Наведені результати товарознавчих досліджень нових зразків печива цукрового з начинками «Дачне» та «Ясне сонечко». Нетрадиційна сировина, використана у рецептурах печива, відрізняється збалансованими мінеральним та вітамінним складом, а також ефективною антиокислювальною здатністю, що дозволяє подовжити терміни зберігання продукції. Розроблені зразки печива цукрового відповідають нормативній документації за фізико-хімічними показниками, а також за показниками мікробіологічної та токсикологічної безпечності

Ключові слова: борошняні кондитерські вироби, нетрадиційна сировина, споживні властивості, харчова цінність, цукрове печиво з начинками

Приведены результаты товароведных исследований новых образцов печенья сахарного с начинками «Дачное» и «Ясное солнышко». Нетрадиционное сырье, использованное в рецептурах печенья, отличается сбалансированным минеральным витаминным составом, а также эффективным антиоксидантным действием, что позволяет продлить сроки хранения продукции. Разработанные образцы печенья сахарного соответствуют нормативной документации по физико-химическим показателям, а также по показателям микробиологической и токсикологической безопасности

Ключевые слова: мучные кондитерские изделия, нетрадиционное сырье, потребительские свойства, пищевая ценность, сахарное печенье с начинками

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CONSUMER PROPERTIES IMPROVEMENT OF SUGAR COOKIES WITH FILLINGS WITH NON-TRADITIONAL RAW MATERIALS WITH HIGH BIOLOGICAL VALUE

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1. Introduction

The pastry products, especially sugar cookies, are in steady demand in the adult and child population according to the marketing research [1]. But the traditional raw materials for preparation of sugar cookies are not full in the biological aspect because of high calorie, high content of saturated fat acids and low nutrition value. The improvement of consumer properties of sugar cookies with fillings is, therefore, acute. The usage of local resources of non-traditional raw materials is most promising and effective in the technological and economical aspects. The unconventional raw materials are a valuable source of healthy nutrients [2]. Therefore, an important task is the rational combination of different sorts of natural raw materials for optimization of the composition and improvement of consumer properties of sugar cookies with fillings [3].

The relevance of researches in this area is that by improving the nutritional value of sugar cookies it is possible to influence on the overall diet of the population because sugar cookies are in high demand according to the researches [1]. The population's modern nutrition imbalance encourages the creation of new food products with improved consumer properties. The considerable problem which needs to be solved is the improvement of amino acid, fatty acid, vitamin and mineral composition in the pastry products.

2. Analysis of previous studies and statement of the problem

Fat, wheat flour, eggs and sugar are traditional raw materials for the sugar cookies production. Analysis of the chemical composition of these ingredients, especially wheat flour [5] and fat [6] proves the need of the usage of non-traditional raw materials for the sugar cookies production. The developments of new rational recipes of pastry products with increased nutritional value with partial or full substitution of traditional ingredients on the milk-containing products, vegetable oils, processed fruit and vegetables and medical and industrial raw materials are conducted [7].

The improvement of the amino acid composition of pastry products can be achieved by the usage of milk products, processed legumes and oilseeds and protein enriching agents in their recipes. The scientists conduct developments for enriching the protein composition of sunflowers [8] and biological fortification of peanuts for optimization of their amino acid composition for confectionery production with increased protein's biological value. In particular, the lactic cheese and sweet whey powder are promising raw materials for the enriching pastry products with protein and minerals. But the question remains little known about the rational correlation of milk products in the recipes of pastry products. The scientific researches show improvement of amino acid composition of pastry products owing to the usage of

bean sprouts, pea grits [11], chickpeas flour and lentil flour in the recipes [12]. The replacement of 30 % wheat flour with the okara (mass produced by pressing bean milk on the filter-press) allows to enrich the product with amino acids [13]. As protein preparations for enriching the pastry products, egg whites enriched with proteins can be used. As a result, not only the amino acid composition is improved, the product acquires dietary properties [14].

The issue of the day in the food production is also the balancing of fatty acid composition of products. It is found that the fraction of unsaturated fatty acids increases and the fraction of saturated fatty acids decreases owing to the addition of non-traditional oils to recipes [15].

It is proved that non-traditional oils surpass the margarine in the content of polyunsaturated fatty acids [5]. The linseed oil has a balanced chemical composition and a high amount of polyunsaturated fatty acids. The amount of polyunsaturated fatty acids in the linseed oil is 5,38 times higher than in the margarine. The amount of polyunsaturated fatty acids in the soybean, pumpkin, sea buckthorn oils is 4,69; 4,61; 4 times higher than in the margarine [16]. The search for vegetable oils with high content α-linolenic acid which is useful for the organism is being conducted. These include Sacha Inchi oil, peony oil, sea buckthorn oil, cypress oil, cress salad oil. The content of α-linolenic acid is 50; 45; 35; 30 % in these oils [17]. The sea buckthorn oil effect on the fatty acid content of lipids is little known. However, it has been scientifically proven that sea buckthorn oil has a balanced ratio of omega-3 and omega-6 fatty acids. The sea buckthorn oil is the next after linseed oil by the content of α-linolenic acid. It allows considering oil as a valuable enricher for fat-containing products [18].

The considerable direction is enriching of confectionery with a limited content of macro- and micro elements and vitamins [19]. This need is dictated by objective environmental factors, which are associated with the change of the composition and nutritional value of products which are used. The next reason is the transformation of the lifestyle related to decreased physical energy expenditure [20].

A special attention from the scientific point of view must be paid to the enriching of fillings of pastry products because some vitamins are thermolabile. It is offered to include processed products of sugar beet [21], sea buckthorn concentrate [22], fruits chokeberry [23], etc. in the composition of fillings. The promising direction in the pastry production is the usage of medical and industrial raw materials and its processed products such as viburnum, hawthorn, buckthorn [24], goji berries [25]. The usage of these ingredients allows to enrich products with vitamins PP, B_1, B_2, mineral elements and cellulose.

Alternative kinds of flour, especially soybean and other legume crops have a positive impact on the improvement of nutritional value, particularly vitamin and mineral composition [26]. The soybean protein isolate and the meal of milk thistle in the recipes of custard cakes and cookies improve considerably the protein and mineral composition [27].

The developments using artichoke's powders [28], moringa and yam powders are proposed for the improvement of consumer properties of pastry products [29].

The scientific developments concerning the improvement of consumer properties of pastry products are varied, but the multifactorial impact of non-traditional oils and fruit and vegetable raw materials on the formation of nutritional and biological value of food products is little studied [2]. Therefore, search for new recipes with non-traditional raw materials for the improvement of protein, fatty acid, vitamin and mineral composition of sugar cookies is relevant. The research presented in the paper aimed at the improvement of consumer properties and nutritional value of products for making better the diet of the population.

3. The purpose and objectives of the study

The purpose of the research is scientific and practical reasoning and developing the recipes of sugar cookies with fillings with the usage of the unconventional supplements to improve its consumer properties.

The purpose can be achieved by solving the following objectives:

– developing of the new recipes of sugar cookies;

– determination of the quality according to the standard;

– study of the amino acid, fatty acid, mineral and vitamin composition of sugar cookies;

– the comprehensive quality assessment.

4. Materials and Methods

The object of the study are the samples of the cookies "Dachne" and "Yasne sonechko" with the usage of the non-traditional raw materials.

The cookies "Dachne" has been produced with the usage of non-traditional raw materials: dried apples powders, dried raspberry leaf powders, dried calendula officinalis powders, pumpkin oil. The cherry plum and zucchini jam enriched with the preparation of the eggshell with lemon juice had been used for the production of fillings.

The cookies "Yasne sonechko" contains lungwort officinalis powders, dried apricot powders, sea buckthorn oil. The sea buckthorn jam with calendula syrup had been used for the production of fillings.

As a check sample, the cookies "Litne" have been used. It is the classic example of sugar cookies according to its recipe. For developing the recipes of sugar cookies, the mathematical modeling of prescription formulations has been used. Restrictions on the total content of ingredients in the recipe are determined by the formula:

$$\sum_{i=1}^{j} x_i = 1000, \quad (1)$$

where x_i, i=1, 2, ..., j is the unknown amount of raw materials of the i type (grams).

Process conditions of the required moisture content of the products are as follows:

$$0{,}05\sum_{i=1}^{j} x_i \le \sum_{i=1}^{j} \lambda_i x_i \le 0{,}1\sum_{i=1}^{j} x_i, \quad (2)$$

where x_i, i=1, 2, ..., j is the unknown amount of raw materials of the i type (grams); λi is the water content in 1 gram of the i ingredient.

Additional conditions of the projected product enrichment with nutrients were determined as a percentage relative to the daily needs.

The following objective function is advisable

$$Z = \sum_{i=1}^{j} a_i x_i \rightarrow \max, \quad (3)$$

where x_i, i=1, 2, ..., j is the unknown amount of raw materials of the i type (grams); a_n is the content of the nutrient of the n type in the 1 gram of the i ingredient (grams).

The task of optimizing the content of the ingredients in the new sugar cookies is the determination of the vector $\vec{X}=(x_1, x_2, ..., x_j)$, maximizing the objective function provided that the coordinates of the vector satisfy the system of inequalities and equations. The solution of the problem is obtained by the simplex method in the MathCAD (Prime 3.0) [31].

The sensory, physical and chemical and microbiological analysis methods were used for the study of consumer properties of new sugar cookies and change of its quality in the goods turnover process [32].

The amino acid composition of sugar cookies was determined by ion exchange liquid-column chromatography on the amino acids automatic analyzer T 339 ("Microtechnick, Czech Republic) [33].

The amino acid score was determined by the ratio of the relevant essential amino acid in the 1 gram of protein of the cookies to the required content in the "ideal protein" according to the FAO/WHO scale [34].

The fatty acid composition of sugar cookies was determined by gas chromatography method on the gas chromatograph HP 6890 (Agilent, США) [35].

The mineral composition of sugar cookies was determined by atomic absorption spectrophotometry method on the atomic absorption spectrophotometer C-115 PK (Semi, Ukraine) [35].

Retinol (vitamin A) was determined by the colorimetric method, which is based on the reaction retinol with antimony trichloride in chloroform with the formation of blue color. The intensity of the color is directly proportional to the content of vitamin A. Ascorbic acid (vitamin C) has been determined by the Tillmans method. Tocopherol (vitamin E) has been determined by liquid chromatography with high isolation capacity [35].

The conventional methods have been used for the study of the toxic elements content in the new cookies. Copper, zinc, lead and cadmium have been determined by the atomic absorption method; arsenic was determined by the colorimetric method, mercury was determined by the flameless atomic absorption method [35].

5. The results of the study of consumer properties of new sugar cookies with fillings

The selection of the formulation was carried out by mathematical modeling method and on the base of product's organoleptic properties. New ingredients have been selected according to their rational relation. Adjustment of the formulations has reduced the content of wheat flour and sugar in the cookies. The content of traditional and non-traditional raw materials is presented in Table 1. It should be noted that the raw materials which have been used for the production of the new cookies are produced in Ukraine and certified in accordance with current legislation.

According to the results of the tasting assessment of sugar cookies, which was held by the tasting commission consisting of 10 people at the Poltava University of Economics and Trade (Ukraine), it has been found that the developed samples of sugar cookies with fillings are characterized by better organoleptic properties than the check sample. The organoleptic assessment was held using the 50-point scale, developed by the authors.

Table 1

The content of components in the new samples of cookies, kg/t

Ingredient	«Dachne»	«Yasne sonechko»
Wheat flour	526,03	608,07
Sugar powder	185,05	179,98
Invert syrup	28,02	29,71
Vegetable-cream mixture	102,10	106,67
Skim milk powder	–	36,05
Whey protein concentrate	52,20	63,16
Fat-free whey powder	21,36	–
Melange	25,69	23,93
Vanilla essence	3,15	2,00
Baking soda	4,14	4,80
Ammonium carbon salt	0,63	0,80
Salt	4,14	4,18
Dried raspberry leaf powder	11,72	–
Lungwort officinalis powder-	–	2,60
Dried apple powder	63,31	–
Dried apricot powder	–	49,52
Dried calendula officinalis powder	2,86	–
Pumpkin oil	15,14	–
Sea buckthorn oil	–	22,40
Cherry plum and zucchini jam	124,45	–
Preparation of eggshell with lemon juice	9,43	–
Sea buckthorn jam	–	114,45
Calendula syrup	–	13,08

The taste and smell are the most important parameters for consumers [36]. According to these parameters, sugar cookies "Yasne sonechko" have got the most points (4,89 points). Sugar cookies "Dachne" have received the most points according to the parameter of "severity of additives". Sugar cookies "Yasne sonechko" have had attractive color. They have received by this parameter maximal 5 points. They have received by the appearance maximal 4,89 points.

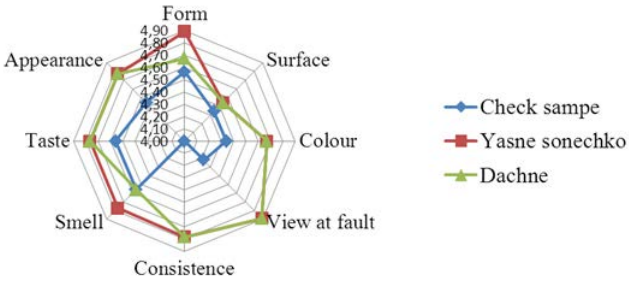

Fig. 1. Profilogramm of organoleptic properties of sugar cookies

The results of the study of physical and chemical indicators of the samples of sugar cookies (Table 2) show

that they comply with European regulations, especially Regulation of the European Parliament and of the Council «Laying down specific rules for the organisation of official controls on products of animal origin intended for human consumption».

Table 2

Physical-chemical indicators of new sugar cookies

Indicator	Norm	Research samples of cookies		
		Check sample	«Dachne»	«Yasne sonechko»
Humidity, %	10±2	9,00±0,29	9,50±0,27	6,10±0,29
Mass fraction of total sugars in terms of dry matter (by sucrose), %	not>27,0	25,16±0,05	21,55±0,05	22,23±0,05
Fat content in terms of dry matter, %	10±2,0	10,84±0,05	10,19±0,05	10,54±0,05
Alkalinity, degree.	not>2,0	1,6±0,05	1,4±0,05	1,2±0,04
Mass fraction of insoluble ash in solution with mass fraction of 10 % hydrochloric acid, %	not>0,1	0,06±0,01	0,02±0,01	0,02±0,01
Water absorption, %	not<150	165±7,90	177±9,90	177±9,90

According to the study, the bacteria Escherichia coli, pathogens, molds and yeasts have not been found in the fresh samples. The amount of mesophilic aerobic and facultative anaerobic microorganisms has not exceeded the norm. The amount of toxical elements has been in full record with the norm.

The nutritional and energy value has improved owing to adjustment of the recipes (Table 3).

Table 3

Nutritional and energy value of the new cookies

Samples of cookies	Content, g/100 g				Energy value kkal/100 g
	fats	proteins	carbohydrates	humidity	
Check sample	10,84	9,39	74,95	5,00	434,92
«Dachne»	10,19	9,41	70,00	9,50	409,35
«Yasne sonechko»	10, 54	10,50	71,48	6,10	422,78

Table 3 shows significant increase of the protein content in the cookies "Yasne sonechko" (by 1,11 g/100 g) as compared with the check sample. The decrease of the carbohydrates content in all samples owing to the replacement of the main ingredients (wheat flour, sugar powder, invert syrup) with the other components is achieved. Especially it is shown in the cookies "Dachne" (by 4,95 g/100 g) as compared with the check sample. The cookies "Dachne" are characterized by a high amount of amino acids. It contains the whey protein concentrate. The total amount of amino acids is increased by 19,76 % compared to the check sample. The total amount of essential amino acids is increased by 34,83 % as compared with the check sample. The total amount of essential amino acids in the cookies "Yasne sonechko" is increased by 32,54 % as compared with the check sample.

One of the most valuable amino acids is lysine. Lysine deficiency in the diet leads to hemodyscrasia, reducing the number of red blood cells and reduction of hemoglobin in blood, abuse calcification of bones and muscle degeneration. The amount of lysine has increased in the cookies "Dachne" by 67 %, in the cookies "Yasne sonechko" by 68 % as compared with the check sample. The content of valine has increased in the cookies "Dachne" and "Yasne sonechko" by 2 %. The content of isoleucine has increased in the cookies "Dachne" by 21 % and "Yasne sonechko" by 15 %.

The biological value of food protein is characterized by the amino acid score; it is calculated as the ratio of the content of amino acids in the studied protein to their content in the conditionally ideal protein that meets the needs of the body. The amino acid score of new products is presented in Table 4. The increase of the lysine score in the new samples, especially in the "Yasne sonechko" is essential. The significant increase of the limited threonine score in the samples is a positive factor. The values of the score in both samples have exceeded 100 %.

Table 4

The amino acid score of the new sugar cookies, %

Amino acid	FAO/WHO scale, g/100 g of protein	Sample		
		Check sample	«Dachne»	«Yasne sonechko»
Isoleucine	4	65	66	67
Leucine	7	104	125	122
Lysine	5,5	47	66	68
Methionine + +cystine	3,5	71	77	78
Phenyl-alanine + + tyrosine	6	102	113	111
Threonine	4	85	100	102
Valine	5	67	57	59

The fraction of saturated fatty acids in all samples has been decreased as compared with the check sample and the fatty acid composition has been approached to "perfect lipid" owing to the usage of alterative oils in the production of new sugar cookies.

As seen from Fig. 2, the check sample is rich in saturated fatty acids (46, 95 %) and low in polyunsaturated fatty acids (13, 23 %). The fraction of fatty acids of cookies lipid base is lower (in the cookies "Dachne" by 14,65 %, in the cookies "Yasne sonechko" by 24,77 %) than it is in the check sample. Along with that, the fraction of polyunsaturated fatty acids is higher significantly.

For the normal functioning, the body needs biometals, currently divided into macro- and micronutrients. Due to the change of prescription, the mineral of sugar cookies has been improved (Table 5).

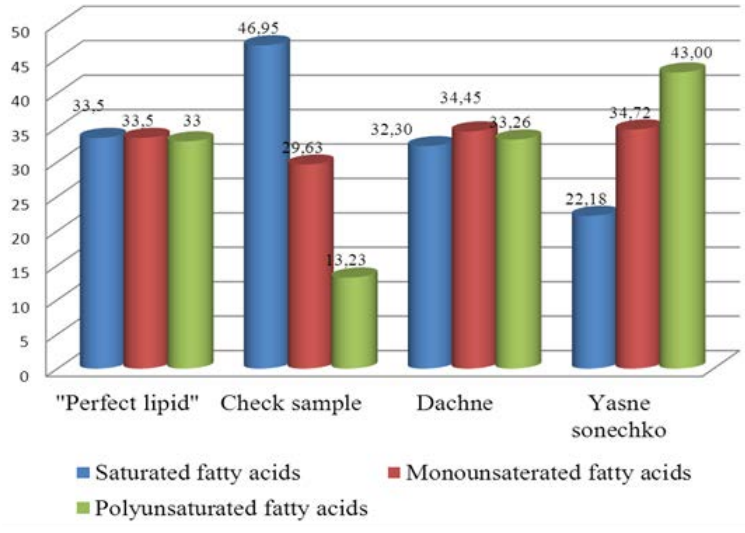

Fig. 2. Fatty acid composition of new samples

Table 5

The mineral composition of the new sugar cookies

№	Mineral elements	Check sample	«Dachne»	«Yasne sonechko»
Macroelements, mg		–	–	–
1	Potassium (K)	163,02	247,03	308,97
2	Calcium (Ca)	90,00	278,00	206,00
3	Silicon (Si)	1,95	1,58	1,82
4	Magnesium (Mg)	14,75	22,56	26,80
5	Sodium (Na)	560,02	326,46	406,34
6	Sulphur (S)	45,42	38,86	42,61
7	Phosphorus (P)	260,00	406,00	380,00
Microelements, mkg		–	–	–
8	Iron (Fe)	900,00	2500,00	1200,00
9	Iodine (I)	0,00	8,40	0,70
10	Manganese (Mn)	370,00	330,00	380,00
11	Selenium (Se)	5,92	3,69	4,71

The content of calcium has been increased in the new products by 2,28–3 times owing to fat-free whey powder and whey protein concentrate addition to the cookies recipes. The highest amount of it is achieved in the cookies "Dachne" due to the addition of the preparation of eggshell with lemon juice. The new products, especially the cookies "Dachne", have been enriched with iodine due to the changes in the recipe.

The study of the vitamin composition of sugar cookies (Table 6) shows that samples of cookies "Dachne" and "Yasne sonechko" are enriched with ascorbic acid, because it is absent in the check sample. The content of the tocopherol has been increased in the cookies "Yasne sonechko" by 37,4 times as compared with the check sample. Therefore, vitamin A content has been determined in the cookies "Yasne sonechko". Its amount has been increased by 28 times as compared with the check sample. It is also associated with the usage of processed products of sea buckthorn and calendula syrup and apricot powder in the recipe of cookies.

Table 6

Vitamin composition of the new cookies, mg %

Vitamin -	Check sample	«Dachne»	«Yasne sonechko»
Ascorbic acid	0,00	3,52±0,04	4,40±0,05
Thiamin	0,08±0,004	–	–
Tocopherol	0,26±0,002	–	9,73±0,60
Retinol	0,005±0,01	0,08±0,03	0,14±0,03

Note: «–» – not determined

The determination of the complex quality indicator has been carried out by organoleptic, physical and chemical, microbiological characteristics and the content of toxic elements, nutritional value, energetically value. The values of the complex quality indicator have been significantly increased in the new cookie samples (Fig. 3).

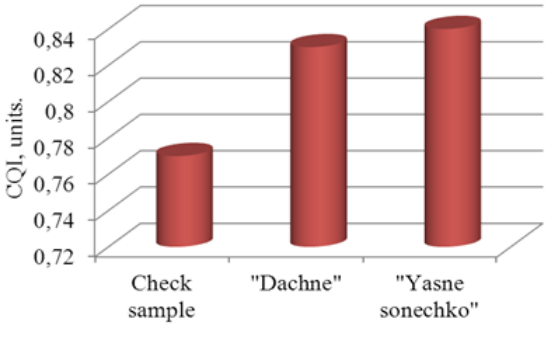

Fig. 3. The values of the complex quality indicators of the sugar cookies

Thus, the study of consumer properties of new types of cookies suggests that by organoleptic characteristics and nutritional value they exceed the check sample, it influenced the increase of the complex quality indicator. The physicochemical, toxicological and microbiological parameters meet the standard.

6. Discussing the research findings of consumer properties of the new sugar cookies

The results of the study, which are analyzed in the paper are characterized by combining the sea buckthorn jam with the calendula syrup in the fillings ("Yasne sonechko") and the usage of cherry plum and zucchini jam with the preparation of eggshell with lemon juice for the first time. The unconventional oils usage in the recipes has been also proposed.

Due to adjusting the recipes of sugar cookies, the consumer properties of the product have been improved. It is caused by the improvement of organoleptic parameters and increase of the beneficial nutritional compounds in the cookies composition. Satisfaction of the retinol daily needs by the intake of 100 grams of cookies "Dachne" has increased by 16 times compared to the check sample, through the usage of calendula powder and pumpkin oil. Satisfaction of the daily needs of calcium has increased (3 times higher than the check sample) and of the daily needs of iron has increased (2,7 times higher than check sample). The signifi-

cant increase of iodine in these cookies should also be noted. 100 g of the product by nearly 6 % satisfies the daily need of the substance. Satisfaction of the daily needs of fatty acids by consumption of 100 g of the product exceeds the similar parameter of the check sample by 2,4 times. The amount of amino acids in the cookies has increased by 1,8–3,5 times. In particular, it should be noted that the daily requirement for leucine and threonine by the intake of 100 grams of cookies is met by 79 and 80 % respectively. Cookies "Yasne sonechko" have been enriched with vitamins A, C and E. It can be explained by the usage of sea buckthorn oil and sea buckthorn jam in the cookies recipe. Due to the consumption of 100 grams of the new cookies, the daily needs of ascorbic acid are met by 6 %. The amount of vitamin A, as compared with the check sample, has increased by 28 times and the amount of vitamin E has increased by 37,4 times. The need for polyunsaturated fatty acids is satisfied almost by 91 %. It is 3,17 times higher than in the check sample. The amount of all essential acids has increased in the cookies and the lysine amount has increased most of all. Satisfaction of the daily needs of essential amino acids has increased by 1,67 times compared to the check sample.

However, along with the key benefits of the cookies, it should be noted that they are characterized by certain disadvantages. Thus, the usage of alternative raw materials, which has been proposed for the recipes of sugar cookies "Dachne" and "Yasne sonechko" is not usually available for the companies that produce large quantities of goods, because it requires additional resources. Also, non-traditional raw materials should be certified. It can also cause certain difficulties in the practical aspect. The usage of the additional raw materials along with traditional will influence the cost of products.

The results can be used for implementation in the confectionery companies of Ukraine and the European Union. Also, it can be used by other scientists because trends to reduce sugar and the total carbohydrate fraction are popular in the world. The developed fillings can be used for wafers, rolls, cakes and other confectionery products. The practical significance of the results is confirmed by patents of Ukraine for utility model "Composition of sugar cookies "Yasne sonechko" (№ 101331, 10.09.2015), "Composition of sugar cookies "Dachne" (№ 101329, 10.09.2015).

Further research is planned to devote to the study of changes in consumer properties during storage, the impact of packaging and different temperature regimes on the processes that occur during goods movement.

7. Conclusions

1. The recipes of new sugar cookies, which are characterized by the reduced content of wheat flour, sugar and fat have been developed. These components are replaced partly by the unconventional raw materials. They contain a high amount of beneficial micronutrients. Thus, cookies "Dachne" also contain a vegetable and butter mixture, fat-free whey powder, whey protein concentrate, dried apple powder, dried raspberry leaf powder, calendula powder, pumpkin oil. Cherry plum and zucchini jam enriched with the preparation of eggshell with lemon juice has been used for the preparation of the filling. The cookies "Yasne sonechko" along with traditional raw materials contain whey protein concentrate, lungwort officinal powder, dried apricot powder, sea buckthorn oil. Sea buckthorn jam and calendula syrup have been used for the preparation of filling.

2. The new cookies samples have been evaluated by the parameters of taste and smell higher than the check sample especially according to the organoleptic evaluation. The cookies "Yasne sonechko" gained the most points. The developed samples meet the standard by the physical-chemical parameters and safety parameters. The energy value of the cookies "Dachne" and "Yasne sonechko" has reduced by 6 % and 3 % as compared with the check sample owing to partial replacement of high-calorie ingredients with unconventional raw materials. This factor has influenced the improvement of the nutritional value. Studies have shown that the reduction of fats and carbohydrates in all samples is achieved.

3. The determination of the fatty acid composition of sugar cookies allows to assert that the amount of saturated fatty acids decreased in all samples (in the cookies "Dachne" by 4,65 %, in the cookies "Yasne sonechko" by 24,77 %) compared to the check sample. Also, the amount of unsaturated fatty acids has increased in both samples by 20,03 and 29,67 times. These positive changes in the fatty acid composition of the products are due to the inclusion of vegetable pumpkin and sea buckthorn oils in the formulation. Adding of milk-containing products (whey protein concentrate, fat-free whey powder) and preparation of shell eggs has an impact on the increase in the amount of amino acids and improvement of the biological value of proteins. In particular, the amount of essential amino acids in the cookies "Dachne" has increased by 34.83 %. It also managed to improve the essential amino acid composition and to increase their content in the cookies "Yasne sonechko" by 32.54 % compared to the control sample. The content of calcium in new products increased by 2,28–3,0 times, which is also associated with the use of milk-containing products. The chemical composition of the filling has influenced the increase of iron, ascorbic acid, tocopherol and vitamin A in the samples.

4. The cookies "Dachne" and "Yasne sonechko" have higher complex quality indicators (0,83 and 0,84 units) due to significant improvement of the nutritional value and organoleptic characteristic of the developed products as compared with the check sample. The check sample according to the results of the qualimetric assessment has had 0.77 units only.

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Досліджено можливість використання порошку з виноградних кісточок у технології здобного печива підвищеної біологічної цінності. Показано, що у порівнянні з пшеничним борошном він характеризується більшою водопоглинальною здатністю. Встановлено, що у присутності порошку з виноградних кісточок клейковина стає менш розтяжною та більш пружною. Доведено позитивний вплив порошку з виноградних кісточок на фізико-хімічні та органолептичні показники якості здобного печива

Ключові слова: виноградні вичавки, виноградні кісточки, порошок, клейковина, водопоглинальна здатність, здобне печиво

Исследована возможность использования порошка из виноградных косточек в технологии сдобного печенья повышенной биологической ценности. Показано, что по сравнению с пшеничной мукой он характеризуется большей водопоглотительной способностью. Установлено, что в присутствии порошка из виноградных косточек клейковина становится менее растяжимой и более упругой. Доказано положительное влияние порошка из виноградных косточек на физико-химические и органолептические показатели качества сдобного печенья

Ключевые слова: виноградные выжимки, виноградные косточки, порошок, клейковина, водопоглотительная способность, сдобное печенье

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THE EFFECT OF GRAPE SEED POWDER ON THE QUALITY OF BUTTER BISCUITS

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1. Introduction

Governments of many countries are developing and implementing national programmes aimed at improval of the nutritional status of population. These programmes include production of everyday food enriched with physiologically functional ingredients. In terms of environmental degradation and economic crisis, such products are essential for the health and working abilities of citizens and for providing a decent future via improved nutrition of children and youth.

All population groups are fond of pastries, in particular butter biscuits that are traditionally made of high-quality wheat flour, margarine or other fats, sugar, and egg products. Although such biscuits contain much fat and a lot of carbohydrates and are devoid of biologically active substances. In this regard, introduction of useful ingredients – dietary fibre, polyphenolic compounds, minerals and vitamins – to the composition of biscuits has a beneficial effect on human health. Such components are abundant in raw plant materials, among which especially interesting is grape pomace (wine production waste). Ukraine is a wine-producing state due to favourable for growing grapes climatic conditions of southern regions and Transcarpathia. Annually, wineries of Ukraine accumulate large amounts of grape pomace after