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Biological Value of Pumpkin Powder when Used in Production

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A B S T R A C T
Its use for the enrichment of flour confectionery products with vitamins, minerals and dietary fiber is substantiated. It is proposed to use pumpkin flour in the amount of 5-15% by weight of wheat flour in the production of basic biscuit. The article is devoted to expanding the range of enriched flour confectionery products. The technology of a biscuit semi-finished product of increased nutritional value with the addition of pumpkin flour is proposed. An analysis of the chemical composition of pumpkin flour is presented.

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Studies of the effect of pumpkin flour on the properties of biscuit dough showed that with an increase in the amount of pumpkin flour additive, the density of the dough increases by 5.3–9.4%, and the foaming ability of the dough decreases slightly by 0.5–1.9%. Studies have been carried out on the effect of pumpkin flour on the quality of biscuit dough and baked goods. The organoleptic characteristics of baked products do not deteriorate with the addition of 5% pumpkin flour [1, 2, 3]. The products had a uniformly colored surface, a light yellow crumb with developed porosity, a taste and aroma with a slight hint of pumpkin seeds. With an increase in the amount of additive, a herbal taste appears in the products, the color of the crumb changes on the cut - a greenish tint appears. When studying the physico-chemical parameters of baked products, it was established that pumpkin flour contributes to an increase in the moisture content of the semi-finished product up to 25-29%, an increase in protein content by 9-13%, mono- and disaccharides by 6.2-6.9%, fats. Also, the developed semi-finished product, in comparison with the control sample, is enriched with vitamin C and beta-carotene. Based on the research, it was found that the use of pumpkin flour in the production of semi-finished biscuit products improves consumer properties and increases the biological value of the product.

Flour confectionery products based on biscuit semi-finished products belong to one of the most popular product groups. But, like most confectionery products, they differ in unbalanced chemical composition[4, 5, 6]. The main disadvantages of biscuit products include a high content of easily digestible carbohydrates, mainly sucrose, as well as a low content of vitamins and minerals. To eliminate these shortcomings, it is advisable to include additives containing these components in the composition of biscuit products. For these purposes, plant raw materials are best suited, for example, processed fruits and vegetables [7, 8, 10].

One of these additives is pumpkin and products of its processing - puree, juice and powder [9]. Currently, pumpkin flour, which is obtained during the processing of plant seeds, has begun to enjoy special popularity and demand. Such flour is rich in vitamins Bb, B2, B9, C, PP, phospholipids, tocopherols, carotenoids, flavonoids, saturated and unsaturated fatty acids, minerals [11, 12, 14]. The

composition of pumpkin flour contains a significant amount of vegetable protein, which contains a number of essential amino acids (lysine, arginine, isoleucine, phenylalanine) and is perfectly absorbed by the human body. The carbohydrate composition of pumpkin flour is represented mainly by mono- and disaccharides, as well as dietary fiber. Carbohydrate components of pumpkin can be easily fermented by yeast and affect the formation of the taste and aroma of flour products [13, 15, 16, 17].

Thus, based on the analysis of the chemical composition of pumpkin flour, it can be recommended for use in the production of flour confectionery.

The purpose of this study was to develop a recipe for an enriched biscuit semi-finished product based on the use of pumpkin flour.

To establish the optimal dosage of pumpkin flour in the recipe for semi-finished biscuit, studies were carried out on the effect of its various amounts on the quality of biscuit dough and baked semi-finished products. Pumpkin flour was introduced in an amount of 5-15% by weight of wheat flour. Biscuit dough was prepared in the main way without heating. The control sample was produced according to the traditional recipe No. 1 according to [18,19].

As can be seen from the presented data, when pumpkin flour is added to the biscuit dough recipe, the foaming of the dough is slightly reduced. The foaming ability of the dough with the addition of pumpkin flour to wheat flour in the amount of 5% decreased by 0.5%, with the addition of 10% - by 1.4% and with the addition of 15% by 1.9%.

With an increase in pumpkin flour in the biscuit dough recipe, the density increases by 5.3-9.4%. The increase in density is also likely due to the high fat content of pumpkin flour. The moisture content of the dough changes slightly and remains within the normal range (36-38%).

After baking semi-finished products, an organoleptic evaluation was carried out in accordance with GOST 53104-2008. Appearance, color, smell, taste, texture of products were evaluated. According to the results of organoleptic analysis, the sample with the content of 5% pumpkin flour had the best performance. The biscuit had a uniform dark golden color, an even shape without damage, well-developed porosity, and a well-baked crumb. The taste and smell are sweetish, with a slight hint of pumpkin seeds. In all respects, the biscuit semi-finished product was not inferior to the control sample. In samples with the addition of 10 and 15% pumpkin flour, the porosity of the finished semi-finished product worsened, a more pronounced taste of pumpkin seeds appeared, and the products had a pale green color [20, 21, 22].

One of the main indicators of the quality of baked products is humidity. The moisture content of the biscuit semi-finished product is 25-29%. The results of determining the moisture content in a biscuit semi-finished product with the addition of pumpkin flour are presented.

From the results presented, with an increase in the amount of pumpkin flour, the moisture content of biscuit semi-finished products increases. So, in samples with 5% additive, the moisture content increased by 1.5%, with the addition of 10% pumpkin flour - by 3.3%, and with the addition of 15% - by 5.9%. A slight increase in humidity can be explained by the fact that proteins and dietary fiber contained in pumpkin flour are able to additionally bind and retain water. But at the same time, the humidity of all samples remains within the limits of the standard.

Since pumpkin flour is a vegetable product and contains a certain amount of organic acids, it was of interest to study the acidity of biscuit semi-finished products. The results of determining the acidity are presented in table.1

Table 1 Quality indicators of the studied samples of biscuit dough

Index	Control sample	Biscuit dough with the addition of pumpkin flour, %		
		5	10	15
Foaming ability, %	209,09 ± 3,0	208,06 ± 3,2	206,14 ± 2,5	205,03 ± 2,5
Density, kg/m3	453,32 ± 4,1	477,49 ± 6,0	490,03 ± 4,0	497,94 ± 5,0
Humidity, %	37,47 ± 0,1	37,38 ± 0,2	37,28 ± 0,2	37,19 ± 0,2

Based on the results of the studies, it can be concluded that the addition of 5% pumpkin flour to the biscuit semi-finished product leads to an increase in acidity compared to the control sample by 50%. With the addition of 10 and 15%, the acidity increases by 2 and 2.25 times. Increasing the acidity of the dough contributes to a more intensive flow of sucrose hydrolysis processes in the process of dough formation, as well as strengthening the protein framework of the dough [24, 25, 26].

When analyzing the presented results, it was found that with the addition of 5% pumpkin flour, the amount of protein increased by 9.8%, with the addition of 10%, the amount of protein increased by 12%, and with the addition of 15% pumpkin flour - by 13 .6%. This is due to the fact that pumpkin flour contains 2.5 times more protein than wheat flour [23, 27].

Table 2 Acidity of the investigated semi-finished products

Index	Control sample of biscuit p/f	Biscuit p / f with the addition of pumpkin flour in the amount,%		
		5	10	15
Acidity, hail	0,04	0,06	0,08	0,09

When analyzing the results, it was found that the amount of carbohydrates increased by 6.9% with the addition of 5% pumpkin flour, by 6.6% with the addition of 10% and increased by 6.2% with the addition of 15% pumpkin flour. The increase in the content of carbohydrates is due to the presence in the composition of pumpkin flour of its own mono- and disaccharides. In turn, this suggests the possibility of reducing the sugar content in the recipe, which will lead to a decrease in the calorie content of the product [28].

Since pumpkin flour contains quite a lot of fat, it was of interest to determine the fat content in the studied biscuit samples. The results of the conducted research are reflected.

It can be seen that the mass fraction of fat increased by 24.4% with the addition of pumpkin flour in the amount of 5%, pumpkin flour is a good source of P-carotene. In this regard, it was of interest to determine its content in the investigated semi-finished biscuit products. The results of the studies carried out are reflected in Table. 3.

Table 3 Determination of the content of beta-carotene in the investigated semi-finished products

Index	Control sample of biscuit p/f	Biscuit p / f with the addition of pumpkin flour in the amount,%		
		5	10	15
Beta-carotene, mg	Not found	0,74	0,85	1,08

rom Table. 3 shows that beta-carotene was not found in the control sample, with the addition of 5% pumpkin flour, the content of beta-carotene was 0.74 mg, with the addition of 10%, the content of beta-carotene increased by 12.9%, with the addition 15% content of beta-carotene increased by 31.5%. The use of pumpkin flour in the production of biscuit semi-finished products makes it possible to enrich them with an indispensable component of P-carotene.

Pumpkin flour contains vitamin C, in connection with this, the change in its content in the studied samples was determined. The results of the study are presented in Table. 4.

Table 4 The content of vitamin C in the studied semi-finished products

Index	Control sample of biscuit p/f	Biscuit p / f with the addition of pumpkin flour in the amount,%		
		5	10	15
Vitamin C, %	Not found	0,58	1,02	1,47

From Table. 4 shows that the control sample does not contain vitamin C. With the addition of 5% pumpkin flour, the content of vitamin C was 0.58%, with the addition of 10 - 10.2%, and with the

addition of 15 - 1.47% . The addition of pumpkin flour to the recipe of biscuit semi-finished products helps to increase the content of vitamin C by 1-1.5% [29].

Thus, on the basis of the conducted studies, it can be concluded that the use of pumpkin flour in the production of biscuit semi-finished products makes it possible to obtain products with high consumer properties. Replacing 5% wheat flour with pumpkin flour makes it possible to enrich biscuit semi-finished products with essential nutrients, improve organoleptic and physico-chemical parameters [30].

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