

The use of non-traditional raw materials in the production of bakery products

O O Prokopenko^{1*}, *E N Efremova*¹, *E A Zenina*¹, and *D V Chapko*¹

¹Federal State Budgetary Educational Institution of Higher Education Volgograd State Agrarian University, 26, Universitetsky Avenue, Volgograd, 400002, Russia

Abstract. To expand the range, in our study we used flour from spelled and spelled grains. Spelled and spelled refers to an ancient type of wheat. The grain contains amino acids, a large amount of protein and dietary fiber. The purpose of the work: to study the effect of spelled flour and evaluate the economic effect of their introduction into production. The organoleptic and physicochemical parameters were carried out according to the specifications 10.71.11-046-38826547-2016. Trial baking was carried out on the basis of the Volgograd State Agrarian University at the Department of Processing Technologies and Food Security. According to organoleptic indicators, Kruassan made from Gremme spelled flour of the 1st grade met all technical requirements. The appearance of the spelled croissant was blurry, the color was brown, the taste was "nut flavor", more sweet. A sample of products made from Gremme spelled flour of the 1st grade met the technical specifications of TU 10.71.11-046-38826547-2016. The moisture content of the product was 37.0%, the acidity was 2.8 degrees, with the addition of spelled flour, the content of potassium and magnesium macronutrients increases. The profitability of the production of croissants with spelled flour was 44%, this indicator was higher by 2% of products made from spelled flour.

1 Introduction

Spelled and spelled are semi-wild types of wheat. This is the most ancient and unpretentious type of wheat. In its composition, the grain contains a large amount of protein from 27 to 37%. Gluten protein, which this cereal is especially rich in, contains 18 essential amino acids for the body, which cannot be obtained from animal food. This type of wheat has an original taste. Nowadays, wheat is gaining more and more popularity. Spelled has a higher content of iron, protein and B vitamins than ordinary wheat. Spelled grain has a low gluten content, thanks to which it can be included in the diet for people who are allergic to gluten.

As a result of the deterioration in the quality of wheat flour, the use of improvers and bleaches by enterprises, the consumer and the manufacturer begin to feel the need to replace wheat flour with more non-traditional and better types of flour [1-3].

* Corresponding author: Elenalob@rambler.ru

Early studies on the use of such non-traditional types of grain crops as spelled and spelt in the production of bakery and confectionery products made these crops relevant in the production of products. Spelled and spelled flour was used in the production of bakery and confectionery products. This flour is rich in dietary fiber, has low energy efficiency, and at the same time has an increased nutritional value, contains all the essential amino acids in its composition [4-7].

Croissants are known all over the world, they are a very nutritious and tasty product, since a large amount of butter is used in the production of these products, the energy value is 290 calories per hundred grams [8-9].

2 Materials and methods

The purpose of the work: to study the effect of spelled flour, spelled flour on the quality of croissants and to evaluate the economic effect of their introduction into production.

Tasks: to consider the physical and chemical indicators and organoleptic indicators of Croissant; to calculate the cost and economic efficiency of products.

The evaluation of organoleptic and physicochemical parameters was carried out according to TU 10.71.11-046-38826547-2016. Sampling was carried out according to GOST 5667-65. Analysis methods according to GOST 5670-96, GOST 21094-75.

Trial croissant baking was carried out on the basis of Volgograd State Agrarian University. Object of study: spelled flour Gremme 1st grade and spelled flour grade Alkoran.

Figure 1 shows the production scheme of the puff yeast product "Croissant".

3 Results

In our study, spelled and spelled flour was used, since this flour contains a large amount of dietary fiber and macronutrients in its composition.

The chemical composition of flour was taken from reference data. According to the conditional division of food products into 3 groups according to the degree of satisfaction of the daily requirement, spelled and spelled flour in terms of protein, carbohydrates, dietary fiber and energy value can be attributed to the group with a high content of nutrients [10-11].

In our study, spelled flour Gremme 1st grade and spelled flour grade Alkoran were used. Table 1 presents the baking properties and quality indicators of spelled and spelled flour.

Table 1. Baking properties and quality indicators of spelled and spelled flour.

Indicators	Spelled flour Gremme 1st grade	Spelled flour grade Alkoran
Moisture content, %	13.0	16.0
Mass fraction of crude gluten, %	28.0	21.4
Mass fraction of protein, %	13.9	12.5
Gluten quality, units approx. IDK	52.0	79.0
Fluidity of a ball of gluten (mm), for a certain time, min.		
0	23.2	25.8
60	41.1	64.0
120	48.3	70.1
180	54.5	76
Water absorption capacity of flour, %	58.4	61.3
Gluten color	light coloured	light coloured
Extensibility of gluten, cm	14	16
Gluten elasticity	good	satisfactory

Table 1 shows that spelled flour is inferior to spelled flour in terms of baking properties. Without the use of any improvers or intervention in the technological scheme, a good quality puff pastry product will not be achieved.

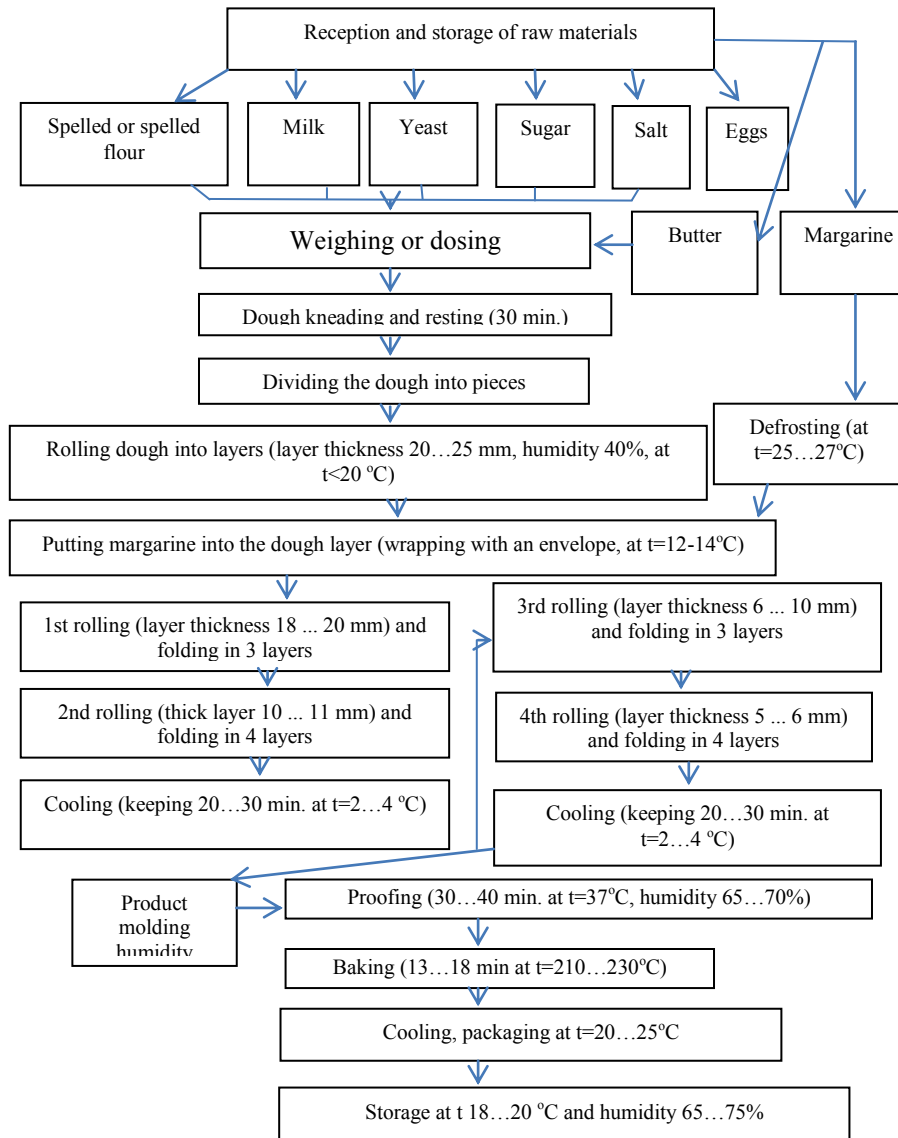


Fig. 1. Technological scheme for the production of Croissant from spelled or spelled flour.

A recipe was developed using spelled and spelled flour. According to the technical conditions 10.71.11-046-38826547-2016 (Table 2), finished croissant products were evaluated in terms of organoleptic characteristics.

According to Table 2 it can be seen that the Gremme Spelled Croissant meets all the requirements of the technical specifications for organoleptic indicators. In appearance, it is clean, even, of the correct form. Taste and smell corresponds to fresh baking, sweet. It has a light brown tint and corresponds to the specifications in color (Figure 2).

Table 2. Characteristics of quality indicators for a croissant prepared on the basis of spelled and spelled flour.

Quality indicators	Spelled flour Gremme 1st grade	Spelled flour grade Alkoran
Appearance and shape	The shape corresponding to this product is crescent, without kinks and dents	The shape is vague, uneven surface without volume
Color	Light brown	Corresponding to the product, brown
Sectional view	Well baked, clearly visible air layers	Well baked, the layers were not clearly visible. Little airiness
Smell	Peculiar to this type of product, without foreign smell	Peculiar to this type of product, without foreign smell
Taste	Sweet	There is a "nut flavor", a sweeter product

A spelled croissant is different from a spelled croissant. The appearance was blurry, the color was brown, there was a "nut flavor" taste, more sweet. The vague shape of the croissant is due to the fact that spelled flour has a high gluten moisture content, which affects the kneading of the dough, resulting in a dough with weak gluten.



Fig. 2. Croissant puff product (on the right - from spelled flour, Alcoran variety, on the left - from spelled flour, Gremme variety).

The product was evaluated according to physical and chemical parameters and the content of macroelements in them (Table 3).

Table 3. Physico-chemical indicators of croissants and the content of macroelements in them.

Physical and chemical indicators	Spelled flour Gremme 1st grade	Spelled flour grade Alkoran
Humidity, %	37.0	38.0
Acidity, hail	2.8	2.9
Macroelements, mg/kg		
Ca	27	12
K	388	658
Na	18	8
Mg	136	139

According to the results of physico-chemical parameters, it was established that the sample from spelled flour, Gremme variety, meets the technical requirements. The moisture content of the product is 37.0%, the acidity is 2.8 degrees, the amount of potassium and magnesium in the finished product using spelled flour is 388 and 136 mg/kg, respectively.

According to the results of Table 3, it can be seen that a sample of spelled flour of the Alkoran variety meets the technical requirements, the moisture content of the product is 38.0% and the acidity is -2.9 degrees.

4 Discussion

When assessing the quality of finished products, we came to the conclusion that the addition of spelled flour to the recipe affects the quality of the finished product. In appearance, the shape of the finished product corresponds to a puff bakery product. The addition of spelled flour to the recipe according to physical and chemical parameters met the requirements of TU 10.71.11-116-37676459-2017, according to organoleptic parameters, the croissant had a "nutty flavor" and a sweeter taste, the shape was vague. At the same time, both products acquired a therapeutic and prophylactic direction (a wide mineral composition is useful for people suffering from allergies and diabetes) [12-13].

Table 4 calculates the cost of raw materials for finished products.

Table 4. Raw material costs for the production of 0.5 kg of the finished product Croissant.

Components	Cost of 1 kg, rub./pc.	Spelled flour grade Gremme		Spelled flour grade Alkoran	
		kg	rub.	kg	rub.
Spelled flour Gremme 1st grade	394	0.5	197	-	-
Baker's yeast	14	0.03	3	0.03	3
Food salt	1.8	0.01	0.2	0.01	0.2
white sugar	45	0.03	1.35	0.03	1,35
Milk	60	0.22	13.2	0.22	13.2
Butter	150	0.05	7.5	0.05	7.5
Margarine	56	0.75	45	0.75	45
Spelled flour grade Alkoran	424	-	-	0,5	212
chicken eggs	45	1	4,5	1	4.5
Bakery improver	115	-	-	0.005	1.5
Total		-	271.75	-	288.25

From Table 4 shows that the cost of raw materials is influenced by the cost of raw materials. The increase in costs is associated with the high price of flour for spelled and spelled grains.

On the basis of the above calculation, the calculation of the cost of production for the variants of experience was determined.

When calculating the full cost of the product, the difference in costs was reflected only in raw materials. The costs required to produce a croissant from wheat flour do not entail changes in the production cycle. The use of spelled and spelled flour does not require changes in the technological cycle of croissant production at the enterprise.

The main indicator of a market economy is profit and profitability. These indicators express the production efficiency of enterprises (Table 5) [14].

Table 5. Economic efficiency of the production of Croissant.

Indicators	Spelled flour grade Gremme	Spelled flour grade Alkoran
Raw material costs, rub.	543.50	576.50
Output, piece/kg	30.00	30.00
Full cost of 1 kg, rub.	708.21	741.21
Weight 1 piece finished product, kg	0.15	0.15
Full cost of 1 piece, rub.	23.61	24.71
Selling price of 1 piece, rub.	42.00	42.00
Profit from the sale of 1 piece, rub.	18.39	17.29
Profitability of production, %	43.79	41.17

The sale of all types of products is profitable for the manufacturer. The amount of profit from the sale of 1 pc. croissant with spelled flour is 18.39 rubles, and in the production of

products with spelled flour 17.29 rubles. Profitability of croissant production with spelled flour is 2% lower than the use of spelled flour. The selling price of a croissant is 42 rubles. Spelled and spelled belong to the crops of organic farming, which cannot and will not affect the cost of raw materials.

The highest percentage of profitability was obtained in the production of Croissants with spelled flour, and is almost 44%, which is 2% higher than the production of products with spelled flour.

5 Conclusion

To expand the range of puff pastry products, we propose to introduce into production the Croissant puff product made from spelled flour of the Gremme variety and spelled flour of the Alcoran variety, which is also expedient for obtaining a Croissant product with a high protein content and a new taste segment. The use of spelled and spelled flour in the production of croissants showed that they reflect the requirements of the technical specifications 10.71.11-046-38826547-2016 in terms of physical, chemical and organoleptic indicators. Croissants with spelled flour according to organoleptic indicators in appearance, shape, color, smell and taste corresponded to puff pastry products. When cutting the product, air layers were visible, which was not observed in products using spelled flour. When comparing the baking properties and quality indicators of flour, as well as finished products, it is noticeable that spelled flour and products made from it have low baking properties and without the use of additional technological methods, a high-quality puff bakery product cannot be obtained.

Acknowledgement

The result of scientific research was published with the financial support of the Ministry of Science and Higher Education of the Russian Federation under agreement No. 075-15-2022-1072 dated June 01, 2022.

References

1. E.N. Efremova, E.S. Taranova, E.A. Zenina, *Application of food supplement in production in order to promote health and prophylactic properties*, IOP Conference Series: Earth and Environmental Science. Conference on Innovations in Agricultural and Rural Development, **341**, 1, 012142 (2019)
2. N.V. Uryadnik, T.L. Sheveleva, *The effect of applying optimal dosages of spelt flour and the production method on the structural and mechanical properties of the dough and the quality indicators of wheat bread*, In the collection: Topical issues of science and economy: new poems and solutions. Collection of materials LIV Student scientific-practical conference, 60-67 (2020)
3. A.I. Akchurina, T.V. Sukhinina, *Spelt: a step from the past to the future*, Commodity specialist of food products, **1**, 28-30 (2019)
4. T.V. Matveeva, S.Ya. Koryachkina, V.P. Koryachkin, E.I. Struchkova, *Influence of corn and rice flour on the quality of biscuit dough products*. News of higher educational institutions, Food technology, **4**, **305**, 32-34 (2008)
5. E.N. Efremova, *Improving the recipe of wheat bread with additives having functional and technological properties* Izvestia of the Nizhnevolzhsky Agro-University Complex: Science and Higher Professional Education, **4**, **40**, 207-213 (2015)

6. A.S. Romanov, N.I. Davydenko, L.N. Shatnyuk, I.V. Matveeva, Examination of bread and bakery products, Quality and safety (Sib.univ.izd-vo, Novosibirsk, 2005)
7. N.V. Tsuglenok, N.N. Tipsina, V.V. Matyushev, I.V. Buyanova, The use of dietary fibers in the technology of flour confectionery production, Vestnik KrasGAU, **5**, 404-411 (2012)
8. E.I. Shcherbakova, Justification of the use of non-traditional raw materials in the production of flour confectionery products, Vestnik YUUrGU, Series "Food and Biotechnologies", **3**, 94-99 (2014)
9. V.A. Yukov, E.I. Likhacheva, The composition of the Volga spelt grain, Khleboprodukty, **7**, 26-27 (2005)
10. E.V. Kryukova, N.V. Leyberova, E.I. Likhacheva, Investigation of the chemical composition of spelt flour, Vestnik YUURGUSeries "Food and Biotechnologies", **2**, 75-81 (2014)
11. E.V. Kryukova, The influence of spelt flour on the quality of butter cookies, Confectionery production, **3**, 2–4 (2014)
12. O.V. Chugunova, N.V. Zavorokhina, V.V. Fozilova, Development of a modern model of the quality of food products based on an integral analysis of customer satisfaction, Bulletin of the Ural State University of Economics, **1**, **39**, 181-187 (2012)
13. A.S. Kazakevich, A.A. Cherkasina, *The use of spelt flour in the baking industry. In the collection: Problems of competition of consumer goods and foodstuffs*, Collection of scientific articles of the 2nd International Scientific and Practical Conference, 178-181 (2020)
14. I.A. Bessmertnaya, O.V. Kazimirchenko, N.V. Vasil'chenko, Evaluation of the quality of butter cookies enriched with natural components of vegetable raw materials, according to physico-chemical and microbiological indicators, Izvestiya KGTU, **54**, 102-115 (2019)