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JUSTIFICATION AND SELECTION OF RAW MATERIALS FOR THE PRODUCTION OF FLOUR CONFECTIONERY PRODUCTS

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The article discusses the rationale and selection of raw materials for the production of flour confectionery in Kazakhstan. The main focus is on the popularity of cookies and gingerbread among consumers, due to their availability and low cost. However, the authors emphasize that traditional flour confectionery products are overloaded with carbohydrates and lack the content of micro- and macronutrients, vitamins and dietary fiber that are important for the body.

The implementation of proposals to improve the nutritional value of these products consists in the introduction of herbal additives into the formulation, which makes it possible to increase the content of essential nutrients and improve the overall composition of the product. In particular, it is planned to use legumes and oilseeds as the main raw materials, as well as powders of melons and fruit crops as fillers. This will significantly increase the nutritional properties of cookies, as well as reduce their calorie content, making the products more useful for consumers.

It is very important that Kazakhstan focuses on local raw materials and cultivated crops, which allows not only to improve and increase the range of baked goods, but also is one of the factors supporting local producers from an economic point of view. The authors of the article refer to the principles of food com binatorics, which emphasize the importance of developing and implementing new recipes to improve the characteristics of confectionery products.

It is very important that Kazakhstan focuses on local resources and grown crops, which can not only improve the range of baked goods, but also support local producers. These studies show the importance of integrating scientific approaches into traditional production processes, which in turn can contribute not only to improving the quality of food, but also to strengthening food security in the country. To summarize, we can say that the introduction of new technologies and the use of alternative raw materials is an important step towards creating more nutritious and environmentally friendly flour products that can meet the needs of the modern consumer.

Keywords: flour confectionery, grain and legume crops, zucchini, melon, apples, apricots, raspberries, sea buckthorn, currants, dry powder

ҰННАН ЖАСАЛҒАН КОНДИТЕРЛІК ӨНІМДЕРДІ ӨНДІРУГЕ АРНАЛҒАН ШИКІЗАТТЫ НЕГІЗДЕУ ЖӘНЕ ТАҢДАУ

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Мақалада Қазақстанда ұннан жасалған кондитерлік өнімдерді өндіруге арналған шикізатты таңдау мәселесі қарастырылады. Негізгі назар тұтынушылар арасында печенье мен пряниктің танымалдылығына аударылған, бұл олардың қолжетімділігі мен төмен бағасымен түсіндіріледі. Алайда, авторлар дәстүрлі ұннан жасалған кондитерлік өнімдердің көмірсуларға бай екенін және адам ағзасына қажетті микро- және макроэлементтер, дәрумендер мен тағамдық талшықтардың жеткіліксіздігін атап өтеді.

Аталған өнімдердің тағамдық құндылығын арттыру бойынша ұсыныстарды іске асыру рецептураға өсімдік текті қоспаларды енгізу арқылы жүзеге асырылады, бұл қажетті заттардың мөлшерін арттыруға және өнімнің жалпы құрамын жақсартуға мүмкіндік береді. Атап айтқанда, негізгі шикізат ретінде дәнді-бұршақты және майлы дақылдарды, ал толтырғыш ретінде бақша дақылдары мен жеміс-жидек ұнтақтарын қолдану ұсынылады. Бұл печеньенің қоректік қасиеттерін айтарлықтай жақсартуға, сондай-ақ оның калориялық құрамын өзгертуге мүмкіндік береді, нәтижесінде өнімдер тұтынушылар үшін пайдалырақ болады.

Негізгі екпін ұннан жасалған кондитерлік өнімдерді, әсіресе кеңінен тұтынылатын өнімдерді байыту олардың сапасы мен тағамдық құндылығын арттыру үшін маңызды фактор екеніне қойылған. Мақала авторлары тағамдық комбинаторика қағидаларына сүйене отырып, кондитерлік өнімдердің сипаттамаларын жақсарту үшін жаңа рецептураларды әзірлеу мен енгізудің маңыздылығын атап көрсетеді.

Қазақстанда жергілікті ресурстар мен өсірілетін дақылдарға бағдарлану өте өзекті, бұл тек нантоқаш өнімдерінің ассортиментін жақсартуға ғана емес, сонымен қатар жергілікті өндірушілерді қолдауға да мүмкіндік береді. Зерттеулер дәстүрлі өндіріс процестеріне ғылыми тәсілдерді енгізудің маңыздылығын көрсетеді, бұл өз кезегінде тағам сапасын арттырумен қатар елдегі азық-түлік қауіпсіздігін нығайтуға да ықпал ете алады. Қорытындылай келе, жаңа технологияларды енгізу және баламалы шикізатты пайдалану – қазіргі заманғы тұтынушылардың қажеттіліктерін қанағаттандыра алатын дәрумендерге бай және экологиялық таза ұн өнімдерін жасау жолындағы маңызды қадам болып табылады.

Түйін сөздер: ұннан жасалған кондитерлік өнімдер, дәнді және дәнді-бұршақты дақылдар, асқабақ, қауын, алма, өрік, таңқурай, шырғанақ, қарақат, құрғақ ұнтақ.

ОБОСНОВАНИЕ И ВЫБОР СЫРЬЯ ДЛЯ ПРОИЗВОДСТВА МУЧНЫХ КОНДИТЕРСКИХ ИЗДЕЛИЙ

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В статье рассматривается обоснование и подбор сырья для производства мучных кондитерских изделий в Казахстане. Основное внимание уделяется популярности печенья и пряников среди потребителей, что обусловлено их доступностью и невысокой стоимостью. Однако авторы подчеркивают, что традиционные мучные кондитерские изделия перегружены углеводами и недостаточны по содержанию важных для организма микро- и макроэлементов, витаминов и пищевых волокон.

Реализация предложений по улучшению пищевой ценности данных изделий заключается в введении в рецептуру добавок растительного происхождения, что позволяет увеличить содержание необходимых полезных веществ и улучшить общий состав продукта. В частности, предполагается использовать зернобобовые и масличные культуры в качестве основного сырья, а также порошки бахчевых и плодово-ягодных культур в качестве наполнителей. Это позволит значительно повысить питательные свойства печенья, а также снизить его калорийность, делая продукты более полезными для потребителей.

Основной акцент делается на том, что обогащение мучных изделий, особенно тех, которые потребляются широкими слоями населения, является ключевым моментом для повышения их качества и пищевой ценности. Авторы статьи ссылаются на принципы пищевой комбинаторики, которые подчеркивают важность разработки и внедрения новых рецептур для улучшения характеристик кондитерских изделий.

Весьма актуально, что в Казахстане ориентируются на местные сырьевые ресурсы и выращиваемые культуры, что позволяет не только улучшить и увеличить ассортимент выпечки, но и является одним из факторов поддержки местных производителей с экономической точки зрения. Данные исследования показывают важность интеграции научных подходов в традиционные процессы производства, что в свою очередь может способствовать не только повышению качества пищи, но и укреплению продовольственной безопасности в стране. Подводя итог, можно сказать, что внедрение новых технологий и использованием альтернативного сырья — это важный шаг к созданию более питательных и экологически чистых мучных продуктов, способных удовлетворить потребности современного потребителя.

Ключевые слова: мучные кондитерские изделия, зерновые и зернобобовые культуры, кабачки, дыня, яблоки, абрикосы, малина, облепиха, смородина, сухой порошок

Introduction. In Kazakhstan, the most popular flour confectionery product for most consumers is cookies and gingerbread. This is due to the relatively low cost and, accordingly, availability to a wide consumer audience. However, these products are overloaded with carbohydrates, contain an insufficient amount of micro- and macroelements, vitamins and dietary fiber.

To increase the nutritional value, additives containing essential nutrients are introduced into the recipe of flour products. Plant-based raw materials containing many important macro- and micronutrients are best suited for this purpose. These can be various fruit and berry and melon crops. In this regard, it is advisable to continue research in the field of developing technology for the production of flour confectionery products. Legumes and oilseeds will be used as the main raw materials for the production of flour confectionery products, and powders of melon and fruit and berry crops grown in Kazakhstan will be used as fillers.

The use of non-traditional raw materials allows changing the caloric content of cookies, increases the content of dietary fiber, macro- and microelements, vitamins and other minor substances.

According to the principles of food combinatorics [1-5], flour products of mass demand, those products that are consumed by a large number of different segments of the population, are subject to enrichment. Much research has been devoted to improving the quality of confectionery products, increasing their nutritional and biological value. Thus, in many countries, bakery and flour confectionery products are modified by adding dietary fiber, vitamins, and minerals to the recipes of these products, using various cereals, processed vegetable products, and oilseeds - sesame, sunflower, etc. [2].

The use of melon and fruit and berry powder in the processing of grain products is an optimal solution for improving their nutritional qualities with health benefits for consumers, and is increasingly being used by processors in this area [6, 7]. Along with increasing the nutritional value, adding melon and fruit and berry crops to baking dough improves the physical, chemical, sensory and microbiological properties of finished products [8, 9, 10]. Due to the richness of nutrients, the consumption of functional products made from melon and fruit and berry powders can prevent some diseases [6, 11, 12]. Based on the above, it can be noted that the problem of forming an assortment of functional flour confectionery products cannot be considered solved at present.

An analysis of scientific literature on this topic shows that there are many studies on the use of plant materials in the technology of flour confectionery products. For example, in the work [13] it is proposed to use biologically active substances and dietary fibers isolated from fruit and vegetable powders in the technology of flour confectionery products for the purpose of enriching the products.

S.E. Kharkov, V.V. Gonchar, I.V. Roslyakov developed technologies for brewed gingerbread products using non-traditional raw materials, such as flour from powdered melon seeds, which helps improve the organoleptic and physicochemical

properties of finished products [14].

Scientists from the Kuban State Technological University have proven the value of processed melon crops – watermelons and pumpkins – as functional ingredients through their research. They have developed a food additive based on watermelon pomace and its seeds, which has membrane-protective, antitoxic and radioprotective properties. The use of this additive in bakery products is facilitated by the fact that this food additive is highly soluble in water. This ability appears as a result of processing the raw materials in a rotary roller disintegrator [15].

Pumpkin processing products are widely used in the technology of bread, bakery and flour confectionery. Pumpkin pomace, seeds, and fermented pumpkin pulp are used as enriching ingredients [16-19]. The use of pumpkin in the technology of bread products is also the subject of the works of I.B. Isabaev. He developed a method for producing rusks with pumpkin puree additives. The finished products had not only good organoleptic properties, but also an optimal calcium and magnesium ratio [19].

Thus, the use of dry powders based on melons and fruit crops as ingredients that increase the nutritional value of flour confectionery products is due to the fact that they are harmless additives of natural origin and, based on the results of the literature review, flour products will be developed using non-traditional raw materials.

Materials and methods. The objects of the study are:

- grain and leguminous crops such as rice, oats, buckwheat, barley, corn, chickpeas, lentils;

- melons - pumpkin, squash, melon;

- fruit crops - apples, apricots;

- berries - raspberries, sea buckthorn, currants.

During the research, traditional methods of assessing the quality of plant materials were used.

GOST 7975-2013 Fresh edible pumpkin. Specifications; GOST 7178-2015 Fresh melons. Specifications; GOST 31822-2012 Fresh Courgettes sold in retail. Specifications; GOST 34314-2017 Fresh apples sold in retail. Specifications; GOST 27572 - 2017 Fresh apples for industrial processing. Specifications; GOST 32787-2014 Fresh apricots. Specifications; GOST 33915-2016 Fresh raspberries and blackberries. Specifications; GOST 6829-2015 Fresh black currants. Specifications; GOST 33954-2016 Fresh red and white currants; GOST R 59661-2021 Fresh sea buckthorn. Technical conditions; TR CU 021/2011 Technical regulations of the Customs Union ”On the safety of food products”; GOST 13586.3-2015 Grain. Acceptance rules and sampling methods.

Results and discussion. According to the data of the conducted literature review, at the present stage, raw materials of plant origin play an important role in the creation of food products. From this position, grain and leguminous crops are a promising crop in the Republic of Kazakhstan.

From the main growing regions of grain (wheat, barley, oats, buckwheat, corn, rice) and legumes (chickpeas, lentils) crops, the following species and varieties were selected based on their technological characteristics for the production of flour confectionery:

- barley varieties ”Sabir” (Akmola region), ”Arpa elite” (Almaty region);

- buckwheat varieties ”Saulyk” (Almaty region), ”Batyr” (Akmola region);

- lentil varieties ”Stepnaya” (Almaty region), ”L-4 400” (Kostanay region);

- chickpea variety ”Ersultan” (Almaty region);

- corn variety ”Dobrynya” (Almaty region);

- rice varieties “Syr Syluy”, “Aikerim” and “Marzhan” (Kyzylorda region);

- oats varieties “Duman” and “Bitik” (Akmola region); ”Arman” (Kostanay region).

The chemical composition of the selected varieties was analyzed. The results of the analysis are summarized in Table 1.

The analysis of the presented table – 1 shows that domestic varieties of grain and leguminous crops have a high content of mass fraction of protein. Studies of grain crop samples show that

the maximum value of mass fraction of protein corresponded to the grain of buckwheat of the variety “Saulyk” (Almaty region) and amounted to 12.5%,

Table 1 - Results of the chemical analysis of the selected grain and leguminous crops

№	Name/variety	Humidity, %	Protein, %	Fat,%	Fiber,%	Starch content,%	Ash content,%
Lentils							
1	”Stepnaya” (Almaty region)	5,7	27,8	2,6	3,6	47,2	2,6
2	”L-4 400” (Kostanay region)	6	27,8	2,4	3,2	46,8	2,4
Chickpeas							
3	”Ersultan” (Almaty region)	5,3	24,6	5,8	5	38,5	0,9
Corn							
4	”Dobrynya” (Almaty region)	6,4	7,7	1,3	1,7	64,4	1,36
Barley							
5	”Arpa elite” (Almaty region)	6,8	10,2	3,5	9,4	51,9	3,2
6	”Sabir” (Akmola region)	6	10	2,3	8,9	51,8	2,2
Buckwheat							
7	”Saulyk” (Almaty region)	9,5	12,5	3,3	9,1	47,9	1,8
8	”Batyr” (Akmola region)	9	10,8	3	9	48,7	2
Rice							
9	“Syr Syluy” (Kyzylorda region);	9,7	7,96	1,2	2,8	68,3	0,41
10	“Aikerim” (Kyzylorda region)	10,5	6,62	1,79	2,5	70,1	0,45
11	“Marzhan” (Kyzylorda region)	11,5	7,4	1,93	2,7	69,4	0,48
Oats							
12	“Duman” (Akmola region)	10,2	12,77	1,8	9,2	57,5	2,54
13	”Arman” (Kostanay region)	10	12,5	3,2	9,3	55,4	2,45
14	“Bitik” (Akmola region)	9,8	11,3	3,6	9,8	56,2	2,58

The analysis showed a high starch content in the selected batches of lentils - up to 47.2% for the ”Almatinskaya” variety. High starch content was found in: corn of the ”Dobrynya” variety (Almaty region) (64.4%), and barley of the ”Arpa Elite” variety (up to 51.9%), the minimum value was noted in the sample of buckwheat grain of the ”Saulyk” variety (Almaty region) (47.9%).

Table 1 shows that the carbohydrate content in the studied samples varies in the range of 70-76%. The highest carbohydrate content was found in the grain of rice of the ”Marzhan” variety. It is known that the quantitative content of carbohydrates in rice grain depends not only on genetic traits, but also on many

external factors and growing conditions (chemical composition of the soil, its acidity and humidity). Dietary fiber, poorly absorbed by the human body, accelerates intestinal peristalsis, normalizes lipid and carbohydrate metabolism in the body, and promotes the elimination of heavy metals. The high nutritional value of rice is provided by the protein composition of rice varieties. Analysis of protein in the grain of selected rice varieties showed that the "Syr syluy" variety has higher rates (7.96%), and the "Aikerim" variety has a mass fraction of protein of 6.62%.

The analysis of Table 1 allows us to state that in the studied samples of oat grains of the Duman variety, the mass fraction of carbohydrates is 2.8%; 1.54% higher than in the Bitik and Arman varieties. As we know, carbohydrates are the main source of energy for physical and mental activity. In addition, carbohydrates are necessary for uninterrupted cell division, muscle strengthening and normalization of growth dynamics [20]. In terms of protein content, the Duman variety also leads, in comparison with other studied varieties, the mass fraction of protein is higher by 1.47%; 0.27%, respectively. And in terms of fat content, the Bitik variety leads.

The results of the research made it possible to identify varieties of grain and leguminous crops with the highest nutritional value, which can serve as the main raw material in the development of technologies for the production of flour confectionery products.

Table 2 - Comparative analysis of the quality of melons and gourds with the requirements of regulatory documents

№	Name of raw material	Pumpkin		Melon		Courgettes	
		according to GOST 7975-2013	sample under study	according to GOST 7178-2015	sample under study	according to GOST 31822-2012	sample under study
1	2	3	4	5	6	7	8
1	Mass fraction of fruits (in case of calibration) that do not meet calibration requirements, %, no more than	10	4	10	5	5	3
2	Mass fraction of bruised and mechanically damaged fruits, %. no more than	not allowed	not found	not allowed	not found	not allowed	not found
3	Mass fraction of foreign impurities (twigs, stalks, leaves). %, no more than	not allowed	not found	not allowed	not found	not allowed	not found
4	The presence of rotten, withered, moldy and dry fruits	not allowed	not found	not allowed	not found	not allowed	not found
5	Presence of agricultural pests and their waste products	not allowed	not found	not allowed	not found	not allowed	not found

The ideological principle of the functional products being developed is the absence of preservatives, dyes, flavors and other artificial food additives. The main ingredients of the products are melons, fruits, berries (powders) dried using a special innovative technology, as well as various food components that allow varying the taste, aroma and functional properties of the products.

Dried crushed melons, fruits and berries contain dietary fiber, pectin and cellulose, which have prebiotic properties.

Next, a comparative analysis of the quality of the studied samples of melons (pumpkin, melon, squash) and fruit and berry (apples, apricots, raspberries, currants and sea buckthorn) crops was carried out with the requirements of regulatory documents presented in Table 2.

The studies showed that all the analyzed samples were in a healthy condition, the mass fraction of fruits was dented and mechanically damaged, foreign impurities; rotten, withered, moldy and dry fruits were not found in the studied samples. The conducted studies showed that the analyzed samples of melons and gourds meet the requirements of regulatory documents, have high technological properties, which can subsequently ensure the maximum output of products during their processing.

Table 3 - Comparative analysis of the quality of fruit and berry crops with the requirements of regulatory documents

№	Name of raw material	Apple		Apricot		Raspberry		Currant		Sea buckthorn	
		according to GOST 27572-2017	sample under study	according to GOST 32787-2014	sample under study	according to GOST 33915-2016	sample under study	according to GOST 33954-2016	sample under study	according to GOST R 59661-2021	sample under study
1	2	3	4	5	6	7	8	9	10	11	12
1	Fruit size by largest transverse diameter, cm, not less than	6	7	10	12	-	-	-	-	-	-
2	Mass fraction of berries that do not correspond to the commercial grade, but correspond to a lower grade, %, no more than	-	-	-	-	5	3	5	2	-	-

3	Mass fraction of fruits that have not reached removable maturity and color. %, not more than	-	-	-	-	-	-	-	-	2	1
4	Mass fraction of bruised and mechanically damaged fruits, %. no more than	not allowed	not found	not allowed	not found	-	-	-	-	5	3
5	Mass fraction of foreign impurities (twigs, stalks, leaves). %, no more than	not allowed	not found	not allowed	not found	0,3	0,1	0,3	0,2	1	0,5
6	The presence of rotten, withered, moldy and dry fruits	not allowed	not found	not allowed	not found	not allowed	not found	not allowed	not found	not allowed	not found
7	Presence of agricultural pests and their waste products	not allowed	not found	not allowed	not found	not allowed	not found	not allowed	not found	not allowed	not found

The studies showed (Table 3) that the samples were in a healthy condition. The presence of agricultural pests and their waste products were not detected in the studied samples. The mass fraction of berries that did not correspond to the commercial grade was within the norm. The studies showed that the analyzed samples of fruit and berry crops meet the requirements of regulatory documents.

Analysis of tables 2 and 3 allows us to state that the studied samples of melons and fruit and berry crops comply with the requirements of regulatory documentation and can be used for research and production of dry powders.

Thus, dry powders from melons and fruit and berry crops can become an excellent basis for developing technologies for the production of flour confectionery products due to their beneficial properties and ability to improve the texture and nutritional value of the final product.

Conclusions. Based on the conducted research, it can be concluded that the development of functional flour confectionery products using non-traditional raw materials, such as legumes, melon and fruit and berry powders, is promising. Such products will have increased nutritional value, improved organoleptic properties and can help prevent various diseases due to the content of natural antioxidants and biologically active substances. The obtained results open up prospects for further research in the field of developing technologies for the production of flour confectionery products using non-traditional raw materials. This will expand the range of functional products enriched with natural antioxidants and biologically active substances, which is especially important in the context of the

modern healthy food market.

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