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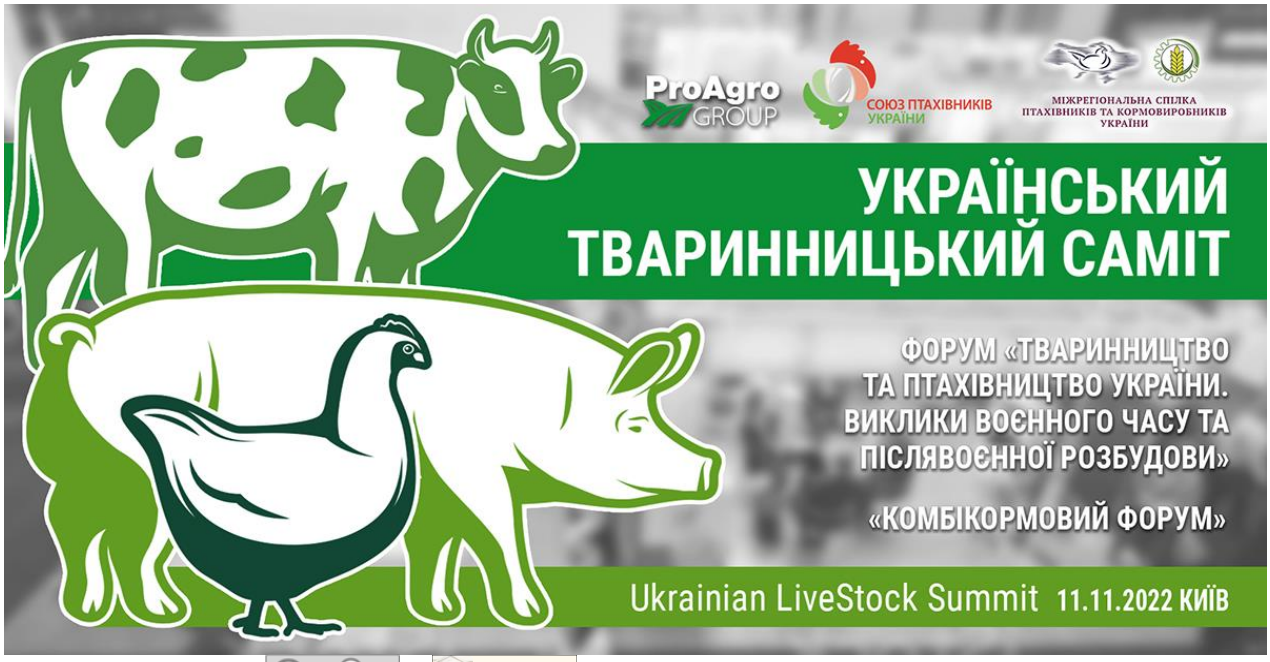

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THE USE OF MILK THISTLE SEED FLOUR IN THE COMPOSITION OF YEAST DOUGH FOR CHEESE PASTRY

Abstract

One of the progressive directions in the development of the production of food products and culinary products is the creation of new flour products and giving them a functional focus by using natural ingredients. The biologically active complex of milk thistle flour contains vitamins, minerals and trace elements, prevents the accumulation of harmful substances in the human body and has a hepatoprotective effect. The article presents the results of research on the use of milk thistle seed flour in the technology of flour products from yeast dough - cheese pastry. The expediency of using milk thistle seed flour in the production of butter products, which was added to the mass of high-grade wheat flour in the amount of 3.0 to 5.0%, was established experimentally. A rational amount of thistle flour in the composition of the yeast dough was established, which is 5.0% by weight of wheat flour. The effect of thistle seed flour on the amount and quality of gluten in the dough was investigated, the effect of new raw materials on the properties of the dough and quality indicators of the finished product was established.

The addition of milk thistle seed flour to the composition of yeast dough for cheesecake has a positive effect on the nutritional value of the finished product, the amount of biologically active substances useful and necessary for the human body has increased: mineral elements, vitamins (vitamins E and group B), unsaturated fatty acids, as well as food fibers The feasibility of using milk thistle seed flour in the production technology of flour products from yeast dough to expand the range of flour products of increased biological value has been proven. The developed flour product using milk thistle flour can be introduced into restaurants as a functional product with increased nutritional value.

Keywords: milk thistle seed flour, butter products, nutritional value, semi-finished product, organoleptic evaluation, vitamins, antioxidants.

Introduction

Modern ecological conditions in our country and in the whole world are characterized by a wide spread of various diseases associated with insufficient content of important macroelements and microelements in the human body, with diseases of the gastrointestinal tract and others. Together with food, substances that have toxic and carcinogenic properties enter the human body. In this connection, there is an urgent need for additional sources of useful substances in the diet of the country's population.

Yeast dough products are one of the most popular among the population and make up almost 45.0% of the assortment of flour products.For residents of Ukraine, bakery products, as well as products made from yeast dough, are products of daily use, which are a source of energy and nutrients for the human body. But the main disadvantage of these products is that their excessive consumption disrupts the balance of food rations in terms of nutritional and energy value. This is explained by the high content of fats and carbohydrates (starch, oligosaccharides), low content of minerals, vitamins and dietary fibers. Therefore, one of the progressive directions in the production of food products is the creation of new flour products and giving them a functional focus by using natural ingredients.

One of the promising ways to solve this problem is the enrichment of flour products from yeast dough with additives of plant origin, obtained from agricultural crops and not previously used in the technology of products from yeast dough [1,2].

Processing of semolina and production of flour from it is one of the directions of development of the industry that produces vegetable oils. It is the meal that contains the remaining portion of oil and other nutrients and biologically active substances. The use of flour from oilseed meal in the production of flour products from yeast dough allows to enrich the chemical composition of products with protein and lipids, to create functional products.

Adding substances that have a hepatoprotective effect to the recipe of flour products from yeast dough is also gaining relevance. Hepatoprotectors - agents that increase the resistance of liver cells to the action of damaging factors, activate its detoxification functions and increase the activity of metabolic processes, improve the functional state of the liver.

Milk thistle seed flour, based on its functional properties, biological value and chemical composition, belongs to products that prevent the accumulation of harmful substances in the human body and have Milk thistle - Silybum marianum (L.) Gaertn - a strong hepatoprotector. Since ancient times, it has been used as a medicinal plant for the treatment of liver diseases. Milk thistle contains the flavolignan silymarin, which has a hepatoprotective effect. The most valuable component of this plant is the seed, which includes flavolignans, the main ones of which are silybin (silymarin), silydianin, silychristin, in addition, the seed contains 32.0% fatty oil, a small amount of essential oil (0.08%), resins, mucilage, and also biogenic amines (thiamine, histamine) and about five flavonoids (taxifolin, quercetin, dehydrokaempferol, etc.), glucose, fructose, rhamnose, xylose, arabinose, galacturonic acid, amino acids, hydroxycinnamic acids, vitamins K, A, E, saponins, tannins, as well as macroelements K (9.2 μg/g), Ca (16.6 μg/g), Fe (0. 08 μg/g) and trace elements Al, Mg, Mn (0.1 μg/g), Cu (1.16 μg/g), Zn (0.71 μg/g), Cr (0.15 μg/g), Se (22.9 μg/g) , V (0.01 μg/g), Sr, Pb. The leaves of milk thistle contain flavonoids [3].

The high content of polyunsaturated fatty acids, dietary fibers, a wide range of minerals, vitamins E and group B, flavonoids in the composition of milk thistle seeds determines the prospects of its use in the production of yeast dough products.

Taking into account the wide range of functional properties of the studied raw materials and the wide interest in their use in the production of food products, the use of thistle seed flour in the production of buttery flour products is an actual direction of using raw materials of local importance to increase the nutritional value of buttery products that have wide popularity and mass consumption.

Literatury review

In the production technology of flour products, in order to reduce the calorie content and increase the biological value, wheat flour is replaced in recipes with chickpea, flax, triticale, sorghum, rice, barley, corn and others. Meals from non-traditional types of raw materials containing dietary fiber are added to the recipe of flour products. Gluten-free therapeutic and preventive products with functional properties are being developed for people with celiac disease.

Analyzing literary sources, we came to the conclusion that there are a number of separate technologies of food products with the use of milk thistle processing products and other plant raw materials.

A. V. Antonenko developed the technology of confectionery products from shortbread using a composition of soybean, sunflower, and thistle meal to obtain functional products with increased biological value [4].

N.V. Novgorodska, A.M. Solomon, I.M. Bernyk developed a recipe for chopped meat semi-finished products. From the conducted experiments, it was established that from a technological point of view, it is most optimal to add thistle meal to the meat system in the amount of 5.0% of the beef mass at the stage of making minced meat. At the same time, the functional and technological properties of the meat system improve, and the organoleptic indicators do not deteriorate [5].

L.A. Mykhonik, A.M. Hryshchenko developed the technology of bread from wheat whole grain flour using meal from thistle seeds. The effect of meal on the amount and quality of gluten in the dough was investigated. The indicators of the technological process and quality of bread made from wheat whole-grain flour with different dosages of thistle seed meal are given. Taking into account the valuable chemical composition, the high content of antioxidants, the use of this raw material made it possible to expand the assortment of bread products for health and preventive purposes [6].

N.P. Buyalska, O.L. Gumenyuk, N.M. Denisova, and V.M. Chelyabiev proved in their work that the use of thistle processing products in the production of bakery products in order to increase the quality, nutritional value and give them health-promoting properties is expedient, scientifically based and experimentally confirmed. It was found that the most optimal is the use of 2.0% milk thistle meal and 6.0% milk thistle oil as an additive to the mass of flour. The use of meal accelerates the fermentation process and improves the lifting power of yeast, which has a positive effect on the physical and chemical indicators of the quality of finished products. Bread with the addition of milk thistle processing

products has better organoleptic and physicochemical properties compared to the control sample [7].

Yana Bachynska investigated the impact of using non-traditional plant raw materials in the production of flour confectionery products with increased biological value. The paper presents the results of the commodity evaluation of the developed products and compares them with the main samples presented in the retail network of Kharkiv. The expediency of using a mixture of dietary fibers and meal from pumpkin seeds as natural plant additives in the production technology of flour confectionery products has been proven [8].

By Veronika Bortikova, Lucas Kolaris and others. [9] established the expediency of using thistle seed flour in the production of cookies. In the course of experiments, the effect of replacing wheat flour on the technological properties of the dough, the change in the water absorption capacity of the flour and the stability of the dough was studied.

Scientists Shahat Mohamed S., Hussein Ahmed S., Hady Essam A. developed the technology of baladi bread using defatted thistle seeds for the treatment and prevention of liver diseases [10]. The therapeutic effect of this product with the addition of thistle seeds was proven during an experiment conducted on rats.

We believe that such a problem as an unfavorable environmental situation, the introduction of substances from the environment that have a toxic and carcinogenic effect, requires the introduction of new functional products into production, in particular flour products from yeast dough, which have a hepatoprotective effect and increased nutritional value. Therefore, the use of non-traditional plant raw materials, namely milk thistle seed flour as part of a yeast semi-finished product for the production of cheesecakeis interesting and relevant.

The purpose and tasks of the research

The purpose of the study is to expand the range of buttery flour products by using milk thistle seed flour to increase the nutritional value of the products and provide them with a functional purpose.

To solve the goal, it is necessary to establish the dosage of thistle seed flour for the preparation of the product and to study the peculiarities of its use, to determine its influence on the technological process, to investigate the change in the organoleptic and physicochemical quality indicators of the semi-finished product and the finished product, to determine the nutritional value and mineral composition of the developed product.

Research materials and methods

The research materials were: the raw material included in the recipe for biscuits with jam, thistle seed flour, produced by the company "BioRaztorpsha", semi-finished dough and finished product.

During the work, standard, generally accepted research methods were used.

Selection and preparation of samples was carried out according to the current standards for bread and bakery products - DSTU 7044:2009. The mass fraction of moisture was determined using Chizhova's device, porosity was determined organoleptically, dimensional stability of the products was determined as the ratio of the height of the product to its diameter. Determination of crude gluten content was carried out in accordance with DSTU ISO 21415-1:2009 Wheat and wheat flour gluten content. Determination of crude gluten manually [8]. The moisture absorption capacity of the flour was determined by the centrifugation method according to the standard method, the acidity of the dough was determined by the titrometric method, the mineral composition and nutritional value of the new products were determined by the calculation method. Tasting analysis of finished products was carried out by scoring samples.

Research results and their discussion

The dough for cheese pastry was prepared using a steam method, and pastry with jam No. 1098 according to the collection of recipes using high-grade wheat flour were used as a control sample.

Spotted milk thistle flour was added to test samples in the amount of 3.0 when kneading the dough; 5.0; 7.0% to the mass of wheat flour in the dough, samples No. 1, No. 2 and No. 3 were formed, respectively. The fermentation temperature of the dough was +29...32°C. The control sample was dough without the addition of thistle seed flour.

The content of milk thistle seed flour in the composition of the yeast semi-finished product for the production of cakes with jam was substantiated by an experimental method. The effect of thistle seed flour on the organoleptic parameters of the puff pastry and the physicochemical properties of the dough was determined.

The obtained data showed that the content of gluten in experimental samples No. 1, No. 2, and No. 3 decreased in comparison with the control sample, respectively, by 1.7%, 2.7%, and 3.3%, but it is within the normative values (for high-grade flour - not less than 24.0%). The decrease in gluten content is most likely due to the introduction of flour from milk thistle seeds, the proteins of which are not capable of its formation. The quality of gluten in the samples with flour from milk thistle seeds in test samples No. 1, No. 2 and No. 3 also changed, the extensibility decreased slightly, the elasticity of the gluten is good, the color is light with a cream shade. The obtained results correspond to the data of the authors' study [6], who established that the addition of thistle meal affects the quantity and quality of gluten, namely, with an increase in the dosage of the studied raw material, the amount of raw and dry gluten decreases, and its quality changes. The results of assessing the amount and quality of gluten in the dough with the addition of different amounts of thistle seed flour in comparison with the control sample are presented in Table 1.

To determine the influence of flour from thistle seeds on the quality of the dough and the finished product, the baking of cheese pastry was carried out. Preparations from fermented yeast dough were subjected to development and curing at an air temperature of 32...35°C and a relative humidity of 75...83%. The duration of baking was 18-22·60 s at a temperature of +210...220°C. The baking properties of the recipe mixtures were evaluated by the quality of the finished

Table 1 – Evaluation of the quality of samples with the addition of different amounts of thistle seed flour

Name of indicators	Variants of the ratio of wheat flour and milk thistle seed flour			
	Control sample (100:0)	Sample 1 (97:3)	Sample 2 (95:5)	Sample 3 (93:7)
Water absorption capacity, %	57.0	59.0	61.0	65.0
Gluten content, %	30.0	29.5	29.2	29.0
Elasticity	good	good	good	good
Extensibility, see	19.0	18.0	17.0	16.5

Table 2 -Acidity dough with the addition of thistle flour

Name of indicators	Variants of the ratio of wheat flour and milk thistle seed flour			
	Control sample (100:0)	Sample 1 (97:3)	Sample 2 (95:5)	Sample 3 (93:7)
Initial acidity of the dough, degrees	2.0	2.0	2.0	2.0
Final acidity of the dough, degrees	3.2	3.5	3.7	3.9

bakery products obtained by trial baking.

In the process of research, it was established that the acidity of the dough in the samples with the addition of milk thistle seed flour after fermentation was higher than in the control sample, this indicates an increase in the intensity of fermentation and contributes to a slight reduction in the duration of the fermentation of the dough. The acidity of the dough in samples with the addition of different amounts of thistle flour is presented in Table 2.

The organoleptic evaluation of the quality of the samples of cheesecakes with the addition of different amounts of thistle seed flour was carried out by means of a point evaluation of the studied samples. The results of the tasting analysis are presented in Table 3.

As a result of the organoleptic evaluation, it was established that according to the main indicators, test samples No. 1 and No. 2 with the introduction of 3.0% and 5.0% flour of milk thistle seeds, respectively, had no significant differences. Vatrushki from the above-mentioned samples had an attractive appearance, pleasant taste and aroma. Sample No. 3 with the introduction of 7.0% milk thistle seed flour differed from the control product by a darker color of the surface of the product and the presence of an extraneous bitter aftertaste.

Thus, when using milk thistle seeds to the mass of wheat flour of the highest grade, it should be considered rational to add thistle flour in the amount of 3.0 to 5.0% of the mass of wheat flour. At the same time, the cheesecakehas an attractive appearance, a correct shape, a smooth surface, a pleasant taste and aroma, a uniform, thin-walled structure of porosity, and a well-formed pulp. The color of the pulp of the finished product is light with a slight grayish tint.

The results of the assessment of the physical and chemical parameters of the finished products are presented in Table 4.

Table 4 – Physico-chemical indicators of the quality of finished products

Characteristic	Adding flour from thistle seeds to the composition of cottage cheese			
	Control 0%	Sample 1 3.0%	Sample 2 5.0%	Sample 3 7.0%
Mass fraction of moisture, %	38.5	38.6	38.8	39.0
Form retention, N/A	0.3	0.3	0.3	0.3

Table 3 – Results of the tasting analysis of organoleptic parameters of new products

Characteristic	Evaluation of the indicator for the content of new raw materials in the composition of culinary products, %			
	Control	Sample 13.0%	Sample 25.0%	Sample 37.0%
Appearance	5	5	4	4
Color	5	5	5	4
Scent	5	5	5	5
Taste	5	5	5	3
Porosity	5	5	4	4
Overall assessment	25	25	23	20

According to the results of the conducted research, we can see that when adding 3.0% flour of milk thistle seeds to the mass of wheat flour (sample No. 1), no changes occurred. The porosity of the cheese pastry was at the level of the control sample, the moisture content was within the limits set by the standard (for butter products, the mass fraction of moisture is 37.0 - 45.0%), the dimensional stability of the sample was at the control level. When adding 5.0% milk thistle seed flour to the mass of wheat flour (sample No. 2), the moisture content increases by 0.8%, and the dimensional stability of the sample is at the control level. When adding 7.0% milk thistle seed flour to the mass of wheat flour (sample No. 3), the moisture content increases by 1.2%, the dimensional stability remains at the control level.

Therefore, the analysis of the obtained data shows that the replacement of a part of wheat flour in the composition of butter products with thistle seed flour affects the quality of the semi-finished dough and the finished product, changes the organoleptic indicators of the product and requires the adjustment of the technological process to obtain a new high-quality product.

Table 5 - Comparative characteristics of the nutritional value of cheese pastry

The name of the nutrient	Content, g/100 g of product	
	cheesecakes with jam N. 1098	cheesecakes with the addition of thistle flour
Squirrels	4.7	5.1
Fats	11.5	12.02
Carbohydrates	37.6	37.8
Food fibers	1.1	1.37
Organic acids	23.8	23.8
Flavonoids, %	-	0.04
Calorie content, kcal	262.5	265.5

Table 6 - Comparative characteristics of the vitamin composition

The name of the nutrient	Content in 100 g of product	
	Cheesecakes with jam N.1098	Cheesecakes with the addition of thistle flour
A, RE	2.9 mcg	2.9 mcg
B1, thiamine	0.73 mg	0.73 mg
B2, riboflavin	0.87 mg	0.9 mg
B4, choline	18.05 mg	18.05 mg
B5, pantothenic acid	0.36 mg	0.36 mg
B6, pyridoxine	0.08 mg	0.08 mg
B9, folates	40.47 mcg	40.47 mcg
B12, cobalamin	0.07 mcg	0.07 mcg
C, ascorbic	0.24 mg	0.24 mg
D, calciferol	0.01 mcg	0.01 mcg
E, alpha tocopherol, TE	5.13 mg	6.1 mg
H, biotin	2.82 mcg	2.82 mcg
RR, NE	1.84 mg	1.84 mg
β-carotene	-	0.03 mg

Taking into account the high biological value of the researched raw material and its functional value, the next stage of the work was the determination of the nutritional value, vitamin and mineral composition of cheese pastry with the addition of thistle flour in a ratio of 95:5 (wheat: milk thistle) in comparison with the analogue. Comparative characteristics are given in tables 5, 6, 7.

The analysis of the obtained data from the calculation of the main food nutrients and biologically active substances shows that the replacement of wheat flour with thistle seed flour in the amount of 5.0% contributes to a slight increase in the content of proteins (by 8.5%), fats (by 4.5%) and a significant increase in the content of dietary fibers (by 24.5%), the calorie content of the product does not change. In addition, the amount of antioxidant vitamins (tocopherol and β-carotene) increases in the cheese pastry with the addition of the

Table 7 - Comparative characteristics of the mineral composition of cheese pastry

The name of the nutrient	Content in 100 g of product	
	Cheesecakes with jam N. 1098	Cheesecakes with the addition of thistle flour
Macroelements		
Kaliy, K	97.98 mg	97.98 mg
Calcium, Ca	54.73 mg	59.3 mg
Silicon, Si	1.083 mg	1.083 mg
Magnesium, Mg	8.88 mg	10.2 mg
Sodium, Na	15.23 mg	15.23 mg
Syra, S	24.69 mg	24.69 mg
Phosphorus, P	63.4 mg	64.4 mg
Chlorine, Cl	371.7 mg	371.7 mg
Microelements		
Bohr, B	9.9 mcg	9.9 mcg
Vanadiy, V	24.12 mcg	24.12 mcg
Iron, Fe	0.95 mg	1.2 mg
Iodine, I	2.17 mcg	2.17 mcg
Cobalt, Co	0.65 mcg	0.65 mcg
Manganese, Mn	0.41 mg	0.41 mg
Copper, Cu	49.03 mcg	49.03 mcg
Molybdenum, Mo	5.271 mcg	5.271 mcg
Selenium, Se	1.95 mcg	1.949 mcg
Fluoride, F	9.24 mcg	9.24 mcg
Chrome, Cr	0.94 mcg	0.94 mcg
Zinc, Zn	0.33 mg	0.33 mg

studied raw materials, the content of calcium, magnesium and iron increases, and the developed product contains flavonoids and flavolignans.

Conclusions

Thus, research shows thataccording to a complex of organoleptic and physicochemical indicators dough and finished producta recipe for cheese pastry using milk thistle flour was developed, the effect of the addition of new raw materials on the quantity and quality of gluten, acidity of the dough, quality and nutritional value of the finished products was determined. It was established that, from a technological point of view, it is most rational to add thistle seed flour to the yeast dough in the amount of 5.0%, replacing wheat flour. At the same time, the organoleptic indicators of the quality of the finished product remain at the control level, the functional and technological properties of the dough change (the acidity of the fermented dough increases), the nutritional and biological value of the product increases. The developed flour product from yeast dough using milk thistle seed flour can be implemented in restaurants as a functional product with increased nutritional and biological value.

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ВИКОРИСТАННЯ БОРОШНА НАСІННЯ РОЗТОРОПШІ ПЛЯМИСТОЇ У СКЛАДІ ДРІЖДЖОВОГО ТІСТА ДЛЯ ВАТРУШОК

Анотація

Одним із прогресивних напрямків розвитку виробництва харчової продукції та кулінарних виробів є створення нових борошняних виробів і надання їм функціональної спрямованості шляхом застосування натуральних інгредієнтів. Біологічно активний комплекс борошна розторопші плямистої містить вітаміни, мінеральні речовини і мікроелементи, запобігає накопиченню шкідливих речовин в організмі людини та володіє гепатопротекторним ефектом. У статті наводяться результати досліджень використання борошна насіння розторопші плямистої у технології борошняних виробів із дріжджового тіста - ватрушок. Дослідним шляхом встановлено доцільність використання борошна насіння розторопші плямистої у виробництві здобних виробів, яке вносили до маси пшеничного борошна вищого сорту у кількості від 3.0 до 5.0%. Встановлено раціональну кількість борошна розторопші у складі дріжджового тіста, яка складає 5.0% до маси пшеничного борошна.

Досліджено вплив борошна насіння розторопші на кількість та якість клейковини в тісті, встановлено вплив нової сировини на властивості тіста та показники якості готового виробу.

Додавання до складу дріжджового тіста для ватрушок борошна насіння розторопші плямистої позитивно вплинуло на харчову цінність готового виробу, підвищилася кількість корисних і необхідних людському організму біологічно-активних речовин: мінеральних елементів, вітамінів (вітамінів Е та групи В),ненасичених жирних кислот, а також харчових волокон. Доведена доцільність використання борошна насіння розторопші плямистої в технології виробництва борошняних виробів із дріжджового тіста для розширення асортименту борошняних виробів підвищеної біологічної цінності.

Розроблений борошняний виріб з використанням борошна розторопші може бути впроваджений у заклади ресторанного господарства, як функціональний виріб з підвищеною харчовою цінністю.

Ключові слова: борошно насіння розторопші плямистої, здобні вироби, харчова цінність, напівфабрикат, органолептична оцінка, вітаміни, антиоксиданти.

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