

## CONFECTIONERY GOODS FOR HEALTHY DIET

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**Abstract:** Confectionery goods are in great demand with different population groups, especially children both in Russia and other countries. This group of products can be considered as a convenient carrier of vital nutrients, the lack of which in the diet of the population in Russia, including preschoolers and school children is a serious problem. The market research of enriched confectionery goods has been carried out in the study. The relevance and demand of the development of given kinds of confectionery goods have been presented; their selection and recipe composition have been proved. The dynamics of the market development is carried out due to imported goods, which indicates the need for the production of domestic products. A group of specialized confectionery goods with various functional orientations was investigated. They are yogurt powder-based candies "Talantiki", enriched with vitamins and minerals; panned sweets "Dr. Konfetkin", sponge cakes and semi-finished goods with local herbs and vitamins. Their recipe composition was scientifically determined, taking into account the characteristics of the active ingredients and their synergistic effects on metabolic processes. The research of consumer properties of specialized goods has been made, which allowed to determine regulated quality indices, including the nutritional value and functional orientation. The testing has been put into practice in the conditions of commercial production. The developed products may be important for the correction of the nutrition and health of both children and adults with impaired nutritional status.

**Keywords:** Specialized confectionery goods, recipe composition, nutritional value, functional orientation

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### INTRODUCTION

Confectionery goods represent a large group of high-calorie foods that are in great demand with different population groups, especially children. However, the physiological value of confectionery, as a source of essential nutrients is small. They contain large amounts of fat (from 5 to 35%), carbohydrates (47 to 100%), the main part of which is sucrose (39.6–100%), starch (34.7–66%) and small amounts of protein (from 3.2 to 10.4%). Energy value ranges from 350 to 528 Kcal, and depends mainly on the set of recipe ingredients (flour, egg and milk products, various additives - nuts, soybeans and others.)

Excessive consumption of these products disturbs the balance of the diet in terms of nutrients as well as energy value. A significant drawback of confectionery is the virtual absence of these important biologically active substances, like vitamins, carotenoids, macro- and microelements. Available scientific studies show

that 100 grams of flour confectionery goods provide about 4–5% of the daily requirement of vitamins B1, B2, and PP. Also it is noted a slight mineral content. At the same time, their contribution to the total dietary energy intake at this level may reach 18-20%. A similar pattern is typical for other groups of confectionery goods [6–8].

The frequency of confectionery consumption by children and adult population in Russia is currently quite high. This is confirmed by the results of an epidemiological study conducted by the Research Laboratory of the structure and nutrition planning of RAMS led by Ph.D. A.K. Baturina.

It was found that 20–25% of children and 6-13% of adults regularly consumed commercial flour confectionery goods, 5–12% - sugar products. Among flour confectionery goods the preference is given to butter cookies (2.5–9.3% of respondents), cakes (3.8–6.4%), wafers and crackers (1.3–3.1%). Children

and teenagers prefer chocolates (more than 6% of respondents), older people – hard sugar sweets [6–7].

The transformations in the confectionery market that have occurred in recent years largely changed the traditional approaches to this group of products. Confectionery goods from high-calorie desserts are gradually becoming important and popular part in the diet of all age groups. They are increasingly being used in the school lunch assortment list. The demand for confectionery of dietary and prophylactic purposes is increasing [1–5].

The presented data strongly suggest that confectionery goods require substantial change of their chemical composition towards increasing the content of vitamins and minerals, dietary fiber and other essential nutrients, while reducing the energy value. This group of products can be considered as a convenient carrier of vital nutrients, the lack of which in the diet of the population, including preschoolers and school children is a serious problem.

## OBJECTS AND METHODS OF RESEARCH

The objects of the study are the raw ingredients, semi-finished products, test and manufactured samples of confectionery goods; representative groups of the population.

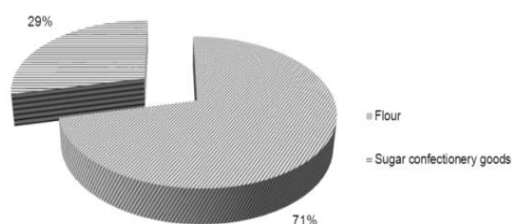
The general and specific test methods of quality and safety of specialized products were used. To identify consumer preferences the questionnaires were applied. The studies were conducted in 5–7 multiple replicates and the obtained data were processed statistically using computer programs.

## RESULTS AND DISCUSSION

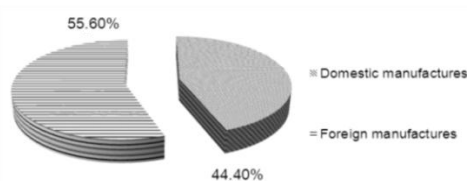
To determine the assortment of products and the ways of usage the market research of flour and sugar confectionery goods has been conducted in Kemerovo.

Figure 1 shows the proportion of flour and sugar confectionery goods in the assortment of the investigated products. Flour confectionery is the largest share - 20 items, sugar - 8 items.

Figure 2 shows the prevalence of foreign manufactured goods - 56.6% compared with domestic products - 44.4%.



**Fig. 1.** Proportion of flour and sugar confectionery goods in the assortment.



**Fig. 2.** Proportion of domestic and foreign manufactures.

Insufficient assortment of sugar confectionery goods of functional orientation was marked. They are hard sugar sweets and toffee candies as a rule. Such group of confectionery goods as panned sweets with high demand in the consumer market is virtually absent in the assortment.

Analysis of functional foods has shown that the enriching additives (%) are used such as iron - 7.25; calcium - 8.7; phosphorus - 2.9; magnesium - 1.44; iodine - 2.9; dietary fiber - 4.35; vitamin C - 15.94; B vitamins - 14.49; vitamin E - 14.49; vitamin A - 13.04; dietary bran - 1.45; folic acid - 1.45; inulin - 1.45; vitamin H - 1.45; pectin - 1.45; probiotics - 7.25.

It demonstrates the need for expanding the assortment of enriched confectionery goods from the point of view of modern Nutrition Science and demand for these products with the population.

A group of specialized confectionery goods with various functional orientations was investigated e.g. yogurt powder-based candies "Talantiki", enriched with vitamins and minerals.

The recipe composition of a candy in mg for one item is the following: premix of B vitamins 44–05 - 20, including: vitamin C (ascorbic acid) - 5, vitamin A (retinol acetate) - 0.0715, vitamin E (tocopherol) - 0.788, vitamin D3 (cholecalciferol) - 0.00036, vitamin B1 (thiamine) - 0.125, vitamin B2 (riboflavin) - 0.143, vitamin B3 (nicotinate) - 1.264, vitamin B5 (pantothenate) - 0.325, vitamin B6 (pyridoxine) - 0.144, vitamin B7 (biotin) - 0.0036, vitamin B9 (folic acid) - 0.0286, vitamin B12 (cyanocobalamin) - 0.0002; mineral premix - 87, including: iron - 1.45, zinc - 0.95, copper - 0.12, potassium iodide - 0.027 (20mkg); yoghurt powder "Jogufres S" - 340.973; maltodextrin "C" Dry MD 01915-250; Jerusalem artichokes dried - 70; crystalline fructose - 90; orange juice concentrate - 30; natural dyes "Beta carotene" - 2; natural flavoring "Orange essential oil" - 4; refined coconut oil - 100; gum - arabic "Fibregam" - 6.

Organoleptic, physicochemical, microbiological indices of quality and safety were investigated. Regulated indices of nutritional value were determined. The organoleptic quality indices are presented in Table 1.

**Table 1.** Organoleptic quality indices of yoghurt enriched candies "Talantiki with orange juice"

No	Index	Characteristic
1	Flavor and aroma	Clearly defined, characterized for given item, without off-flavor and odor. The flavor of enriching component is allowed.
2	Color	Candies "Talantiki with orange juice" vary from light orange to orange. The presence of inclusions is allowed.
3	Outer appearance	The surface is smooth. Slight damage of the surface due to automatic packing is allowed.
4	Shape	Round, biconvex, film-coated
5	Amount of items, having defects in appearance and color % (by weight), but no more than	2.0

The nutritional value (Table 2), indicating functional orientation of specialized products was determined. Recommended consumption portion is two candies a day for children aged from 3 to 7 years; three candies per day for children over 7 years.

The recipe of panned confectionery "Dr. Konfetkin" was scientifically determined. The recipe of developed product "Dr. Konfetkin" includes the following components, g/100 g of panned sweets: blueberry extract - 0.8; ascorbic acid - 0.29; vitamin A acetate (500ME/mg) - 0.024; cretaceous-toffee - 12.0;

cocoa butter - 4.8; sugar - 9.6; dry milk substitute - 44.33; MCC - 8.0; flavor "Blueberry" - 0.16; sugar - 14.8; Gum Arabic "Quick Gum" - 0.48; cocoa powder- 4.7; bee wax - 0.016 (average weight of covered panned sweets is 1250 mg).

Organoleptic and physicochemical indices of specialized product were determined (Table 3).

Regulated indices of nutritional value of panned confectionery, the information about consumption rates and the adequacy to the percentage of consumer demand are presented in Tables 4 and 5.

**Table 2.** Nutritional value of yogurt enriched candies "Talantaiki"

Nutritional value 100g of candies		% of normal physiological needs for children in a candy		
		3-7 years	7-11 years	11 years and older
Fats, g	10.00	-	-	-
Protein, g	11.59	-	-	-
Carbohydrates, g	51.00	-	-	-
Vitamin C (ascorbic acid), mg	500.00	10.0	8.3	7.7
Vitamin A (retinol), mg ER	7.15	14.3	10.2	7.9
Vitamin E (tocopherol) current. equiv., mg	78.80	11.3	7.9	6.6
Vitamin D3 (cholecalciferol), mg	0.036	3.6	3.6	3.6
Vitamin B1 (thiamine) mg	12.50	13.8	11.3	9.6
Vitamin B2 (riboflavin) mg	14.30	14.3	11.9	9.5
Vitamin B3 (nicotinate), mg	126.40	11.5	8.4	7.0
Vitamin B5 (pantothenate) mg	32.50	10.8	10.8	9.3
Vitamin B6 (pyridoxine), mg	14.40	12.0	9.6	8.7
Vitamin B7 (biotin), mg	0.36	23.7	17.8	14.2
Vitamin B9 (folic acid), mg	2.86	14.3	14.3	9.5
Vitamin B12 (cyanocobalamin), mg	0.02	13.3	10.0	6.7
Iron, mg	145.00	14.5	12.1	12.1
Zinc, mg	95.00	11.9	9.5	7.9
Copper, mg	12.00	19.6	16.8	14.7
Iodine, mg	2.00	20.0	16.7	14.3
Energy value, kcal	340.36			

**Table 3.** Organoleptic and physicochemical indices of panned sweet "Dr. Konfetkin"

Index	Characteristic
Taste and aroma	Clearly defined, characterized for this item, with cocoa flavor, without off-flavor and odor. The taste of enriching component is allowed.
Color	Color is from light brown to dark brown. The color of the body is in accordance with the recipe composition. The presence of inclusions in the shell and body is allowed.
Outer appearance	The surface is smooth, shiny.
Shape	Round, biconvex, sugar-coated with cocoa powder, pelleted body.
Amount of agglomerated and wrought items,% (by weight) of no more than	2.0
The average weight of a panned sweet, g	1.25 ± 15%
Moisture content,% , no more than	6.5

**Table 4.** Regulated indices of nutritional value of panned sweets "Dr. Konfetkin"

Indices 100 g	Nutritional value
Mass fraction of ascorbic acid, mg	288.0
Mass fraction of vitamin A, retinol mg	3.6
Carbohydrates, g	63.2
Fat, g	18.9
Energy value, kcal	428.0

**Table 5.** Consumption rates and the adequacy to the satisfying percentage of physiological needs of children and adults

Name of vitamin	Age group	Consumption rates, mg	30-50% from the standard	In a panned sweet, mg	Amount of panned sweets	Range of application, mg
Vitamin C	from 3 to 7 years	50	15–25	3.6	4–5	14.4–18.0
	from 7 to 11 years	60	18–30		5–7	18.0–25.2
	from 11 to 14 years	60–70	18–35		6–9	21.6–32.4
	from 14 to 18 years	70–90	21–45			21.6–32.4
	adults	90	27–45		6–10	21.6–45.0
Name of Vitamin	Age group	Consumption rates, mkg/ret.eq	30–50% from the standard mkg/ret.eq.	In a panned sweet, mkg, retinol	Amount of panned sweets	Range of retinol application, mkg
Vitamin A	from 3 to 7 years	500	150–250	45	4–5	180–225
	from 7 to 11 years	700	210–350		5–7	225–315
	from 11 to 14 years	800–1000	240–500		6–9	270–405
	from 14 to 18 years					
	adults	900	270–450		6–10	270–450

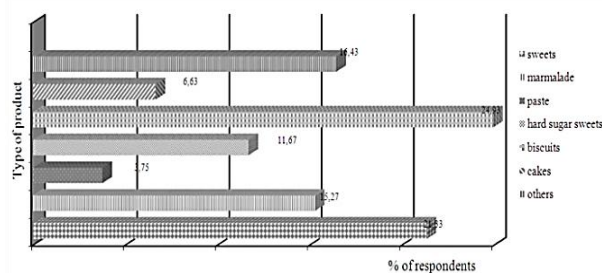
As shown in the table the consumption of the recommended amount of confectionery provides the intake of at least 30–50% of the daily needs of children and adults in vitamins A and C.

The content of blueberries in confectionery recipes enhances its functional orientation towards the correction of visual function. Sponge cake for special purposes was developed; it was associated with the problem of carbohydrate metabolic disturbance due to excessive consumption of sugar. The latter is a risk factor for diabetes, cardiovascular diseases, cancer, atherosclerosis, overweight and obesity.

There is a need to prevent these diseases through the development and use of nutritional goods with sugar substitutes, one of them is sorbitol. Taking into account the objectives, consumer motivations and preferences when choosing products specialized confectionery goods were investigated. People with impaired carbohydrate metabolism were involved in the survey.

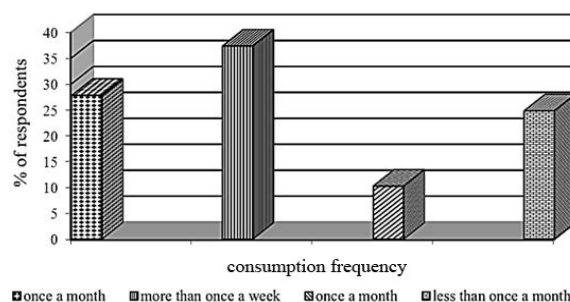
The results show that 72% of respondents acquire specialized confectionery goods. The most popular items are sweets (22%) - of sugar confectionery goods and biscuits (25%) - of flour confectionery goods (Figure 3). As for the other types of specialized confectionery either their assortment is limited, or they are not available due to the relatively high price.

Low popularity of cakes is due to the fact that they are relatively new and they are insufficiently presented in stores.



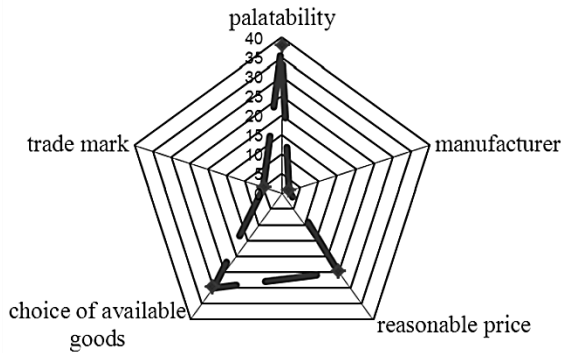
**Fig. 3.** Preferences to types of confectionery goods, % of respondents.

Figure 4 shows that 37% of respondents consume goods with sugar substitutes more than once a week, 28% - once a week, 25% - at least once a month.



**Fig. 4.** Consumption of goods with sugar substitutes.

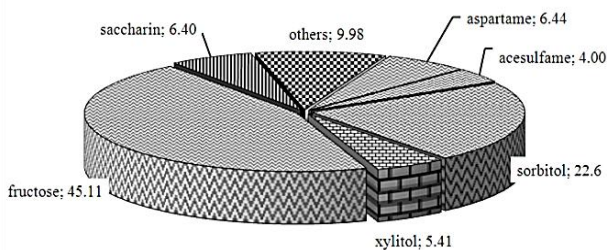
The criteria that are important to customers buying specialized confectionery goods are shown in Figure 5.



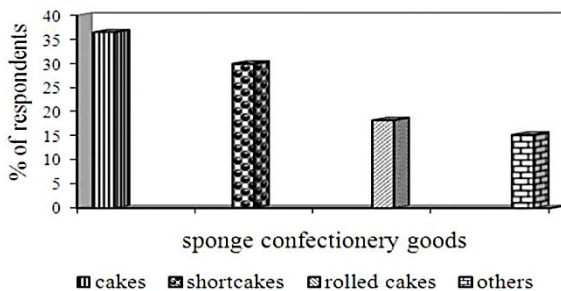
**Fig. 5.** Selection criteria when buying confectionery goods.

According to the data in Figure 5 it can be concluded that the main criterion when buying specialized confectionery goods is organoleptic qualities. The fact is that the trade organizations still present a small assortment of goods so the second criterion is its variety. The next criterion is the reasonable price of confectionery goods whereas the trade mark and the manufacturer are at the low position.

The greatest amount of respondents (55%) intakes from 100 to 250 g of goods containing sugar substitutes on a daily basis, 19% - from 250 to 500 g, 5% - more than 500 g. Consumers prefer to buy sponge confectionery goods with the sweeteners which were indicated in Figure 6.



**Fig. 6.** Preferences to sweeteners.



**Fig. 7.** Preferences to sponge confectionery goods.

Figure 7 shows 73% of respondents are ready to buy sponge confectionery goods with sweeteners, the most popular types of them are cakes (36.5%) and shortcakes (30%).

On the basis of market research we can conclude that the majority of respondents are ready to consume the sponge goods on sorbitol (cakes), as for decorating semi-finished products - fruits and berries; the most

important criterion when choosing specialized flour confectionery goods is their organoleptic quality indices. Consumers are able to pay from 20 to 30 rubles for 100 g of this product.

Semi-finished sponge cakes and shortcakes were developed. "Weak" wheat flour, sorbitol, eggs, lecithin, whey, "paste for churning", vanilla were selected as the main raw materials.

In sponge goods intended for persons with impaired carbohydrate metabolism and tended to diabetes, sugar is replaced by sorbitol. The recipe composition has been developed taking into account the diet for diabetics, for them it is not recommended to eat more than seven units of bread per meal. The content of sweetener in the laboratory samples was taken as a percentage of the flour.

When selecting the amount of sorbitol the sweetness coefficient of 0.5-0.6 towards sucrose was taken into account.

Sorbitol having the characteristics and properties distinctive from sugar cannot fully ensure good egg whipping, so to improve the quality of the finished product the emulsifiers - "the paste for churning" and lecithin are further included in the recipe composition. It is taken into account that the recommended amount of "the paste for churning" should not exceed 3%. Adding the paste not only improves the churning process and the distribution of the components in the recipe mixture, but also reduces the consumption of eggs with partial replacement for whey, thereby reducing the cost price of the finished products. Adding "the paste for churning" allows you to get products with high volume and uniformly porous structure, slows the staling and improves the quality of confectionery goods by increasing porosity. The use of lecithin reduces the viscosity of the dough, replaces sugar in the developed sponge product without decreasing quality indices of dough and finished products. It is considered that the permissible amount of soybean lecithin should not exceed 1%. Adding to the recipe "the paste for churning", whey and lecithin enables to reduce the amount of eggs by 25%.

The samples of sponge semi-finished goods with sorbitol content from 60 to 90% by weight of the flour and lecithin content of 0.1 to 1% were examined. To evaluate the organoleptic quality indices such as taste, color, smell, shape, appearance and crumb texture we developed a 30-point scale. The results obtained during the research of the organoleptic indices of the samples with different contents of sorbitol were processed using least - square method. The regression model is the following:

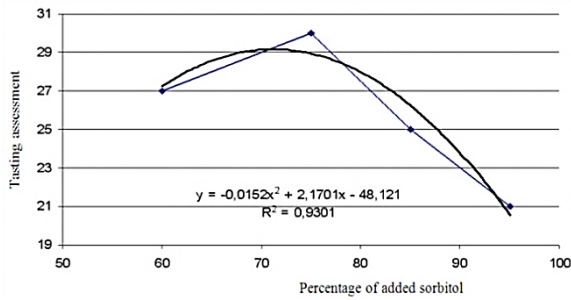
$$K = -0.0152 c + 2.1701 c - 48.121, \quad (1)$$

where K - tasting assessment, c - percentage of added sorbitol.

The quality of the created model is proved by the coefficient of determination  $R^2 = 0.93$ , i.e. the change variation of the organoleptic indices depends on the change variation of the percentage of added sorbitol. The average approximation error  $A_{average} = 10\%$ ,

indicating that the prediction accuracy for the created model is 90%.

The impact of the amount of sorbitol on organoleptic quality indices of sponge product is shown in Figure 8.



**Fig. 8.** Impact of the amount of sorbitol on the organoleptic quality indices of sponge product.

The optimum percentage of added sorbitol will correspond to the best organoleptic indices, i.e.,  $K_{opt} = K_{max}$ . The differential of organoleptic indices on the percentage of added sorbitol:

$$\frac{d-c}{d-c} = -0.0304 c + 2.1701. \quad (2)$$

Extremum point, in this case is the maximum point:

$$-0.0304 c + 2.1701 = 0, \quad (3)$$

$$c = 71.38.$$

The confidence interval with the reliability of 0.95:  $F(t) = 0.95/2 = 0.475$ , we find  $t = 1.96$ . Optimal percentage of added sorbitol is 75% by weight of the

flour. The practical research is confirmed by mathematical calculations.

It is shown that the organoleptic sample with 75% of sorbitol has the best characteristics. The sample containing the least amount of sorbitol (60%) is characterized by insufficient sweetness. Samples containing more than 80% of sorbitol have a very sweet taste. Furthermore, the amount of sorbitol consumed by a man should not exceed 30 grams per day.

The samples of semi-finished sponge goods with different content of lecithin in the recipe were investigated. Analysis of the data obtained during the tasting assessment of samples using the least - square method allowed to determine the functional dependence of the organoleptic index of K on the percentage of added lecithin l ( $R^2 = 0.93$ ):

$$K = -7.2765 l_2 + 12.6612 l + 16.21536. \quad (4)$$

To find the extremum points of created function the differential of organoleptic indices by the percentage of added lecithin was found and it was equated to zero:

$$\frac{d-K}{d-l} = -14.5531 \cdot l + 12.6612, \quad (5)$$

$$-14.5531 \cdot l + 12.6612 = 0, \quad (6)$$

$$l_{max} = 0.97.$$

The maximum value of organoleptic indices (in points) is achieved with 0.97% of lecithin. The commodity assessment of developed goods was given and the indices of their nutritional value were identified (Tables 6-8).

**Table 6.** Physicochemical indices of semi-finished sponge product

Index	Index value		
	With sugar	With sorbitol	IS 10-060-95
Humidity, %	24 ± 1	22 ± 1	25 ± 3
Mass fraction of total sugar (sucrose on) in terms of dry matter, % no more than	22.0 ± 1	8.0 ± 1	In accordance to the calculated content of the recipe with permissible deviations + 2.5%

**Table 7.** Indices of absorptivity and porosity

Index	Index value		
	With sugar	With sorbitol	According to TC 9134-133-02068315-10, no less
absorptivity, %	382 ± 3	352 ± 3	340
porosity, %	64 ± 3	73 ± 3	65

**Table 8.** Nutritional value of sponge semi-finished goods and shortcakes, g / 100g

Item	Proteins	Fats	Carbohydrates	Energy value, kcal/100g	Amount of bread units, g
Sponge semi-finished cake with sorbitol	5.0	3.5	39.2	208.0	3.3
Sponge semi-finished cake with sugar (test)	10.42	7.0	59.5	349.0	5.0
Sponge shortcake (with sugar) with a layer of black currant jam (with sugar)	4.6	7.3	64.7	343.0	9.2
Sponge shortcake (with sorbitol) with a layer of black currant jam (fructose)	5.2	3.5	61.1	293.0	5.0

The sponge shortcake (with sorbitol) with a layer of blackcurrant jam (not less 30% by weight of the product) possesses an energy value of 15% lower than the sponge shortcake (with sugar) with the same layer, the amount of bread units is 5g per 100g of a product. It is acceptable when feeding of persons suffering from diabetes, as for them it is recommended to consume not more than 7 bread units per meal.

The recipes and technology of confectionery goods were tested at enterprises NGO "SOUTH" (Biysk), they were certified under the requirements of international standards ISO 9000.

The developed confectionery goods may be important in ensuring a healthy diet of certain population groups taking into account the nutritional status.

#### REFERENCES

1. Gur'yanov, Yu.G., Lobach, E.Yu., and Dorn, G.A., Analiz rynka i razrabotka specializirovannykh konditerskikh izdelij, obogashhennykh mikronutrientami (Analysis of the market and the development of specialized pastry products enriched with micronutrients), *Polzunovskij vestnik* (Polzunovsky Vestnik), 2012, no. 2 / 2, pp. 212-217.
2. Gur'yanov, Yu.G., Kostin, A.N., and Dorn, G.A., Obespechenie kachestva specializirovannykh produktov v rezul'tate vnedrenija standarta ISO 9001 (Quality Assurance of specialized products as a result of the introduction of ISO 9001), *Konditerskoe proizvodstvo* (Confectionery production), 2012, no. 4, pp. 20-21.
3. Dorn, G.A., and Sidorova, O.S., Issledovanie potrebitel'skikh svoystv muchnykh konditerskikh izdelij s saharozamenitel'jami (Study of consumer properties of flour confectionery products with sugar substitutes), *Polzunovskij vestnik* (Polzunovsky Vestnik), 2012, no. 2 / 2, pp. 131-135.
4. Dorn, G.A., Novikov, I.G., and Gur'yanov, Yu.G., Razrabotka specializirovannykh konditerskikh izdelij i ih tovarovednaja ocenka (Development of specialized pastry and commodity assessment), *Tovaroved Prodovol'stvennykh Tovarov* (Commodity Researcher of Foodstuffs), 2012, no. 3, pp. 5-8.
5. Egorova, E.Yu., Reznichenko, I.Yu., Bochkarev, M.S., and Dorn, G.A., Razrabotka novykh konditerskikh izdelij s ispol'zovaniem netradicionnogo syr'ja (Development of new confectionery products using unconventional materials), *Tehnika i Tehnologija Pishhevykh Proizvodstv* (Food Processing: Techniques and Technology), 2014, no. 3, pp. 31-38.
6. Savenkova, T.V., Taleysnik, M.A., Shatnyuk, L.N., Spirichev, V.B., and Vorob'eva, I.S., *Obogashhenie konditerskikh izdelij vitaminami i mineral'nymi veshhestvami* (Enrichment of confectionery goods with vitamins and minerals), Moscow: Filial GMP «Pervaja Obrazcovaja tipografija», 2003. 48 p.
7. Spirichev, V.B., Shatnyuk, L.N., and Poznyakovskiy, V.M., *Obogashhenie pishhevykh produktov vitaminami i mineral'nymi veshhestvami. Nauka i tehnologija* (Food enrichment with vitamins and minerals. Science and technology), Novosibirsk: Sib. Univ. Publ., 2005. 548 p.
8. Savenkov, T.V., and Svyatoslavova, I.M., Ingredienty v tehnologijah konditerskikh izdelij (Ingredients in confectionery technology), *Pishhevye ingredienty v sozdanii sovremennykh produktov pitaniya* (Food ingredients to create modern food), Moscow: DeLee plus, 2014. pp. 297-316.
9. Ping Jianfeng, Wang Yixian, Wu Jian, Ying Yibin, Ji Feng, Determination of ascorbic acid levels in food samples by using an ionic liquid-carbon nanotube composite electrode, *Food Chem.*, 2012, vol. 135, no. 2, pp. 362-367.
10. Varela Paula, Ares Gaston, Sensory profiling, the blurred line between sensory and consumer science. A review of novel methods for product characterization, *Food Res. Int.*, 2012, vol. 48, no. 2, pp. 893-908.
11. Yildiz Oktay, Alpaslan Mehmet, Properties of rose hip marmalades, *Food Technol. And Biotechnol.*, 2012, vol. 50, no. 1, pp. 98-106.

