

UDC 664.68

Abuova A.B., Doctor of Agricultural Sciences, Associate Professor

Sumkina S.V., undergraduate

Zhangir Khan West Kazakhstan agrarian-technical university, Uralsk, Kazakhstan

EFFECT OF FLOUR COMPOSITE MIXTURES ON SAFETY AND QUALITY INDICATORS OF SHORTBREAD COOKIE

Abstract

This article presents the results of the physical and chemical and microbiological analysis of confectionery products from flour composite mixtures. As flour composite mixtures, rape, sorghum and chick pea flour was used at a concentration of 30%. The study of the chemical composition, harmlessness, microbiological resistance, showed the promise and the possibility of using flour from rapeseed, chickpea and sorghum to improve the nutritional and biological value of food.

Keywords: *flour composite mixtures (FCM), rape, sorghum, chickpeas, control, flour, tasting, wetting, acidity, alkalinity, microbiological indices, heavy metals, State standard, quality, safety.*

At the present days, the confectionery industry faces a number of tasks: expansion of the assortment, prophylactic products with biologically active additives, increasing the resistance of the organism in unfavorable conditions; improving the quality and extending the shelf life of confectionery.

One of the promising directions for solving these problems is the use for the production of flour confectionery products of finished concentrates, products of multi component composition, which are called flour composite mixtures (FCM). They occupy an increasing place in the structure of flour products, because they can be used to produce a wide range of products: muffins, biscuits, cakes, cookies, pastries, croissants, slices, donuts, pancakes [1].

Raw materials of plant origin are widely used in the production of flour confectionery. These are foods with a high content of dietary fibers and biologically active substances (wheat bran, oatmeal, soybean and rice flour, wheat germ, oats and products of its processing, rice bran, corn flour, herbal and leaf infusions, spices, vegetable and fruit additives).

Use in the production of flour confectionery products of composite mixtures from non-traditional types of flour allows to give semi-finished products a functional orientation and increase their nutritional value, to use grain resources more efficiently and to reduce the cost of production. Features of the chemical composition - the amino acid and fractional composition of proteins, the structure and temperature of gelatinization of cornmeal grains, the content of other polysaccharides, vitamins and minerals, various pretreatment (thermal, moisture-thermal, flattening, extrusion) provide specific flavor, functional and technological properties of flour from cereals, legumes and oilseeds [2].

The purpose of the research is to study the safety and quality indicators of shortbread cookies prepared with the addition of sorghum, chickpeas and rapeseed flour.

The research was carried out within the framework of the project «Development and introduction of innovative technologies of confectionery products from flour composite mixtures of local plant raw materials» (State Registration No. 0115PK 02882) of the program of university funding for 2015-2016.

Object and methodology. The objects of the study were a confectionery product (biscuit) with the addition of 30% flour composite mixture of sour, chickpea and rape flour. Laboratory studies

were conducted in the Test Center of the Research Institute of Biotechnology and Nature Management of the ZKATU named after Zhangir Khan.

Research methods:

1. 24901-2014 State standard. Biscuit. General specifications;
2. 10114-80 State standard. Confectionery. Method for determining wetting;
3. 5898-87 State standard. Confectionery. Methods for determining acidity and alkalinity;
4. 26811-86 State standard. Method for determining the mass fraction of total sulfuric acid;
5. 26929 - 94 State standard. Mineralization for the determination of the content of toxic elements;
6. 10444.15-94 State standard. Food products. Methods for determining the amount of mesophilic aerobic and facultative - anaerobic microorganisms;

Features of the chemical composition - the amino acid and fractional composition of proteins, the structure and temperature of gelatinization of cornmeal grains, the content of other polysaccharides, vitamins and minerals, pretreatment determine the specific flavor, functional and technological properties of flour from cereals, beans and oil crops.

Sorghum is one of the most useful cereals. Croup of sorghum is white, yellowish, brown and black. The benefits of cereal from such cereals can not be overestimated. As already mentioned, sorghum is a storehouse of vitamins, and in the first place - vitamins of group B. Thiamine (B1) favorably affects the functions of the brain, as well as higher nervous activity. It also normalizes gastric secretion and cardiac muscle work, increases appetite and increases muscle tone. The content of riboflavin (B2) sorghum is superior to many other cereals. This vitamin maintains skin and nail health and hair growth. Finally, pyridoxine (B₆) stimulates metabolism [3].

Among other things, sorghum is an excellent antioxidant. The polyphenolic compounds that enter into it strengthen immunity, protecting the body from the influence of negative environmental factors. In table 1 - food value, vitamins, macro elements and microelements, energy value of sorghum grain are given.

Table 1 - Food value, vitamins, macro elements and microelements, energy value of sorghum grain

Indicators	Volume	Indicators	Volume
Caloric value	323 kkal	Vitamin PP (Niacin equivalent)	5,1426 mg
Proteins	10,6 g	Choline	93 mg
Fats	4,12 g	Calcium	99 mg
Carbohydrates	59,6 g	Magnesium	127 mg
Alimentary fiber	3,5 g	Sodium	28 mg
Water	13,5 g	Potassium	246 mg
Saturated fatty acids	0,51 g	Phosphorus	298 mg
Unsaturated fatty acids	3,08 g	Chlorine	47 mg
Starch	58 g	Sulfur	98 mg
Mono- and disaccharides	1,6 g	Iron	4,41 mg
Ash	2,2 g	Zinc	2,17 mg
Vitamin	E2,7 mg	Copper	390 mkg
Vitamin PP	3,3 mg	Manganese	2,459 mg
Vitamin B ₁ (thiamine)	0,46 mg	Bor	344 mkg
Vitamin B ₂ (riboflavin)	0,16 mg	Silicon	48 mg
Vitamin B ₅ (pantothenic)	1 mg	Cobalt	2 mkg
Vitamin B ₆ (pyridoxine)	0,4 mg	Aluminum	1548 mkg
Vitamin H (biotin)	20 mkg		

The chickpea composition includes such an important element as manganese, which is an enzyme necessary for energy production and antioxidant defense capacity of the organism. It is known that when one cup of chickpea is used, a person replenishes the daily norm of this substance by 84.5 percent.

In addition, there are in the chickpea and other equally important minerals and vitamins: calcium, selenium, copper, zinc, iron, iodine, sodium, vitamin A, B₁, PP, beta-carotene and many other elements necessary for human health.

Table 2 shows the content of nutrients (calories, proteins, fats, carbohydrates) per 100 g of edible part.

Table 2 - Nutritional value and chemical composition of chickpea flour

Indicators	Volume	Indicators	Volume
Caloric value	309 kkal	Silicon (Si)	92 mg
Proteins	20,1 g	Boron (B)	540 mkg
Fats	4,32 g	Molybdenum (Mo)	60,2 mkg
Carbohydrates	46,16 g	Selenium (Se)	28,5 mkg
Ash	3 g	Manganese (Mn)	2,14 mg
Starch	43,2 g	Copper (Cu)	660 mg
Mono- and disaccharides	2,96 g	Iodine (I)	3,4 mkg
Polyunsaturated fatty acids	2,9 g	Zinc (Zn)	2,86 mg
Saturated fatty acids	0,67 g	Iron (Fe)	2,6 mg
Water	14 g	Sulfur (S)	198 mg
Alimentary fiber	9,9 g	Chlorine (Cl)	50 mg
Vitamin PP (Niacin equivalent)	3,3366 mg	Phosphorus (P)	444 mg
Vitamin B ₁ (thiamine)	0,08 mg	Potassium (K)	968 mg
Vitamin A	15 mkg	Sodium (Na)	72 mg
Beta-carotene	0,09 mg	Magnesium (Mg)	126 mg
Titanium (Ti)	228 mkg	Calcium (Ca)	193 mg
Nickel (Ni)	206,4 mkg	Cobalt (Co)	9,5 mkg

The most popular crop in the world market is canola, one of the main oilseed-protein crops, which is the fifth in the world after soy, cotton, peanuts and sunflower in terms of oil production. Rapeseed oil is widely used directly in food when preparing salads, cold dishes, marinades, mayonnaise and other sauces, is used in bakery and confectionery production as additives to the test, when preparing cookies and other culinary products [4].

Rapeseed oil contains all physiologically important acids in the optimal ratio and therefore has, in terms of the physiology of human nutrition, advantages over other vegetable oils. Polyunsaturated fatty acids of rapeseed oil help to strengthen the walls of blood vessels and lower cholesterol levels in the blood, prevent the risk of thrombus formation, regulate fat metabolism [5].

To compose flour composites, different components were used with a contrasting protein content: wheat flour of superior quality - 70%; nut oil - 10%; rapeseed - 10%; sorghum - 10%.

On the basis of the data obtained, it can be noted that when using composite mixtures of general-purpose flour, the flavor qualities of finished products are higher, as is the increase in protein content due to added high-protein flour components, as compared to products based on high-grade flour only.

Table 3 shows the content of nutrients (calories, proteins, fats, carbohydrates, vitamins and minerals) per 100 g of edible part.

Table 3 - Nutritional value and chemical composition of oilseed rape

Indicators	Volume
Proteins	30,8 g
Fats	43,6 g
Carbohydrates	7,2 g
Alimentary fiber	5,8 g
Water	8,1 g
Ash	4,5 g
Saturated fatty acids	6,2 g
Mono- and disaccharides	3,5 g
Starch	3,7 g
Vitamin PP	10 mg
Vitamin B ₁ (thiamine)	0,11 mg
Vitamin B ₂ (riboflavin)	0,25 mg
Vitamin E (TE)	7,4 mg
Vitamin PP (Niacin equivalent)	15,9 mg
Calcium	454 mg
Magnesium	311 mg
Sodium	139 mg
Potassium	979 mg
Phosphorus	840 mg
Iron	6,3 mg
Energy value	544 kkal

To compose flour composites, different components were used with a contrasting protein content: wheat flour of superior quality - 70%; nut oil - 10%; rapeseed - 10%; sorghum - 10%.

On the basis of the data obtained, it can be noted that when using composite mixtures of general-purpose flour, the flavor qualities of finished products are higher, as is the increase in protein content due to added high-protein flour components, as compared to products based on high-grade flour only.

As the proportion of wheat flour decreases from 100% (control) to 70% in composites, taking into account the ratio of other added components, the protein content (by 35%), macro- and microelements such as sodium (by 16%), potassium (by 108%), calcium (by 21%), iron (by 33%), magnesium (by 41%) and phosphorus (by 6%). The content of B vitamins (by 19%), B₂ (by 30%), PP (by 6%) and P-carotene (by 43%) is increasing.

To assess the consumer properties, a tasting evaluation of cookie samples obtained with the addition of flour composite mixtures was carried out. The experts assessed the appearance and organoleptic parameters of the quality of the cookie on a 5-point scale (there is an Act of the Acceptance (Tasting) Commission on 15.11.2016). The results of the research determined the matrix of consumer preferences, which includes the most important indicators for consumers of biscuit quality. For biscuits, the desired quality indicators are: appearance, harmony of taste, flavor intensity, loose consistency, shape safety, low calorie content and convenient packaging.

When assessing the quality of cookies, the highest average score was obtained with products adding 10% rapeseed 10% nut and 10% sorghum to 70% of wheat flour. In these samples, experts noted the correct shape in combination with a uniform light brown color, smooth surface and a clear pattern. There was also a pleasant taste and aroma of products from composite mixtures. A high assessment of the physical and chemical and organoleptic parameters of the quality of the studied biscuits allows us to recommend the use of mixtures of wheat, chickpeas, sorghum and rapeseed flour in the production of flour confectionery products.

The results of the expert evaluation and physicochemical indicators of the quality of cookies are presented in Table 4.

Table 4 - Expert evaluation and physicochemical indicators of the quality of cookies

Variant number	Indicators	
	Control	Cookies with the addition of the FCM 30%
Structure	3,5	4,6
Surface	3,8	4,5
Shape	4,2	4,1
Color	3,0	4,3
Taste	3,5	4,5
Smell	3,0	4,2
Total Quality Score	3,5	4,4
Wetting	150	152
Acidity	0,08	0,07
Alkalinity	0,6	0,6
Sulfuric acid	-	-
Copper (mg / l)	0,22	0,21
Mercury (mg / l)	-	-
Cadmium (mg / l)	0,010	0,006
Zinc (mg / L)	0,004	0,002

The organoleptic evaluation of the investigated samples showed that the incorporation of composite mixtures of flour from unconventional plant raw materials into the formulation improves the organoleptic characteristics and texture of the sand semi-finished product. Rapeseed flour, enriching products with polyunsaturated fatty acids of the omega-3 family, gives the sandy semi-finished product a beautiful shade with rapeseed specks, which gives the liver a special look and juicy taste, which is different from the traditional cookie. Sorghum flour replaces the baking powder and gives the liver friability and porosity. Nut flour - a soft consistency and a delicate rich taste and a golden yellow color. Porosity is uniform, thin-walled, with well-structured crumb.

According to the organoleptic characteristics, the cookies have an attractive appearance, pleasant taste and aroma, small particles of rapeseed and chickpea were present on the surface of the products of shortbread cookies from the FCM. There is a slight smell and taste characteristic of leguminous crops, which does not reduce their consumer dignity. Studies have shown that the most interesting is the sample with 30% of the composite mixture, since this is the maximum dosage of the enrichment additive, in which the sample does not lose its organoleptic qualities and fully complies with the standard State standard 24901-2014 «Cookies. General specifications».

Wet ability is characterized by the ratio of the weight of the products after wetting to the mass of dry products and is expressed as a percentage. Establishing an increase in the weight of flour confectionery products when immersed in water at a temperature of 20 °C for a certain time.

The quality of the cookie depends to a large extent on the ability to absorb water. In this case, the intensity or speed of this process is of great importance. Wet ability characterizes the porosity of flour confectionery products. This indicator is standardized depending on the grade of flour used and ranges from 130% to 200%. For shortbread cookies, the norm is not less than 150%. The results of the research showed that both the control sample and the biscuit with the addition of the ISS of 30% are responsible for the requirements of State standard 24901-2014. This also indicates that during the manufacture of cookies, the formulation and technology of preparation were strictly observed.

The method for determining alkalinity is based on the neutralization of the acid contained in the sample, with sodium hydroxide (potassium hydroxide) in the presence of phenolphthalein until the appearance of a pink color.

The alkaline reaction of the biscuit is due to the presence in it of partially partly decomposed baking disintegrant when baking, as well as the products of their decomposition.

The excess content of alkaline compounds in the biscuit is undesirable and strictly normalized. Regardless of the type of cookie, this indicator should not exceed 2. Indicators of acidity and alkalinity

in all samples do not exceed the norm of this State standard 24901-2014. Biscuit. General specifications.

The presence of sulfuric acid in confectionery products is not allowed. During the study, no sulfuric acid was detected in any sample.

One of the strongest in action and the most common chemical pollution is the contamination with heavy metals. Lead, zinc, cadmium, mercury, molybdenum, chromium, manganese, nickel, tin, cobalt, titanium, copper, vanadium are heavy metals.

The whole danger of exposure to heavy metals lies in the fact that they remain in the human body forever. You can withdraw them only by consuming proteins contained in milk and white mushrooms, as well as pectin, which can be found in marmalade and fruit and berry jelly. It is very important that all products are obtained in ecologically clean areas and do not contain harmful substances.

With the technology of food production, toxic elements can appear in contact with equipment made of metal, not authorized by health authorities. The sanitary inspection bodies set strict standards for the content of toxic elements in food raw materials and finished food products. For most products, there are maximum permissible concentrations of toxic elements in basic foods.

Based on the results of the study of the samples for the presence and the amount of heavy metals, it can be concluded that the detected heavy metals such as copper, lead, cadmium and zinc are within the norm, in accordance with the requirements of the standard. These indicators are very important in assessing the quality and safety of confectionery.

The results of the microbiological analysis are shown in Table 5 below.

Table 5 - Microbiological indicators of cookies

Variant number	MAaFAM, KOE/g (m ³)	E. coli	Mold
Control	-	-	-
Cookies with the addition of the FCM 30%	-	-	-

When determining the microbiological parameters of the specimens, E. coli and mold were not detected. The number of mesophilic aerobic and facultative-anaerobic microorganisms was not detected. Microbiological indicators of cookies meet the requirements established in the Technical Regulations of the Customs Union «On Food Safety» in force in the territory of the Republic of Kazakhstan.

Thus, the concept of preparing a short cookie «SoNuRa» was developed with the addition of 30% FCM instead of wheat flour of the highest grade, which allows to correct the technological process.

On the basis of the data obtained, it can be noted that a composite combination of 70% of wheat flour of the highest grade, 10% of rape flour, 10% of sorghum and 10% of chickpea flour is a source necessary for the full functioning of the body of substances: proteins, vitamins, minerals, polyunsaturated fatty acids acids and dietary fiber, and is also safe for the health of consumers.

Based on the results of the performed studies, prototypes were obtained, the best results were introduced in ISAE, the «Technological instruction» and the draft Standard of the Organization «Sand cookies from flour composite mixtures» were developed.

This method of preparing shortbread cookies from flour composite mixtures of local plant raw materials in confectionery production provides a safe food for health sandwiches with increased nutritional value and functional purpose.

REFERENCES

1. Abuova A.B., Chinarova E.R., Akhmetova G.K., Maudarkhan Zh.B. Ispol'zovaniya sorgovoy muki v proizvodstve muchnykh konditerskikh izdeliy // Materialy V Mezhdunarodnoy nauchno-tekhnicheskoy konferentsii VGUIT. – Voronezh, 2015. - . 311-314 (in Russian).

2. Baibat'yrov T.A., Abuova A.B., Tapalova Zh.E. Rasshireniye assortimenta konditerskikh izdeliy s ispol'zovaniyem rapsovoyego maslo // Zdorovoye pitaniye: mat. VIII mezhd. nauch.-prakt. konf. - Saratovskiy gosudarstvennyy agrarnyy universitet imeni I.N. Vavilova. - Saratov, 2014. – S. 26-27 (in Russian).

3. Kulichenko A.I. Sovremennyye tekhnologii proizvodstva konditerskikh izdeliy s primeneniyyem pishchevykh volokon // Molodoy uchenyy. - 2014. - 4. - S. 203-206 (in Russian).

4. Rodionova N.S., Derkanosova A.A. Izucheniye potrebitel'skikh svoystv kompozitnykh smesey dlya muchnykh konditerskikh izdeliy // Vestnik VGUIT.. - 2012. - 1. - P. 98-99 (in Russian).

5. Trukhmanov S.V. Ispol'zovaniye zhmykha semyan rapsa v tekhnologii proizvodstva muchnykh konditerskikh izdeliy funktsional'nogo znacheniya. – avtoref. ... kand. s.-kh. nauk: 06.02.01. - M.: Voronezhskiy gosudarstvennyy agrarnyy universitet im. K.D. Glinka, 2010. - S. 12 (in Russian).

(,)

, , , - .

, , ,

, - 70%

(,) 30%

152%, 0,07% , -0,6 , , 24901-2014

« . » .

(,).

– B. ,

, .

, ,

. - .

70% 30% (, ,):

-152%, 0,07%, -0,6 , ,

, , 24901-2014 « . »