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TECHNOLOGY ELABORATION OF BISCUITS WITH REDUCED SUGAR CONTENT

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Topicality. In this article the current production state of flour confectionery is analysed, as well as some conclusions on improving the biscuit production technology through adding raw materials of plant origin with preferential organoleptic characteristics and reduced sugar content are made. **Aim and methods.** The aim of the study is to substantiate the technology of biscuits with "Zdorovia" flour and carob powder. The object of this research is the technology of biscuit semi-finished product with low sugar content. The subject of this article is flour mixtures with "Zdorovia" flour (TC 10.6-05476322-001:2013 "Flour "Zdorovia"), and carob powder (Conclusion of the state sanitary-epidemiological examination of carob pods powder (carob powder) № 05.03.02-03/13533 dated 23.02.2012), biscuit dough from flour mixtures, baked biscuit semi-finished product. Research methods: theoretical generalisation method, calculation and organoleptic methods. **Results.** In this article, the results of theoretical and experimental research of biscuit technology elaboration are presented. The chemical composition of "Zdorovia" flour and carob powder is analysed, particularly, the possibility of their use in low-sugar biscuit products is proved. Organoleptic parameters are studied, and the rational concentration of "Zdorovia" flour and carob powder in flour mixtures is determined. The nutritional value and glycemic index of biscuit products are calculated. **Conclusions and discussion.** The traditional recipe of biscuit with cocoa powder is analysed. The advisable traditional recipe change is demonstrated in measures of replacing premium wheat flour with "Zdorovia" flour, as well as cocoa powder with carob powder, and 10 % of sugar with carob powder. The nutritional value of "Zdorovia" flour, carob powder and biscuit products is substantiated, and the glycemic index of elaborated products is defined. The rational concentration of "Zdorovia" flour and carob powder in biscuit recipes is installed in proportion of 30 % of "Zdorovia" flour and 100 % of carob powder. It is found out that the elaborated biscuit has the best organoleptic properties, such as smell, taste, colour, provided when used concentration of 30 % of "Zdorovia" flour and 100 % of carob powder. Additionally, it is proved that the addition of "Zdorovia" flour and carob powder to the biscuit recipe makes it possible to establish that their fat content decreased by 5,2 %, carbohydrate content – by 7,7 %, including mono- and disaccharides – by 9,3 %, starch content – by 12,4 %, still, fiber content increased by 96,9 % compared to control. The energy value of the test sample decreased by 6,6 %, and the glycemic index was 26,2 un.

Keywords: technology; biscuit; glycemic index; carob; flour mixture, carbohydrates.

The urgency of the problem

The problem formulation. The domestic market of Ukraine presents a wide range of flour confectionery products manufactured in restaurant industry establishments and craft confectionery production facilities. The current trend of this market is the search for alternative technological solutions, in particular, the technologies development of flour confectionery products with increased nutritional value, that can directly affect metabolic processes and stimulate protective body functions. This raises the necessity of available domestic food raw materials, which are a natural source of biologically active substances, and can have a positive effect on the human body.

Biscuits are one of the most common and popular flour confectionery products. Until now, a significant share (about 2 thousand tons) of the biscuit market is delivered from abroad (Pro-consulting, 2019). Biscuit products are characterised by high taste qualities, still, they contain a large number of simple carbohydrates and fats, and scantily biologically active substances. Therefore, it is important to enrich biscuit products with ingredients that hold dietary fiber, vitamins, macro- and micronutrients, and have a low content of simple carbohydrates.

At present, it is urgent to look for alternative types of domestic and imported raw materials, that are a natural source of biologically active substances, and can have a positive effect on the human body. Domestic raw materials include "Zdorovia" flour, which is made from grain germinated in sea salt aqua, containing a wide range of macro- and micronutrients, including organic iodine. In comparison with this, imported raw materials consist of carob powder which substitutes cocoa flour. It is produced from carob pods, that allows to reduce the sugar amount and the glycemic index of finished products.

The main part of "Zdorovia" flour is starch. Mono- and disaccharides are contained in it in negligible quantities. Thus, compared to wheat flour, the starch content is lower by 21,3 %, and the fiber content is higher by 314,3 %. It is determined that the protein content of "Zdorovia" flour increases. Thus, in wheat flour the protein content is 10,6 g, and in "Zdorovia" flour it is 12,3 g, which is 16,5 % more. In grain, fats are contained in the aleurone layer and fetus, so, considering the yield of "Zdorovia" flour, its fats content is 46,1 % higher than wheat flour one.

The mineral and vitamin composition of "Zdorovia" flour also improved: the potassium content increased by 97,7 %; magnesium – by 263,6 %; iron – by 152,8 %. The iodine content was determined as 32 mcg. The thiamine content in "Zdorovia" flour increased by 322,2 % comparatively to wheat flour, and vitamin B3 – by 4,4 times (Kryvoruchko, 2014). Based on the analysis of "Zdorovia" flour chemical composition, it is determined that the content of essential nutrients in this flour is higher than in wheat one.

Cocoa powder is one of the herbal ingredients in biscuit recipes. According to the decree "On requirements approval for cocoa and chocolate products", "cocoa powder/ cocoa is a food product obtained by grinding roasted and cleaned from the hard shell (cocoa vela) cocoa beans into powder, containing a mass fraction of cocoa butter not less than 20%, and in terms of dry matter and moisture mass fraction, not more than 9%" (Ministry of Agrarian Policy and Provision of Ukraine, 2016). Powder under the trademark "carob" can be considered a promising substitute for cocoa one, since the latter is three times more expensive than carob powder (Verkhovna Rada of Ukraine, 2013). According to analysed patent and literature sources, carob powder has not been studied in biscuit production technology (Poliakov et al., 2004; Buialska et al., 2018; Horodyska, 2018).

The technology elaboration of biscuit products with flour of germinated wheat grain and carob powder requires the study of their technological properties, as well as reasoning of rational concentration and impact on the biscuits quality.

The state of the problem in research. Domestic and foreign scientists' works are devoted to the elaboration of innovative technologies of flour confectionery products with increased nutritional value and low sugar composition, including biscuit dough: A. M. Dorokhovych, V. V. Dorokhovych, M. F. Kravchenko, M. I. Nazar, O. V. Samokhvalova, N. I. Cherevychna, A. M. Chuiko, O. H. Shydakova-Kameniuk.

Unresolved issues. Due to the growing interest of consumers in flour confectionery, including biscuit dough, the creation of innovative technologies for biscuit products is important. The presence of a high content of high-grade wheat flour, sugar and eggs in biscuits has a negative impact on human health, resulting in diseases such as obesity, diabetes etc.

The use of raw materials with low sugar content and high nutritional value in biscuit products technology is an important objective, which can be solved by analysing the domestic market of biscuit products and ways of increasing their nutritional value, grounding the use possibility of "Zdorovia" flour and carob powder in flour mixtures, elaborating the technology of biscuit products with high nutritional value and low sugar content.

Aim and methods of research

The aim of the article is to substantiate the technology of biscuit products with "Zdorovia" flour and carob powder.

The methodological basis of this research is the process of modeling the biscuit products technology and recipe by 30% of premium wheat flour replacement with "Zdorovia" flour, and 100% of cocoa powder replacement with carob one.

The object of the study is the technology of biscuit semi-finished product with low sugar content.

The subject of the study is the complex of flour mixtures with "Zdorovia" flour (TC 10.6-05476322-001:2013 "Flour "Zdorovia") and carob powder (Conclusion of the state sanitary-epidemiological examination of carob pods powder (carob powder) № 05.03.02-03/13533 dated 23.02.2012).

Research methods: theoretical generalisation method, calculation and organoleptic methods.

Information base – scientific articles, thesis abstracts, tutorial books, normative documentation, Internet resources.

Results of the research paper

Traditional biscuit products, like most flour confectionery, contain large amounts of sugar, flour. They may contain starch, cocoa powder and dairy products as well. Therefore, during the production of flour confectionery from biscuit dough, the problematic issues of improving their nutritional value are solved; the use of raw materials that have a wide range of technological properties, that will raise organoleptic, structural and mechanical characteristics of biscuit products; intensification of technological process; long shelf life. In particular, a promising direction of assortment expanding of biscuit products with useful nutrients is the inclusion of other flour types in their recipe, along with wheat one – amaranth, buckwheat, rice, corn (including extruded), barley. All this allows to create new products with improved chemical composition (Table 1).

Table 1. Comparative chemical composition of different flour types (g/100 g)

Flour type	Premium wheat flour	Barley flour	«Zdorovia» flour	Rice flour	Corn flour	Extruded corn flour	Amaranth flour	Buckwheat flour
Moisture content	14,5	14,0	14,5	14,0	14,0	9,0	15,2	14,0
Proteins	10,3	10,0	12,3	7,3	7,2	6,1	14,8	11,6
Lipids	0,9	1,6	1,9	2,0	1,5	8,1	1,79	2,3
Starch	67,7	55,1	60,4	55,2	68,9	70,9	60,1	54,9
Fiber	0,1	1,5	8,7	9,0	0,8	1,0	4,34	10,8
Vitamins, mg:								
B_1	0,18	0,33	0,76	0,34	0,38	0,38	0,1	0,3
B_2	0,06	0,13	0,39	0,08	0,14	0,07	0,19	0,14
B_3	1,29	4,48	7,02	0,3	0,21	1,1	1,0	0,3
B_6	0,16	0,43	0,88	0,54	0,48	0,25	-	0,34
B_9	0,03	0,04	0,08	0,03	0,02	-	0,04	0,02
Mineral elements, mg:								
K	176	453	348	314	340	141	52	325
Ca	24	93	82	40	34	20	215	70
Mg	44	150	160	116	104	38	30	258
Fe	2,10	7,4	5,31	2,09	3,7	2,7	2,1	8,2
I, mcg	-	8,9	32,0	2,3	5,2	-	-	5,1

Source: elaborated by the author on the basis of works (Skurikhin & Tutelian, 2002; Lisovska et al., 2017; Mykolenko et al., 2019)

Dry flour substances are carbohydrates which are characteristic of grain crops. The analysis of Table 1 data shows that the content of dry matter in different flour types is slightly different from premium wheat flour, except for extruded corn and amaranth. A characteristic feature of different flour types is higher level of ash and fiber content than in wheat one. There is also a higher content of B vitamins and minerals. There is no iodine among mineral elements in wheat, extruded corn and amaranth types of flour, in contrast to "Zdorovia" flour, in which the iodine content is 32 mcg/100 g.

The use of non-traditional flour types allows to expand the assortment of biscuit products, improve the structural and mechanical properties, as well as increase the nutritional value due to the peculiarities of their chemical composition (Iorgacheva et al., 2010).

To substantiate the feasibility of using carob powder in biscuit products technology, its chemical composition should be considered in comparison with cocoa powder. Comparative analysis of the chemical composition of cocoa and carob powders is given in Table 2.

According to Table 2 data, the content of carbohydrates in carob powder is twice higher due to mono- and disaccharides increase. Comparative analysis of mono- and disaccharides of cocoa and carob powder is given in Table 3.

Table 2. Comparative chemical composition of cocoa and carob powders (g/100 g)

Indicator name	Cocoa powder	Carob powder
Proteins	24,2	3,9
Lipids	17,5	0,71
Carbohydrates, including: – mono- and disaccharides – fiber – starch and otherpolysaccharides	45,3 3,5 17,4 24,4	94,9 60,2 34,7 -
Ash	5,0	2,61

Source: elaborated by the author on the basis of works (Skurikhin & Tutelian, 2002; Bengoechea et al., 2008)

Table 3. Mono- and disaccharides content in cocoa and carob powders (mg/100 g)

Names for sugar	Cocoa powder	Carob powder
Sucrose	1,42	49,6
Fructose	1,59	5,2
Glucose	0,49	5,4

Source: elaborated by the author on the basis of works (Skurikhin & Tutelian, 2002; Santos et al., 2005)

The results of Table 3 show that the main mono- and disaccharides are sucrose, glucose and fructose, the content of which is 35/3,3/11 times higher in carob powder than in cocoa one.

The analysis of mono- and disaccharides content in carob powder indicates the energy value and possibility of reducing the sugar amount in biscuit products recipes.

In the technology of biscuit production, sugar plays the role of a structure creator, but it has a high caloric content. Sugar is rapidly absorbed from the small intestine and causes a sharp rise of glucose level in blood, thereby, accelerating the glycemic response. For quantitative assessment of certain carbohydrates ability in the product content to cause a glycemic reaction, the concept of "glycemic index" is introduced (Dorokhovych & Kovbasa, 2015; Karpenko et al., 2019). The glycemic index is an indicator of food products effect on sugar level in blood, which shows how quickly glucose enters the bloodstream due to digestive processes (Polumbryk, 2011).

Simple carbohydrates differ from each other in the "sweetness index" – a comparative dimension that shows how many times less, compared to sucrose, a sweetener should be taken in order to prepare some substance equivalent in sweetness to 9% sucrose solution, and is determined by organoleptic method. Herewith, the sweetness is taken as 1. In such a case, the sweetness index of sucrose is 1,0; glucose – 0,7; fructose – 1,5; lactose – 0,3. According to organoleptic parameters (powder taste), the sweetness index of carob powder is 0,5 (Romanovska, 2021). However, carob powder is not considered to be a substitute for sugar, as it belongs to the food ingredient, and can be used as a stand-alone food product (Dorokhovych & Gulich, 2007).

Carob powder also contains a wide range of macro- and microelements (Table 4).

Table 4. Elemental composition of cocoa and carob powders (per 100 g)

Minerals	Cocoa powder	Carob powder
Macronutrients, mg		
Potassium	1689	863,8
Calcium	55,0	212,3
Magnesium	191	72,7
Phosphorus	655	225,5
Natrium	7	4,86
Micronutrients, mkg		
Iron	14800	3818
Manganese	4625	1024
Copper	4550	4800
Zinc	7100	2471

Source: elaborated by the author on the basis of works (Skurikhin & Tutelian, 2002; Calixto & Canellas, 1982)

The results of the study in Table 4 demonstrate that the content of mineral elements in carob powder is slightly lower than in cocoa powder. Still, it should be noted that carob powder has a higher calcium content as compared to cocoa powder – 3,86 times.

Carob powder is a valuable product that contains a wide range of vitamins (Table 5).

Table 5. Vitamin content in cocoa and carob powders (per 100 g)

Vitamin name	Cocoa powder	Carob powder
Water soluble, mg		
Riboflavin	0,3	0,41
Niacin	1,8	204,6
Pyridoxine	0,3	26,2
Folic acid	0,045	46,2
Cabalamin	-	1,43
Ascorbic acid	-	149,9
Fat soluble, mkg		
Retinol	-	1,55
Calciferol	-	5,4
Tocopherol	3,1	5,92

Source: elaborated by the author on the basis of works (Skurikhin & Tutelian, 2002; El-Shatnawi & Ereiej, 2001)

The results of Table 5 show that in carob powder riboflavin is 1,3 times more, niacin – 109,4 times, pyridoxine – 84,5 times, folic acid – 1026 times. The presence of cobalamin (1,43 mg) and ascorbic acid (149,9 mg), which are absent in cocoa powder, is observed as well. The total content of fat soluble vitamins in carob powder is 5,93 mg, in cocoa powder – 3,1 mg, which is 52,2 % less than in carob powder. This difference is due to the presence of

retinol and calciferol vitamins in carob powder, which are absent in cocoa powder. Additionally, tocopherol in carob powder is 47,6 % more than in cocoa one. The studied chemical composition shows that the protein content in carob powder is 3,9 g/100 g, and is 6,4 times lower than in cocoa powder, but contains 8 essential amino acids.

Thus, "Zdorovia" flour and carob powder have a high content of nutrients, including vitamins and minerals. This proves the feasibility of adding them to flour mixtures in order to create biscuit products technology and recipe in the ratio of premium wheat flour : "Zdorovia" flour : carob powder, which is *3,5:1,5:1*.

Traditional recipes and technology of biscuit with cocoa powder were used to make a biscuit with "Zdorovia" flour and carob powder (Pavlov, 1998). When elaborating the recipe of biscuit products, the sweetness index of carob powder (0,5) was taken into account, which reduced the sugar content by 10 %.

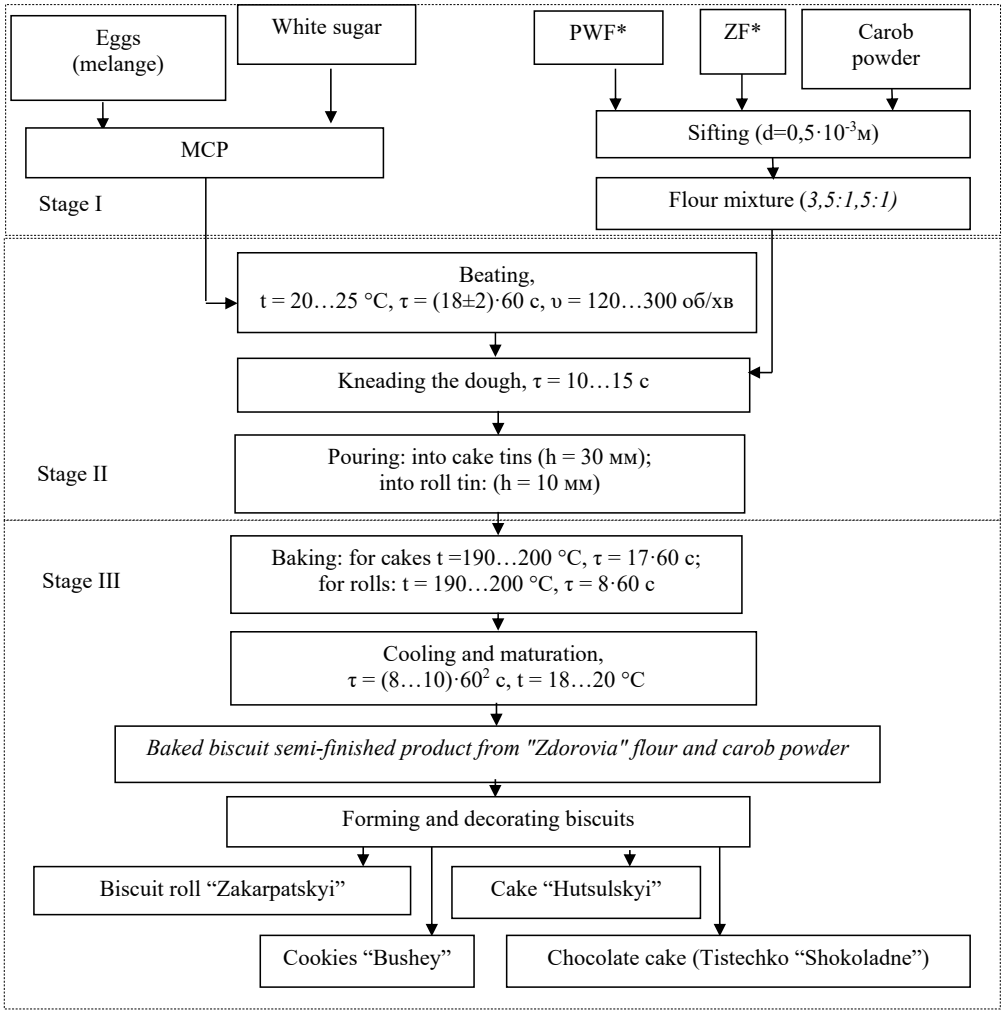
The technological scheme of biscuit production with "Zdorovia" flour and carob powder is presented in Pic. 1. It is found out that replacing 30 % of premium wheat flour with "Zdorovia" flour, 100 % of cocoa powder with carob powder, and 10% of sugar with carob powder improve organoleptic characteristics (the biscuit has the right form and reflects the form of baking, it is intact and with straight slices; the surface of the semi-finished product is smooth, slightly bumpy; the view in section is uniform, the structure (consistency) of the crumb is perfectly baked, loose, very elastic, with developed porosity; the taste corresponds to the definite biscuit name) (Pic. 1), the nutritional value of the elaborated biscuits increased (Table 6).

Table 6. Nutritional value of biscuit semi-finished products (per 100 g, %)

Indicators	**Baked biscuit semi-finished products**		
	Control	**Experiment**	**Difference, %**
Proteins, g	12.4±0.25	11.6±0.24	-6.4
Lipids, g	15.5±0.36	14.7±0.28	-5.2
Carbohydrates, g, including: – mono- and disaccharides – starch – fiber	51.8±2.11 31.1±1.15 19.4±0.25 1.32±0.57	47.8±1.97 28.2±0.29 17.0±0.48 2.6±0.68	-7.7 -9.3 -12.4 96.9

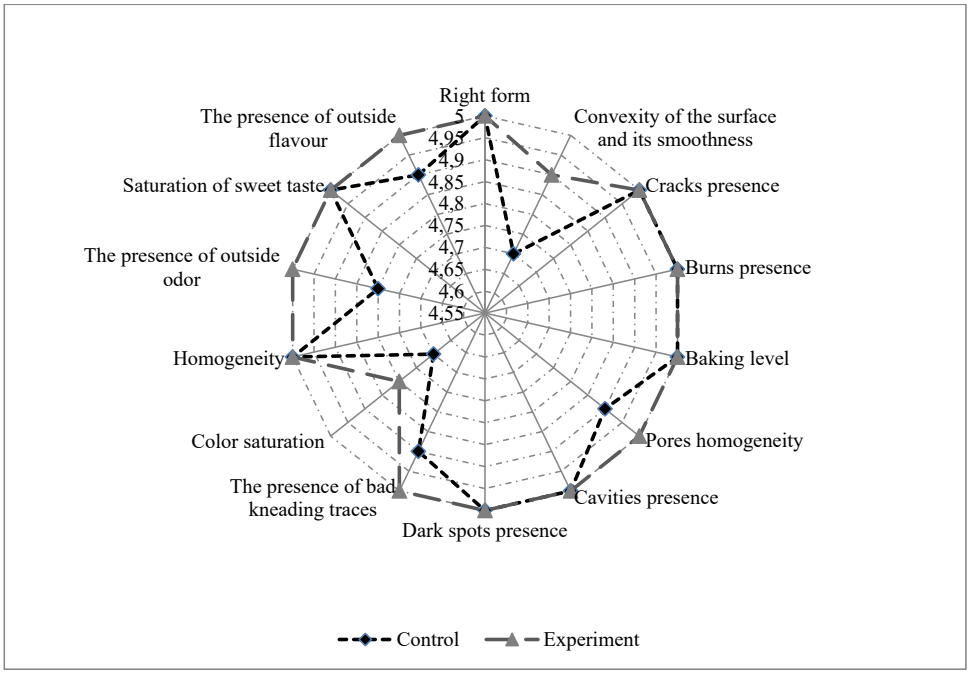
Source: own elaboration

Analysing the carbohydrate composition of biscuits with "Zdorovia" flour and carob powder, it should be noted that the total carbohydrate content decreased by 7,7 % relative to the control. The content of mono- and disaccharides decreased by 9,3 %, and the content of starch – by 12,4 %. However, the content of dietary fiber, which includes fiber, increased significantly, namely by 96,9 % relative to the control sample. One of the important indicators that characterises the researched sample of the biscuit is the energy value, which depends on the content of proteins, fats and carbohydrates contained in it. The energy value of biscuits with "Zdorovia" flour and carob powder is 369,9 kcal, which is 6,6 % less than the control sample.



Pic. 1. Technological manufacturing scheme of biscuit products on the basis of flour mixture (PWF – premium wheat flour, ZF – "Zdorovia" flour)
Stage I. Mechanical culinary processing of raw materials;
Stage II. Preparation of biscuit dough from flour mixture and pouring it into tins;
Stage III. Heat treatment, cooling, maturation, molding and trimming
Source: own elaboration

In order to substantiate the feasibility of replacing sugar in biscuits in the amount of 10 % per carob powder, the glycemic index is determined taking into account the glycemic index of definite carbohydrates (Tables 7, 8).



Pic. 2. Organoleptic quality profile of biscuit semi-finished products (control – biscuit with cocoa powder; experiment – biscuit from "Zdorovia" flour and carob powder)
Source: own elaboration

Table 7. The glycemic index of biscuit (control) (per 100 g)

Name of raw materials	Consumption of raw materials – per 100 g of biscuit	Carbohydrate content, g									
		Glucose (GI = 100%)		Fructose (GI = 20%)		Sucrose (GI = 20%)		Maltose (GI = 105%)		Starch (GI = 70%)	
		in 100 g		in 100 g		in 100 g		in 100 g		in 100 g	
		raw	biscuit	raw	biscuit	raw	biscuit	raw	biscuit	raw	biscuit
PWF*	31,66	0,02	0,006	0,02	0,006	0,11	0,03	0,05	0,01	67,7	21,43
Granulated sugar	31,65	-	-	-	-	99,85	31,6	-	-	-	-
Cocoa powder	8,44	0,49	0,04	1,59	0,13	1,42	0,11	-	-	24,4	2,05
Total		0,046		0,136		31,74		0,01		23,48	

GI (control) = 1 × 0,046 + 0,2 × 0,136 + 0,6 × 31,74 + 1,05 × 0,01 + 0,7 × 23,8 = 35,86 un.

Table 8. The glycemic index of biscuit (experiment) (per 100 g)

Name of raw materials	Consumption of raw materials – per 100 g of biscuit	Carbohydrate content, g											
		Glucose (GI = 100%)		Fructose (GI = 20%)		Sucrose (GI = 20%)		Maltose (GI = 105%)		Starch (GI = 70%)		Carob (GI = 50%)	
		in 100 g		in 100 g		in 100 g		in 100 g		in 100 g		in 100 g	
		raw	biscuit	raw	biscuit	raw	biscuit	raw	biscuit	raw	biscuit	raw	biscuit
PWF*	17,16	0,02	0,004	0,02	0,004	0,11	0,02	0,05	0,01	67,7	15,0	-	-
ZF*	9,5	0,03	0,002	0,03	0,002	0,22	0,02	-	-	60,4	5,73	-	-
Granu lated sugar	18,49	-	-	-	-	99,85	18,46	-	-	-	-	-	-
Carob powder	8,44	-	-	-	-	-	-	-	-	-	-	0,5	0,04
Total		0,456		0,436		18,5		0,01		20,73		0,04	

Note*: PWF – premium wheat flour, ZF – "Zdorovia" flour.

GI (experiment) = 1 × 0,456 + 0,2 × 0,436 + 0,6 × 18,5 + 1,05 × 0,01 + 0,7 × 20,73 + 0,5 × 0,04 = = 26,2 un.

Source: elaborated by the author on the basis of the work (Kovbasa et al., 2009).

The glycemic index of biscuits in the control sample is 35,86 un., in the experimental sample – 26,2 un., which is 27 % lower. The obtained data show that the replacement of sugar in 10 % amount by carob powder reduces the glycemic index of the elaborated biscuits by 9,66 un. from the control sample.

Thus, the presented data demonstrate that the use of "Zdorovia" flour and carob powder in the technology of biscuit production leads to content increase of essential nutrients (fiber), minerals and vitamins, as well as content decrease of glycemic index compared to traditional biscuits.

Based on the obtained results, the perspective of the further study is to elaborate trimming semi-finished products using carob powder, and to determine a comprehensive quality indicator of biscuit products.

Conclusions and discussion of results

In the course of research, the following conclusions can be drawn:

After analysing different types of flour used in manufacturing biscuits and semi-finished products, in particular, it is found that "Zdorovia" flour has a high nutritional value. According to technological requirements, it can be used in biscuit production.

It is established that a promising substitute for cocoa powder in the technology of biscuit production is a powder under the trade name "carob".

The recipe, technology and technological scheme of biscuit production from flour mixture in the ratio of premium wheat flour : "Zdorovia" flour : carob powder, which is *3,5:1,5:1*, is elaborated.

According to the research results of organoleptic properties and chemical composition of the elaborated biscuits, it is determined that compared to control samples, prototypes of biscuits have a significantly higher nutritional value. Fiber content increased by 96,9 %, fat content decreased by 5,2 %, carbohydrates content – by 7,7 %. The glycemic index of biscuits in the control sample is 35,86 un., and in the experimental, it is 26,2 un., which is 27 % less.

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РОЗРОБКА ТЕХНОЛОГІЇ БІСКВІТІВ ЗІ ЗНИЖЕНИМ ВМІСТОМ ЦУКРУ

Актуальність. У статті проаналізовано сучасний стан виробництва борошняних кондитерських виробів та зроблено висновки щодо покращення технології виробництва бісквітів за рахунок додавання сировини рослинного походження з покращеними органолептичними показниками та зниженим вмістом цукру. **Мета і методи.** Метою дослідження є обґрунтування технології бісквітних виробів із борошном «Здоров'я» та порошком керобу. Об'єкт дослідження – технологія бісквітного напівфабрикату зі зниженим вмістом цукру. Предмет дослідження – борошняні суміші з борошном «Здоров'я» (ТУ 10.6-05476322-001:2013 «Борошно «Здоров'я») та порошком керобу (Висновок державної санітарно-епідеміологічної експертизи на порошок зі стручків ріжкового дерева (порошок керобу) № 05.03.02-03/13533 від 23.02.2012 р.), бісквітне тісто з борошняних сумішей, випечений бісквітний напівфабрикат. Методи дослідження: теоретичне узагальнення, розрахункові, органолептичні. **Результати**. Наведено результати теоретичного та експериментального дослідження розробки технології бісквітних виробів. Проаналізовані хімічний склад борошна «Здоров'я» та порошку керобу і доведена можливість їх використання для бісквітних виробів зі зниженим вмістом цукру. Досліджено органолептичні показники і визначено раціональну концентрацію борошна «Здоров'я» та порошку керобу у борошняних сумішах. Розраховано харчову цінність та показник глікемічності бісквітних виробів. **Висновки та обговорення.** Проаналізовано традиційну рецептуру бісквіту з порошком какао. Доведено доцільність зміни традиційної рецептури за рахунок заміни борошна пшеничного вищого сорту на борошно «Здоров'я» та порошку какао на порошок керобу, а також 10 % цукру на порошок керобу. Обґрунтовано харчову цінність борошна «Здоров'я», порошку керобу та бісквітних виробів, визначено показник глікемічності розроблених виробів. Встановлено раціональну концентрацію борошна «Здоров'я» та порошку керобу у рецептурі бісквітів, яку становлять 30 % борошна «Здоров'я» та 100 % порошку керобу. Встановлено, що за концентрації борошна «Здоров'я» 30 % та 100 % порошку керобу розроблений бісквіт має найкращі органолептичні властивості: запах, смак, колір. Доведено, що додавання до рецептурного складу бісквітів борошна «Здоров'я» та порошку керобу дозволило встановити, що вміст жирів у них зменшився на 5,2 %, вуглеводів – на 7,7 %: у тому числі моно- і дисахаридів – на 9,3 %, крохмалю – на 12,4 %, клітковини зріс на 96,9 % порівняно з контролем. Енергетична цінність дослідного зразка зменшилась на 6,6 %, показник глікемічності становив 26,20 од.

Ключові слова: технологія; бісквіт; показник глікемічності; кероб; борошняна суміш; вуглеводи.