

PROSPECTS FOR USING GRAIN FLOUR IN BREAD TECHNOLOGY

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Changes in the lifestyle of the population and social conditions are reflected in human needs for energy, and its source – food. The proportion of the diet of baked goods is reduced, but the body's need for micronutrients and other essential substances is not changed. This leads to the fact that none of the population groups fully receives the substances necessary for a healthy diet, primarily proteins, vitamins, minerals, dietary fibre and many other components of healthy food [1].

The deficiency of nutrients in the body revealed during the survey of the population is an inevitable result of a significant reduction in energy costs and, as a consequence, a corresponding decrease in the total amount of food consumed with a simultaneous increase in the proportion of refined products that have undergone deep technological processing, canning and storage. The structure of the diet is of great importance, the food set and the quality of food consumed, primarily its nutritional value, which is determined by surveying the country's population over the past decade, as well as a significant increase in the consumption of refined, high-calorie, practically lost vitamins and other irreplaceable substances, products [2].

Bread and bakery products are important sources of energy, protein and carbohydrates in human nutrition, providing over 30 % of their daily intake [1].

Bread products in the diet are a classic, nature-created source of B vitamins. The content of E and B vitamins in wheat, as in most other cereals, is relatively high and, moreover, is well balanced with human needs.

Technological processing of grain crops, including wheat and rye, into flour is accompanied by significant losses of micronutrients – vitamins and minerals, removed along with the grain shell. In the production of bread, bakery and flour confectionery products from flour, the loss of these important biologically active substances increases. Thus, the amount of B vitamins (thiamine, niacin, vitamin B6, folic acid) and a number of minerals (iron, calcium) in the manufacture of bread, from grinding grain to baking, is reduced by 2–6 times. Large losses of vitamins

and minerals when grinding flour and baking bread is not the only reason for the decrease in the role of this product in providing modern humans with B vitamins and a number of macro- and microelements [3].

The nutritional value of bread consists of useful substances and can provide the physiological need of humanity as the main source of energy. The nutritional value of bread depends on its energy value (vitamins, minerals; essential amino acids; assimilated fatty acids, etc.). The digestibility of bread depends on the structure, composition, taste and additional additives used in the manufacture.

The use of bakery products additionally enriched with missing micronutrients in the diet will make it possible to bring them to the widest groups of the population, including those most in need of improving nutritional status and health.

In this work, cereals and legumes – chickpeas and corn – are used as protein fortifiers. In terms of chemical composition and nutritional value, they are close to the sources of animal protein – meat, fish, and milk. Among plant proteins, leguminous proteins are of great importance – soybeans, peas, lentils, beans, legumes and oilseeds – sunflower, cotton. Pulses are high in digestible protein, amino acids, lysine and methionine. The protein content in legumes averages 21 to 46.8%. Protein is rich in essential amino acids, especially lysine 2–2.5 times more than proteins of cereals. Of the proteins of other plants, the solubility and digestibility of leguminous proteins is higher.

Research objects. Wheat flour of the first grade, chickpea and corn flour. The resulting bean flour is produced in accordance with GOST 52189–2003, GOST 14176–69 (organoleptic and physicochemical indicators) [4].

To substantiate the optimal use of whole-grain corn and chickpea flour as a biologically active additive for the enrichment of bakery products, studies of the nutritional value of the studied components and a comparative analysis with wheat flour of the first grade were carried out.

The results of the study of the chemical composition of first grade wheat flour, whole-grain corn and chickpeas used in the production of bakery products are presented in Table 1.

Analysis of the data on the chemical composition of whole-ground corn and chickpea flour showed a significant difference in all indicators in comparison with wheat flour of the first grade.

The protein content in chickpea flour is 1.9 times higher than in first grade wheat flour. The fat content is 2.04 times more, carbohydrates 1.11 times less. And the fat content in corn flour is 2.44 times higher than in the first grade wheat flour. You can also note the high content of minerals in bean flour compared to wheat flour of the first grade, namely K, Ca, Mg, P and Fe. Thus, the calcium content in chickpea flour is 9.24 times more, in corn – 4.2 times more than in wheat flour, the iron content is 4.96 and, accordingly, 3.3; potassium – 6.38 and, respectively, 2.9 times.

Table 1

Chemical composition of 1st grade wheat flour and leguminous flour

Nutrients	100 g of product contains		
	Wheat flour of the first grade	Chickpea flour	Corn flour
Fat, g	0.91	1.86	2.22
Carbohydrates, g	68.14	61.18	67.3
Ash content, g	0.71	3.2	0.96
Proteins, g	11.69	22.17	11.2
Amino acids, mg			
<i>irreplaceable:</i>			
isoleucine	531	1712	456
valine	568	1260	480
leucine	868	1684	1360
lysine	242	1703	326
methionine	140	371	218
threonine	339	826	334
tryptophan	119	257	83
phenylalanine	632	1235	590
<i>replaceable:</i>			
alanine	375	1083	732
arginine	549	1752	504
aspartic acid	441	2325	690
histidine	241	870	281
glycine	435	909	372
glutamic acid	3401	2450	1960
proline	1120	907	972
serine	515	1092	508
tyrosine	331	544	391
cystine	245	315	190
Mineral substances, mg			
Ca	17.1	158	71.5
Mg	18.9	94.5	104.0
Fe	1.14	5.65	3.76
P	79	318	301.0
K	117	746	340.5
Vitamins, mg			
β -carotene	—	0.03	0.215
E	2.73	0.89	0.62
C	—	3.08	4.08
PP	1.2	2.11	1.85
Energy value, kcal	331	364	336

The vitamin composition also has significant differences. Particularly noteworthy is the β -carotene content, which is not found in first grade wheat flour. Whole chickpea flour contains 7.03 times more lysine, methionine 2.65 times, isoleucine 3.22 times, valine 2.22 times, leucine 1.94 times, etc. in wholemeal corn flour by 1.35 times, methionine – 1.56 times, isoleucine – 0.86 times, leucine – 1.57 times more than in wheat flour of the first grade, etc.

The results of the study showed significant differences in the amount of non-essential amino acids. Chickpea flour contains more essential amino acids, with the exception of glutamic acid and proline, than wheat flour. Bean flour contains 1.38 times less glutamic acid, 1.23 times less proline than wheat flour. Thus, the obtained high indicators of the nutritional value of whole grain flour confirm the possibility of using it as a biologically active additive for enriching bakery products with proteins, vitamins, and minerals.

Conclusion. The quality indicators of the studied types of flour have been determined. Based on the analysis of the chemical and biological composition of first grade wheat flour and chickpea, corn flour, it can be concluded that the presence of a complex of valuable food components in the studied types of flour can affect the quality and nutritional value of products and are used as biological fortifiers in the production of bakery products.

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