives a new more extravagant taste to the dishes from them, while enriching them with vitamins, trace elements, bioflavonoids, dietary fibers, etc. It is known that the use of desserts made from fruit and berry raw materials and protein products increases the absorption of protein by the body almost twice. The role of the catalyst, which affects the absorption of protein is removed by organic acids.

Fruit and berry desserts are an indispensable source of pectin, a fiber that reduces human cholesterol helps reduce fat accumulation and helps remove harmful substances from the body. The researches of N. N. Lipatov, G. Yu. Sazhinov, O. I. Bashkirov (2001) proved that fruit desserts, to some extent, will solve the problem of improving the quality of nutrition of the population through the supply to the body of organic acids that contribute to the digestive process, inhibit the processes of rot in the digestive tract and remove salt sediments.

Thus, we believe that the use of matrix mathematical methods of modeling for calculation of prescription composition development desserts of a given c with a high content of biologically active substances and high organoleptic characteristics is relevant. Such dishes will significantly enrich the human diet with biologically active substances, dietary fiber, improve the organoleptic characteristics of the dishes and the quality of the food as a whole and supply the population with products from natural fruits and berries.

Purpose and research methods

The purpose of the article is to create a mathematical model to determine the balance in the compositions of desserts made using blended semi-finished vegetable

raw materials, analysis of the chemical composition of model pairs of fruit and berry raw materials, organoleptic analysis and physicochemical parameters of the dish.

The methodological basis of the study is the analysis of the chemical composition of desserts and modeling of the composition of the blended semi-finished product, the study of the competitiveness of innovative culinary products.

Research methods are methods of experiment planning with indication of tasks and mathematical processing of experimental data using modern computer programs, standard organoleptic, structural-mechanical, physio-chemical quality indicators of ready-made desserts.

Information base of research is scientific articles, materials of international congresses and symposiums, scientific and practical conferences, normative and technical documentation, patents, copyright certificates, statistical data.

Research results

Presentation of the main research material. *The object of research* is an innovative technology of fruit and berry desserts. *The subject is* model systems of Sambuca, obtained on the basis of blended pairs of ingredients. The subject of the study were desserts made from natural non-traditional raw materials and desserts made by traditional techniques. For the basic sample, we chose the recipe of a dessert "Apple Sambuk".

It is possible to obtain desserts with high content of biologically active substances and high organoleptic characteristics by applying non-traditional herbal supplements. The main factor in our choice was the ability to form the structure of the product and the presence of high levels of vitamin C, organic acids, etc.

The main raw materials for the development of desserts were selected dogwood, cranberry, kiwi and apples. Selected berry raw material is a natural supplier to the human body of biologically active substances belonging to the category of essential and essential – vitamins, bioflavonoids, minerals and dietary fibers (Lipatov & Bashkirov, 2001)).

It is worth noting, the selected plant components in chemical composition are one of the most valuable. However, they are underutilized in the processing and restaurant industries. Therefore, we consider that this choice is relevant.

The innovative dessert technology development is aimed at the maximum achievement of the main goal: obtaining products enriched with biologically active substances with high-quality indicators, compared to desserts made by traditional technology. An important element of this process is the study of the chemical composition of innovative raw materials and the determination of vitamins and minerals.

The task was solved in several steps: research of the chemical composition of innovative raw materials, determination of the vitamins content and minerals in innovative desserts (Table 1).

Tabl. 1. Modeling the composition of blended pairs

Components	Number of main components in a blended pair									
Apple (A), %	70	0	30	35	40	45	50	55	60	65
Fruit and berry raw (B), %	0	70	40	35	30	25	20	15	10	5

Source: own development

Calculated mathematical modelling has been used to study the composition of products enriched with natural additives with high-quality parameters. The quality criterion has been chosen as the maximum total value of biologically active substances: vitamins and minerals.

For each pair of ingredients (apple or fruit and berry puree A: B), were calculated characteristics for a model percentage with a step of 5%.

The calculations made it possible to correctly evaluate the nature of the change in characteristics with the successive change in the percentage ratio of ingredients and make the choice of sample, the best criterion for the maximum value of biologically active substances.

The task of optimizing the formulations of products was to select the components and determine their ratios, which provide the maximum approximation of the mass fraction of nutrients to the standards. Based on this principle, indicators are generated that allow to evaluate the composition of the biologically active substances and its balance in the modeling product.

The choice of the best ratio in steam was influenced by the limit on the maximum total content of organic acids, which accelerate the absorption of protein.

The analysis of the characteristics of the selected pair of ingredients and the justification for choosing the best option according to the selected quality criterion was using a preliminary calculation performed as a calculation of an array of data – a set of values of the quality criterion, depending on the quantitative ratio of the components in the pair of ingredients.

Thus, for the blended pair "apple – cranberry puree", was formed the vector of components from the innovative product (m =2: A-30%, B-40%? Table 2)

$$\vec{x} := \begin{pmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{pmatrix} = \begin{pmatrix} \frac{30}{100} \\ \frac{40}{100} \\ \frac{15}{100} \\ \frac{1.5+5+8.5}{100} \end{pmatrix}^T, \qquad \vec{x} = \begin{pmatrix} 0.3 \\ 0.4 \\ 0.15 \\ 0.15 \end{pmatrix}^T, \tag{1}$$

where $x_k(k=1,2,3,4)$ – components (in parts) of the formulation of a new product, namely x_1 – amount of apple puree (in parts), x_2 – amount of other puree (in parts) , x_{k3} – amount of sugar (in parts), x_{k4} – amount of gelatin, egg white and water (in parts).

Complied condition:

$$x_1 + x_2 + x_3 + x_4 = 1 \tag{2}$$

The quantitative ratio of the main ingredients c_m was defined as:

$$c_m = \frac{x_1(m)}{x_2(m)} \tag{3}$$

where $x_1(m) + x_2(m) = 0.7$ (constant value in this research), m – nodal point number.

The set of nodal points is shown in the Table 2.

Tabl. 2. The calculated ratio of the content of the main components in the blended pair

The ratio of the components in the blended pair (in parts)									
m	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
$x_1(m)$ (in parts)	0.0	0.30	0.35	0.40	0.45	0.50	0.55	0.60	0.65
$x_2(m)$ (in parts)	0.70	0.40	0.35	0.30	0.25	0.20	0.15	0.10	0.05
c_m	0.0	0.75	1.0	1.33	1.8	2.5	3.67	6.0	13.0

Source: own development

The Mathcad computer system was used to calculate the values of quality criteria.

For the selected list of vitamins were formed vectors of data on the amount of vitamins (in mg) in 100 g of each component of the innovative product and indicated, respectively: in apple puree – av, cranberry puree – bv, in addition, in other recipe components, such as gelatin, egg white, water, respectively –zhv, biv, vv (in 100g of product).

For the selected list of mineral elements formed vectors of data on the number of mineral elements (in mg) in 100 g of each component of the innovative product: in apple puree – am, in cranberry puree – bm.

Moreover, the content of vitamins and minerals (in mg) in other components that were included in the dessert recipe and indicated the vectors of the mineral content – in sugar, gelatin, egg white, water, respectively – cm, zhm, bim, vm(in 100 g of product).

Vectors of data on the content of vitamins and minerals (mg) in all components of blended pair m =2:

$$av := \begin{pmatrix} 0.03 \\ 0.03 \\ 0.02 \\ 0.07 \\ 0 \\ 0 \\ 165.0 \\ 0.3 \end{pmatrix}; bv := \begin{pmatrix} 0.02 \\ 0.04 \\ 0.05 \\ 0.3 \\ 0 \\ 0 \\ 10.0 \\ 0.6 \end{pmatrix}; zhv := \begin{pmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{pmatrix}; biv := \begin{pmatrix} 0 \\ 0.0002 \\ 0.03 \\ 0 \\ 391.87 \\ 0.012 \\ 0 \\ 0 \end{pmatrix}; vv := \begin{pmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{pmatrix}; cm := \begin{pmatrix} 0.6 \\ 0.6 \\ 0.4 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{pmatrix};$$

$$am := \begin{pmatrix} 2.2 \\ 278 \\ 16 \\ 9 \\ 0.047 \\ 0.11 \\ 0.15 \\ 0 \end{pmatrix}; bm := \begin{pmatrix} 0.6 \\ 348.0 \\ 8.0 \\ 42.0 \\ 0.27 \\ 0 \\ 0.15 \\ 0.001 \end{pmatrix}; zhm := \begin{pmatrix} 0.03 \\ 0.018 \\ 10.5 \\ 1.2 \\ 0 \\ 0 \\ 0 \\ 0 \end{pmatrix}; bim := \begin{pmatrix} 0.0007 \\ 7.3 \\ 0.48 \\ 0.43 \\ 0.004 \\ 2.5 \\ 0.011 \\ 0.96 \end{pmatrix}; vm := \begin{pmatrix} 0 \\ 0.13 \\ 1.72 \\ 0.38 \\ 0 \\ 0 \\ 0 \\ 0 \end{pmatrix}.$$

Vectors V = $(V_1, V_2, \ldots V_8)^T$ of the total values of the amount of each specific vitamin and each mineral element M = $(M_1, M_2, \ldots M_8)^T$ were calculated by the formulas:

$$\mathrm{V} = \mathrm{av} \cdot x_1 + \mathrm{bv} \cdot x_2 + \mathrm{zhv} + \mathrm{biv} + \mathrm{vv} \tag{4}$$

$$\mathrm{M} = \mathrm{am} \cdot x_1 + \mathrm{bm} \cdot x_2 + \mathrm{cm} + \mathrm{zhm} + \mathrm{bim} + \mathrm{vm} \tag{5}$$

The sum of the elements of these vectors gave us the total amount of vitamins and minerals in m option of the innovative product:

$$SV = \sum_{i=1}^{8} V_i, \quad SM = \sum_{i=1}^{8} M_i,$$
$$S(m) = SV + SM \tag{6}$$

During the calculations, the value of the quality criterion was obtained $f(c_m) = S(m)$. For the option m =2 (table 2) :

$$V = \sum_{i=1}^{8} V_i = 110.598, \quad SM = \sum_{i=1}^{8} M_i = 118.338,$$
$$S(m) = SV + SM = 228.935 \tag{7}$$

The best quantitative composition of ingredients can be selected according to the maximum value of the criterion $\max_m f(c_m)$.

Tabl. 3 Estimated ratio of the main components in the blended pair "Apple-cranberry"

BAR	blended pair, mg							
	0,75	**1,0**	**1,33**	**1,8**	**2,5**	**3,67**	**6,0**	**13,0**
Vitamin	174,602	62,595	110,598	118,598	126,599	134,599	142,6	150,6
minerals	217,944	43,633	118,838	130,789	143,239	155,69	168,141	180,592
Sum	392,546	106,227	228,935	249,387	269,838	290,29	310,741	331,192

Source: own development

This approach was used to investigate the characteristics of other model pairs based on apple puree.

The obtained model mathematical systems were used in the devising of recipe compositions and the preparation of desserts.

The produced desserts characteristics have been determined in the technological laboratory of the Technology Department of Restaurant and Ayurvedic Products.

In today's environment, the development of new types of food is widely used in the profile method of sensory evaluation and computer simulation. At the same time, researchers try to take into account all possible positive and negative sides of the created product using model samples with different content of innovative component. The data of mathematical and statistical researches indicate the direct dependence of the total usefulness of finished products. Thus, it should be noted that the optimal concentration of introduction of new semi-finished products in the amount of 20-30% provides the top number of biologically active substances. However, we should

also note that increasing the concentration leads to the loss of physical quantities (whipping, foaming property, sustainability). Besides. reducing the amount of fruit and berry component is not useful (Tabl. 4.).

We used profile evaluation of the received innovative samples of desserts, compiled profile grams and conducted the definition of the blended pair, which would ensure the maximum content of biologically active substances in the dish.

The method of determining the quality criterion of products by quantitative indicators includes the definition of specific indicators and descriptors that characterize the product, the conversion of units into dimensionless units (if necessary), drawing up a mathematical model and the calculation of the criterion of product quality. The quality criterion is constructed on the area principle, that is the value of the complex criterion corresponds to the area of the polygon in which the distance from its center to the vertices is equal to the normalized values of the individual quality indicators f_j, $j = \overline{1,N}$, where N – the number of individual quality scores:

$$S = \sum_{j=1}^{N}\left(\frac{1}{2}\cdot f_j \cdot f_{j+1}\cdot sin\frac{2\pi}{N}\right) = \frac{1}{2}sin\frac{2\pi}{N}\cdot\sum_{j=1}^{N}\left(f_j \cdot f_{j+1}\right), \qquad f_{N+1} = f_1 \cdot . \tag{8}$$

For each sample with values set of individual indicators $(f_1, f_2, \ldots, f_N)$, it is possible to calculate the value of the complex criterion S.

The qualitative area (S) of polygon is equal to the total sum of the areas of the triangles, formed by corresponding lines of the individual (partial) quality indicators. Instead of the function S, it is advisable to use another function F, which differs from S only by a constant multiplier, which doesn't affect the choice of the largest value. To choose the most successful option with the largest value of the complex criterion, it is enough to use the criterion formula:

$$F = f_1 f_2 + f_2 f_3 + \ldots f_{N-1} f_N + f_N f_1 \cdot \tag{9}$$

For each sample with a set of values of individual indicators, it is possible to calculate the value of the complex criterion F. The advantage of this criterion is its sensitivity to the possible excessive reduction of any of the indicators, as well as simplicity of use. The best one is the sample for which the value is larger (Koretska & Zinchenko, 2013). The problem of finding the optimum value and the influence of a new ingredient (and in this case of blended pair) on the food system was solved as the problem of finding the extremum of a target multi-criteria function of product quality of a nonlinear character with a system of constraints on individual quality indicators.

At the Department of Technology of Restaurant and Ayurveda Products, were conducted researches on the use of blended pairs of fruit and berry raw materials in the technology of Sambuk dessert – model samples were prepared and physical and chemical parameters were studied. The nutritional value of the samples was also determined (by calculation method).

Analysis of the chemical composition of the model samples shows a significant decrease in the total carbohydrate content. With the recipe demotion of sugar, the structure of the dish is obtained using blended purees with a high content of pectin. Thus, the calorie reduction of the model samples is 36.9% in the "Apple-Dogwood Sambuk", 29.7% in the "Apple-Cranberry Sambuk" and 51.3% in the "Apple-Kiwi Sambuk" and attributes innovative desserts to reducing food (Dorokhovych & Kovbasa,

2015; Dorokhovych & Zinchenko, 2016). At the same time, was noted an increase of 11.5% in the content of mineral substances of the "Apple-Dogwood Sambuk".

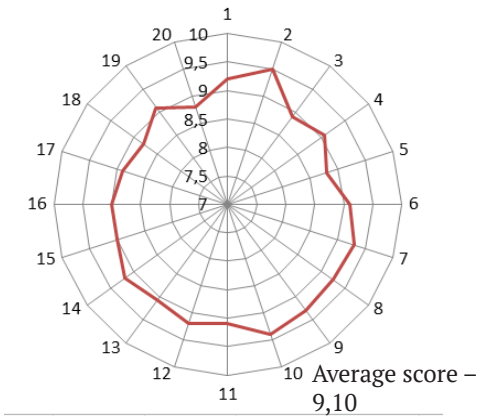
Tabl. 4. Chemical composition and energy value of innovative desserts

Indicators	Apple "Sambuk" (traditional)	Innovative desserts such as «Sambuk»		
		Apple-dogwood	Apple-cranberry	Apple-kiwi
Mass fraction of dry materials, %	16,2	20,7	21,9	21,2
Content of proteins, g	5,25	4,52	4,62	4,56
Content of fats, g	0,84	0,34	0,4	0,4
Content of carbohydrates, g	26,29	13,16	15,84	13,48
Content of fibre, g	Traces	0,3	0,70	1,4
Content of organic acids, g	Traces	0,5	0,77	1,3
Content of ash, g	Traces	0,17	1,38	0,9
Energy value, kcal/100 g	121,52	73,78	85,48	72,48
Content of vitamins, mg	174,602	150,545	143,741	155,81
Content of mineral substances, ml	217,944	252,676	236,647	228,53

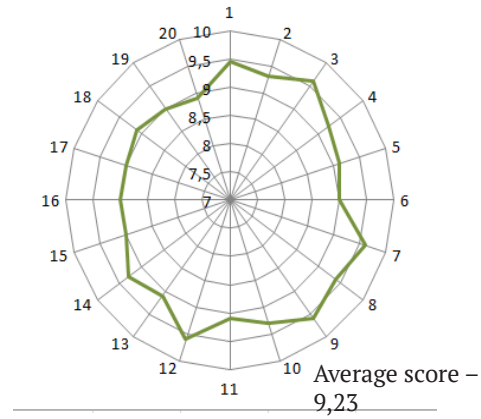
Source: own development

During the evaluation of organoleptic characteristics of desserts, a critical limit for the descriptors was set at 6.0 points, and the values of the experimental indicators with a score below 4.0 (which don`t meet the requirements of the regulatory documentation and don't represent the scientific interest) were not taken into account. Each main indicator had its own branch into descriptors that reveal the value of a particular indicator, and therefore in the description of profile grams their description may be repeated (Koretska et al., 2020).

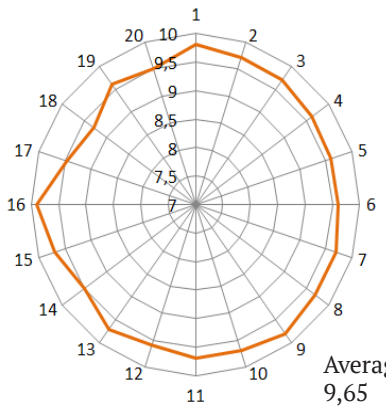
The obtained experimental data were used to construct a diagram of the criterion "quality polygon", which provides visualization of the choice of the optimal sample and calculation of the average score of the sample.



a)

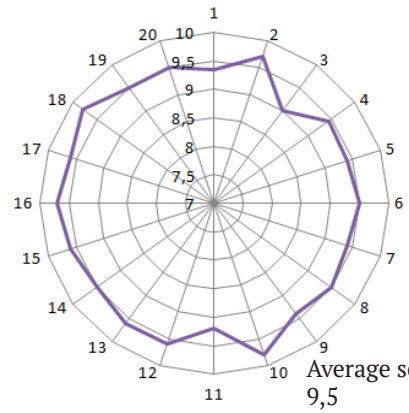


b)



Average score – 9,65

c)



Average score – 9,5

d)

Fig.1 Profile gram of organoleptic indicators.
a) – control sample (dessert with apple); b) – Apple-Kiwi dessert;
c) – Apple-Cranberry; d) –Apple-Dogwood.
Indicators: 1 – appearens, 2 – homogeneity of inclusions, 3 – naturality; 4 – colour, 5- clearness, 6 – homogeneity, 7 – naturalness; 8 – taste, 9 – tastyness, 10 – intensity, 11 – homoheneity, 12 – naturality; 13 – clear and strong smell; 16 – balance; 17 – consistency, 18 – density, 19 – viscosity, 20 – fluidity.
Source: own development

Assessment of the quality level of innovative products is a comparison of the set of quality indicators of these products with the corresponding set of indicators of the basic model. For the basic sample, we took a truly achieved set of values of product quality indicators, in this case, desserts, which is accepted for comparison. A comprehensive method was used to determine the quality level of the samples. All the values of the physicochemical parameters of the obtained model samples of Sambuk (Table 5) are translated into points. During the conversion, specific values were assumed for the best indicator (namely, which would be equal to a maximum of 10 points) with the best, in our opinion, indices of a single indicator. The calculation of the complex criterion of quality of the new dish was performed according to formula 7 (Koretska et al., 2020; Zinchenko & Koretskaya, 2013).

The analysis of the results has shown that the use of unconventional fruit and berry raw materials slightly increases the mass fraction of dry substances in the dish. Density and acidity increase in small limits, which is explained by the high content of organic acids in the blending pairs. Besides, the increase of acids influences the positive change in the specific volume of the dish. Having analyzed the data of the conducted researches, we determined that taking into account physicochemical and organoleptic indicators the calculation of the rating of innovative dishes showed that creative developments received high points. Despite being slightly smaller than other samples, the criterion "polygon area" (538 points) received the highest number of rating points by using apple-dogwood blended puree (dish rating – 94.72 points). The control sample received only 91.18 points.

Tabl. 5. Evaluation of model desserts by physicochemical and organoleptic characteristics / parameters

Indicators	Prototypes							
	Control sample (dessert with apple)		Apple-Kiwi		Apple-Cranberry		Apple-Dogwood	
	Value	Marks	Value	Marks	Value	Marks	Value	Marks
Specific volume, cm^3/g	1,46	9,24	1,52	9,62	1,58	10	1,35	8,54
Mass fraction of dry materials, %	16,2	7,40	21,2	9,68	21,9	10	20,7	9,45
Density, g/cm^3	1,280	9,60	1,32	9,90	1,34	10	1,29	9,66
Acidity, pH	3,4	10,0	4,4	7,06	3,8	8,82	4,8	5,88
Organoleptic assessment of indicators, marks	-	9,10	-	9,23	-	9,65	-	9,50
General content of vitamins, g/100g	174.60	10	155,8	8,92	143.7	8,232	150,5	8,62
General content of mineral substances, g/100g	217,94	8,63	228,5	9,04	236.7	9,37	252.7	10
Polyhedron area, $marks^2$	-	583,2	-	640,6	-	623,4	-	538,4
Ranking of the dessert, $mark^2$		91,18		92,77		82,47		94,72

Source: own development

Conclusions and discussion of results:

Given the above data, the following conclusions can be drawn:

– to predict the content of biologically active substances in the proposed desserts, it is advisable to use the results of mathematical modeling of the composition of blended pairs with berry-fruit raw materials;

– modeling of both chemical composition and physicochemical parameters, quality indicators of innovative desserts using non-traditional vegetable raw materials, allows to state that the developed dishes have high quality indicators (low carbohydrate content, high content of fiber, minerals, organic acids) and meet the requirements of consumers;

– according to the results of organoleptic evaluation of the studied samples of whipped desserts, it should be noted that the use of blended semi-finished products in innovative dessert technologies leads to improved consumer characteristics of the dish;

– due to technological decisions, developed whipped desserts can be recommended in preventive and dietary nutrition, which will expand the existing range.

The scientific novelty of the obtained results is that for the first time the use of dogwood berries, cranberry and kiwi fruits in the technology of whipped desserts such as “Sambuk” have been proposed.

The practical significance of the obtained results is manifested in the possibility to use the proposed modeling of new recipes and in their implementation in restaurants.

Prospects for further research are the ability to carefully assess the competitive status of the range of functional culinary products.

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МОДЕЛЮВАННЯ ІННОВАЦІЙНОЇ ТЕХНОЛОГІЇ ПЛОДОВО-ЯГІДНИХ ДЕСЕРТІВ

Актуальність. Науковці багатьох країн відзначають, що їжа контролює та моделює різні функції в організмі людини і, як наслідок, бере участь у підтримці здоров'я та запобігає зниженню ризику виникнення ряду захворювань. Асортимент харчування в закладах ресторанного господарства, нарівні з торгівлею, є тією сполучною ланкою, яка поєднує харчову промисловість із споживачами. Окрім того, багатокомпонентність страв, які пропонують споживачам заклади ресторанного господарства, ускладняються численними способами кулінарної обробки. **Метою роботи** є створення математичної моделі для визначення балансу біологічно активних речовин в рецептурних композиціях десертів виготовлених з використанням купажних напівфабрикатів рослинної сировини. **Завданням дослідження** є визначення складу купажної рецептурної суміші модельної пари рослинного пюре з максимальним вмістом біологічно-активних речовин. **Результати.** Наукова новизна отриманих результатів полягає в тому, що було вперше отримано математичні моделі купажних пар та досліджено фізико-хімічні та органолептичні показники інноваційних десертів. Використовували сучасні методи дослідження органолептичні, фізико-хімічні; математичну обробку експериментальних даних проводили за допомогою комп'ютерних технологій. **За результатами органолептичної оцінки рейтинговий бал десерту яблуко-кизил перевищив контрольний зразок на яблучному пюре (97,72 проти 91,18 балів[2]). Висновки та обговорення**. Розроблені технології збивних десертів із внесенням модельних купажних пар рослинної сировини відповідають вимогам нормативної документації та вимогам споживачів, що дозволяє розширити асортимент цієї групи страв. Наукова новизна одержаних результатів полягає у тому, що було запропоновано

моделювання складу та використання в технології збивних десертів типу «Самбук» ягод кизилу, плодів журавлини, ківі та яблук. Практичне значення отриманих результатів проявляється у можливості використовувати запропоноване моделювання нових технологій та у впровадженні їх у закладах ресторанного господарства.

Ключові слова: ресторанна продукція, купажований напівфабрикат, математичне моделювання, десерти, оцінка якості.

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МОДЕЛИРОВАНИЕ ИННОВАЦИОННОЙ ТЕХНОЛОГИИ ПЛОДОВО-ЯГОДНЫХ ДЕСЕРТОВ

Актуальность. Ученые многих стран отмечают, что еда контролирует и моделирует различные функции в организме человека и, как следствие, участвует в поддержании здоровья и предотвращает снижение риска возникновения ряда заболеваний. Ассортимент питания в заведениях ресторанного хозяйства, наравне с торговлей, является тем связующим звеном, которое объединяет пищевую промышленность с потребителями. Кроме того, многокомпонентную блюд, которые предлагают потребителям заведения ресторанного хозяйства, усложняются многочисленными способами кулинарной обработки.

Целью работы является создание математической модели для определения баланса биологически активных веществ в рецептурных композициях десертов изготовленных с использованием купажных полуфабрикатов растительного сырья. Задачей исследования является определение состава купажные рецептурной смеси модельной пары растительного пюре с максимальным содержанием биологически активных веществ.

Результаты. Научная новизна полученных результатов заключается в том, что впервые получении математические модели купажных пар и исследованы физико-химические и реологические показатели новых десертов. Использовали современные методы исследования органолептические, физико-химические; математическую обработку экспериментальных данных проводили с помощью компьютерных технологий. По результатам органолептической оценки рейтинговый балл десерта яблоко-кизил превысил контрольный образец на яблочном пюре (97,72 против 91,18 балов[2]).

Выводы и обсуждение. Выводы и обсуждение. Разработанные рецептуры збивних десертов с внесением модельных купажных пар растительного сырья соответствует требованиям нормативной документации и требованиям потребителей, позволяет расширить ассортимент этой группы блюд. Научная новизна исследования заключается в том, что впервые было предложено использование в технологии збивних десертов типа «Самбук» ягоды кизила, клюквы, плоды киви и яблок. Практическое значение полученных результатов проявляется в возможности использовать предложенное моделирования новых рецептур и во внедрении их в заведениях ресторанного хозяйства.

Ключевые слова: ресторанная продукция, купажированный полуфабрикат, математическое моделирование, десерты, оценка качества