Application of cedar flour in the production of bakery products

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Abstract. To maximize profits, entrepreneurs need to continually expand their product mix. Bakery products require constant updating. In our study, in the production of wheat bread, we used cedar flour as a food additive. The purpose of the study is to improve the production of bakery products, which consists in the addition of cedar flour. The study was carried out at Volgograd State Agrarian University. Wheat bread was backed by straight dough method. After that, studies were carried out on the organoleptic and physicochemical characteristics of the bakery product. A tasting assessment was also carried out. In terms of organoleptic characteristics, wheat bread with cedar flour had an indistinct shape, with uniform porosity, without voids and traces of impurity, in taste and smell it corresponded to this product, with a slight smell of walnut, color from light yellow to dark brown, and in the places of the cut and the sides are lighter. By all indicators, wheat bread with cedar flour met the requirements of GOST 31805-2018. The profitability of the product has been calculated. The production of wheat bread with cedar flour is 8% higher than the production of wheat bread. The production of bakery products with the addition of cedar flour is an important reserve for using the production potential of the bakery industry at the present stage of its development.

1. Introduction
The increase and variety of the assortment of bakery products in modern conditions are the main national economic tasks. The most effective solution to this problem may be through the introduction of advanced technologies that are suitable for use at food industry enterprises, allowing obtaining products with high profitability. The introduction of intensive technologies allows one to increase the volume of products, expand the range, improve quality, reduce the cost of products by reducing the lengthy stages of dough preparation. The bakery industry in our country has to solve a number of problems associated with increasing the nutritional value and quality of bakery products. One of the main ways to solve them is the development of new formulations for therapeutic and prophylactic purposes [1, 2].

Manufacturers of bakery products are always faced with a difficult choice of flour raw materials that meet their requirements, since flour affects the shelf life, taste, organoleptic characteristics, structure and presentation of finished products. One of the types of flour is cedar flour [3, 4].

Cedar flour is a product made by cold pressing of cake and oil, obtained from the kernels of cedar nuts. A homogeneous mass of powdery consistency has a pleasant aroma and delicate taste. Cedar
flour is higher in calories than other types, but much healthier. Pine nut flour has a positive effect on immunity, and is also useful for improving the functioning of the liver, digestive system, and excretory organs. It allows you to cleanse the body of toxic substances.

Loose mass of pine nuts is widely used in the baking industry, since it has many beneficial properties. On the basis of this unique product, delicious dishes are prepared that leave no one indifferent [5].

The chemical composition of the flour, which is obtained from the fruit of the cedar tree, is rich. The product is saturated with vitamins, minerals, amino acids, dietary fiber and other useful elements. However, it is important to remember that flour is high in calories. 100 g contains about 432 kcal [6].

100 g of powdered mass contains 31 g of proteins, 19 g of fat and 33 g of carbohydrates. It also contains a huge amount of vitamins such as A, E, K, C, PP and D, as well as B vitamins (B1, B2, B3, B4, B6, B9) in the product will be high. Vitamin A, C and E are natural antioxidants. The friable beige mass contains unique proteins saturated with amino acids, mostly irreplaceable. There is a high concentration of arginine, tryptophan, lysine and methionine [7, 8].

Pine flour should have a clean taste and aroma, similar to the taste and aroma of pine nuts; consistency - loose, powdery; color - uniform, light beige; when mixed with ingredients forms a homogeneous mass.

2. Materials and methods
The relevance of the topic is determined by the fact that bread and bakery products are products that are consistently in high demand among the population and occupy an important place in providing the population with high-grade food.

The aim of the work is to increase the range of wheat bread, which consists in the addition of cedar flour.

To do this, it is necessary to solve the following tasks:
- to consider the technological scheme for the production of wheat bread, which ensures a high quality product and competitiveness in the market for the production of bakery products;
- to determine the organoleptic, physical and chemical characteristics of finished products;
- to calculate the economic efficiency of wheat bread with the addition of cedar flour.

Wheat bread was made in accordance with regulatory documents, including GOST, TU, product recipes and technological instructions.

The experiment was carried out on the basis of the Department of Processing Technologies and Food Safety of the Volgograd State Agrarian University.

The chemical composition of wheat cedar flour with a high fat and protein content is presented in Table 1.

| Product name  | Chemical composition |
|--------------|----------------------|
|              | humidity, % | fat content, % | protein, % |
| Wheat flour  | 8.3         | 1.32          | 11.35      |
| Cedar flour  | 8.7         | 6.94          | 11.31      |

Analysis of Table 1 showed that cedar flour is characterized by a high content of fat and protein, which allows it to be positioned as a high-lipid flour mixture for the production of a wide range of bakery products, including functional products.

3. Results and discussions
In our study, the wheat bread production process was carried out by straight dough method. The difference between the straight dough method is that the dough is immediately kneaded from all components. The duration of fermentation is 2.5-3.5 hours. After 50-60 minutes, the dough is kneaded. Then dough cutting, consisting of operations: dividing the dough into pieces, preliminary proofing,
molding and final proofing. The final stage in the preparation of wheat bread is baking, which finally forms the quality of the bread. Wheat bread was baked at a temperature of 210-220 °C for 55 ± 10 minutes in a baking chamber [9, 10].

Wheat bread was made according to the classic recipe; in the production of bread with the addition of cedar flour, cedar flour was added to the premium wheat flour in an amount of 25% of wheat flour. The recipe for wheat bread and wheat bread with cedar flour is presented in table 2. Figure 1 shows dough samples placed in final proofing molds.

**Table 2. Recipe for making wheat bread**

| Raw materials          | Wheat bread (control sample) | Wheat bread with cedar flour (prototype) |
|------------------------|------------------------------|----------------------------------------|
| Wheat flour            | 500 g                        | 400 g                                  |
| Cedar flour            | -                            | 100 g                                  |
| Yeast                  | 3 g                          | 3 g                                    |
| Granulated sugar       | 3 g                          | 3 g                                    |
| Water                  | 350 ml                       | 350 ml                                 |
| Salt                   | 4 g                          | 4 g                                    |
| Vegetable oil          | 15 ml                        | 15 ml                                  |

**Figure 1. Control sample (1); prototype (2)**

In order to improve and control the quality of the products, organoleptic and physicochemical studies of the finished product were carried out. Organoleptic, physical and chemical indicators must comply with GOST 31805-2018 «Bakery products from wheat bakery flour. General technical conditions». The organoleptic characteristics of wheat bread are presented in table 3.

**Table 3. Organoleptic characteristics of finished products**

| Indicator name       | Wheat bread                                    | Wheat bread with cedar flour            |
|----------------------|-----------------------------------------------|----------------------------------------|
| Colour               | Light yellow to dark brown on the upper crust, lighter at the incision | Light yellow to dark brown on the upper crust, lighter at the incision |
| Smell                | Specific to this type of product, without foreign smell | Specific to this type of product, without foreign smell |
| Taste                | Inherent to this type of product, without any foreign taste | Pleasant nutty taste, without foreign aftertaste |
| Surface              | No major cracks and explosions                | No major cracks and explosions         |
| Consistency          | Elastic, after light pressure takes its original shape | Elastic, after light pressure takes its original shape, the effect of crumbling is reduced |
| The form             | Not blurry - rectangular                       | Not blurry - rectangular                |
Figure 2 shows cutaway samples for organoleptic comparison.

**Figure 2.** Wheat bread (control sample) and wheat bread with cedar flour (test sample) in section

In terms of organoleptic characteristics, wheat bread with cedar flour had an indistinct shape with uniform porosity without voids and traces of impurity; in taste and smell it corresponded to this product with a slight smell of walnut, color from light yellow to dark brown, and in the places of the cut and the sides are lighter.

The tasting was carried out by a commission of 5 people, consisting not only of experts, but also of persons with proven sensory sensitivity, in order to make the result more reliable (table 4).

To assess the appearance, the whole product was taken, then cut and carefully laid out on a common dish. The samples were taken for tasting at the same temperature at which the given product is consumed. Analysis of the quality of the bread was carried out 12 hours after baking.

**Table 4.** Assessment of the quality of finished products on a 5-point scale (1-2 – low; 3 – average; 4-5 – higher)

| Quality indicators               | Estimates, score | Wheat bread | Wheat bread with cedar flour |
|----------------------------------|------------------|-------------|------------------------------|
| Form                             | 1-5              | 4.6         | 4.7                          |
| Colour                           | 1-5              | 4.8         | 4.8                          |
| Surface                          | 1-5              | 4.5         | 4.6                          |
| Crumb condition                  | 1-5              | 4.5         | 4.7                          |
| Porosity                         | 1-5              | 4.6         | 4.7                          |
| Smell                            | 1-5              | 4.9         | 5                            |
| Taste                            | 1-5              | 4.9         | 5                            |
| Final quality assessment         |                  | 4.7         | 4.8                          |

Based on the data obtained in Table 4, the control sample has an assessment of 4.7, and the prototype is 4.8. The results of carrying out physicochemical methods are presented in table 5.

**Table 5.** Physical and chemical indicators of finished products

| Indicators                                | Wheat bread | Wheat bread with cedar flour |
|-------------------------------------------|-------------|------------------------------|
| Crumb moisture, %                         | 43.0        | 43.2                         |
| Crumb acidity, degrees, no more           | 2.8         | 3.0                          |
| Crumb porosity, %, not less               | 72.0        | 72.4                         |
| Mass fraction of sugar in terms of dry matter, % | 3.0 | 3.2 |
| Mass fraction of fat in terms of dry matter, % | 2.2 | 5.3 |
According to the data obtained from Table 4, it can be concluded that the introduction of cedar flour has unambiguously influenced the quality indicators of the finished product. The moisture, acidity and porosity of the prototype did not change significantly compared to wheat bread. The mass fraction of fat increased by 3.1%, this is due to the fact that cedar flour has high lipid properties and is rich in fats.

Calculation of indicators of baking, shrinkage and yield of bakery products is presented in table 6.

**Table 6. Indicators of baking, shrinkage and yield of bakery products**

| Indicators                  | Wheat bread | Wheat bread with cedar flour |
|-----------------------------|-------------|------------------------------|
| Baking loss, %              | 11.0        | 11.0                         |
| Shrinkage, %                | 4.7         | 4.7                          |
| Test output, g              | 147         | 147                          |
| Product output, g           | 149         | 149                          |
| Volumetric output of products, cm³ | 338         | 330                          |

The analysis of table 5 showed that the pack and shrinkage correspond to the norm, which indicates the correctness of the selected temperature and baking time, as well as the correct cooling mode of hot bread. The obtained result of calculating the percentage yield of wheat bread from premium flour turned out to be 3% more than the yield of the dough, so it can be assumed that when cutting the dough pieces, there was a slight underweight of the dough pieces.

After carrying out an organoleptic and physicochemical quality assessment, it was found that wheat bread with the addition of cedar flour met the standards for this type of bakery products.

The addition of cedar flour to the total mass has a positive effect on the color of the crust, the elasticity of the crumb, while the staling process slows down, the content of vitamins C, P and K, β-carotene and minerals increases. Small cracks appear in the lower surface of the bread, the dimensional stability does not decrease, the taste and smell characteristic of the nut is strong.

The final result of the manufactured product depends critically on its cost and profitability. We calculated the economic efficiency of the production of wheat bread [6].

The calculation of the production cost of the control and prototype is presented in table 7.

**Table 7. Calculation of the production cost of wheat bread (100 kg)**

| The name of indicators                              | Wheat bread | Wheat bread with cedar flour |
|-----------------------------------------------------|-------------|------------------------------|
| Raw materials and basic materials, rubles           | 1573.50     | 1789.20                      |
| Auxiliary materials, rubles                         | 40.00       | 40.00                        |
| Wages of production workers, rubles                 | 68.50       | 68.50                        |
| Payment for electricity, rubles                      | 164.70      | 164.70                       |
| Depreciation deductions per month, rubles            | 20.80       | 20.80                        |
| Container cost, rubles                               | 0.22        | 1.06                         |
| Equipment maintenance and operation costs, rubles    | 166.40      | 166.40                       |
| Production cost, rubles                              | 2018.87     | 2249.57                      |
| Other costs, rubles                                  | 20.18       | 22.49                        |
| Total production cost, rubles                        | 2054.27     | 2273.12                      |

Using the data from table 6, it is possible to conduct a comparative analysis of the indicators of the production cost of the production of wheat bread and wheat bread with the addition of cedar flour. The
data in the table show that only the cost of raw materials affects the cost of production. All other indicators remain unchanged, since the technological process of product production does not change.

The calculation of the economic efficiency of the production of bakery products is presented in table 8.

Table 8. Economic efficiency of wheat bread production

| The name of indicators | Wheat bread | Wheat bread with cedar flour |
|------------------------|-------------|-----------------------------|
| Production cost, rubles / kg | 20.54 | 22.73 |
| Selling price, rubles / kg | 30.00 | 35.00 |
| Net profit, rubles per unit | 9.46 | 12.27 |
| Profitability of sold products,% | 46.06 | 53.98 |

Table 7 shows that the profitability of wheat bread with the addition of cedar flour is 8% higher than that of wheat bread, while the sales price increases with the content of cedar flour, the annual net profit increases, and the production efficiency increases.

4. Conclusions

Studies were carried out aimed at solving an important national economic problem - providing the population with a wide range of food products, improved quality, increased nutritional value, intended for preventive nutrition.

A recipe for wheat bread with the addition of cedar flour has been developed. The use of cedar flour in the production of wheat bread from premium flour helps to improve such organoleptic quality indicators as the appearance of the bread, the state of the crumb and taste, the finished product retains its splendor longer, the bread is more airy and aromatic. Physicochemical studies have been carried out, which show that bread with the addition of cedar flour has higher physical and chemical characteristics than wheat bread. Such bread can be called a functional food product, since it contains a wide range of natural trace elements, vitamins and minerals that have a high biological value, in addition, it can be used for therapeutic and prophylactic purposes.

The production of wheat bread according to the developed recipe provides the company with an expansion of the range and an increase in customers.

Thus, we can conclude that the development of the production of bakery products with the addition of cedar flour is an important reserve for using the production potential of the bakery industry at the present stage of its development.

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