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IMPROVING THE TECHNOLOGY OF BAKERY PRODUCTS PRODUCTION IN ORDER TO ENSURE FOOD SECURITY OF THE POPULATION

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Abstract

Bakery products occupy one of the leading places in the diet of the population and are an important source of carbohydrates, proteins, vitamins and minerals. Modern trends in the development of bakery involve the use of food additives that improve nutritional value, functional properties, shelf life and organoleptic characteristics of products. The paper considers the classification of food additives, their technological significance and impact on the quality of bakery products. The problems of using additives and the prospects for improving technology, taking into account the requirements of safety and healthy nutrition, are outlined.

Keywords: *bakery products, food additives, functional products, nutritional value, baking technology*

Introduction

The modern food industry is focused not only on providing the population with mass-consumption products, but also on the production of functional and specialized food products. Bread, as one of the most consumed products, plays a key role in ensuring food security. However, traditional bakery products do not always fully satisfy the physiological needs of the body for the necessary nutrients.

One of the ways to increase the nutritional value of bread is the use of food additives and enriching components: protein concentrates, dietary fiber, vitamins, minerals, enzyme preparations, as well as natural vegetable ingredients (pumpkin, soy, flaxseed flour, vegetable and fruit powders). Their use allows not only to improve the quality of products, but also to give them functional properties, which corresponds to global trends in healthy eating. Proteins are an essential component of food, with their deficiency, hematopoiesis decreases, the development of a growing organism is delayed, the metabolism of fats and vitamins, the activity of the nervous system, liver and other organs is disrupted, and cell recovery slows down after severe diseases.

Protein deficiency is one of the serious problems in the nutrition of the population, especially socially vulnerable groups. Protein deficiency in the country is 30–40% and increases annually, therefore, along with the use of ready-made protein preparations, it is necessary to use non-traditional protein sources (Erashova L. D., Pavlova G. I., Ermolenko R. S., 2009).

Fortified bakery products with protein-containing additives from non-traditional vegetable raw materials are one of the promising ways to increase nutritional value.

Legumes are often used as a source of cheap vegetable protein, since, in addition to their unique chemical composition, they are characterized by their availability and availability of sufficient raw materials. A large number of plant-based proteins and relatively low production costs make it possible to significantly compensate for the protein deficiency in human nutrition. Chickpeas are one of the oldest crops that have been cultivated in the Middle East and other tropical and subtropical countries since time immemorial (Klochkova I. S., Davydovich V. V., 2018). All additives used in the bakery industry can be divided into several groups:

The structure – forming and dough improvers are enzyme preparations (amylases, xylanases), emulsifiers (lecithin, mono- and diglycerides of fatty acids), oxidants (ascorbic acid, Enriching additives – mineral salts (iron, calcium, zinc), B vitamins, vitamin D, dietary fiber, Functional ingredients – protein concentrates from legumes, whey, seeds; powders of vegetables, fruits, herbs; prebiotics, Stabilizers and preservatives – organic acids (sorbic, propionic), essential oils and natural extracts with antimicrobial action. All these additives affect the quality of bread in different ways: Enzymes and emulsifiers improve the gas-holding capacity of the dough, increase the volume and porosity of the bread. Protein concentrates increase the content of essential amino acids, especially lysine, which is deficient in wheat flour. Dietary fiber (bran, fiber, pectin) normalizes digestion and reduces the glycemic index of bread. Mineral supplements make it possible to create preventive products (for example, bread fortified with iron to prevent anemia). Vegetable and fruit powders give products new flavors and increase the content of biologically active substances (Pashchenko L. P., Kurchaeva E. E., Kulakova Yu.A., Yakovleva.E.A., 2004).

The purpose of the study is to analyze the technological and physiological features of the use of food additives in the production of bakery products.

Materials and methods

This study examined the classification of additives by functional purpose, the effect of protein, mineral and vitamin additives on bread quality, the role of enzyme preparations and dough improvers, the use of vegetable powders and dietary fibers, and the safety assessment and regulations for the use of additives in baking. Data from open sources, including scientific articles, books and publications, were used as materials. related to the topic of food additives in bakery. A search was conducted for sources using the electronic databases Google Scholar, Scopus and Web of Science to identify relevant research.

Results and discussion

During the work, five experimental bread samples were prepared with a mixture of chickpea and barley flour from 1 to 5% by weight of wheat flour. The products were made using a non-stick method according to a unified formulation (Ershov P. S., 2001).

The mixture used in the research process had a humidity of 15% and an acidity of 1.8 degrees. At the first stage of production, the mixture was mixed with wheat in appropriate proportions and added to the dough, the dough was kneaded at a temperature of 30–320 C for 40 minutes, the final moisture content of the dough was 42%, which met the requirements of the technological instructions (dough moisture 42–45%).

The kneaded dough of the control sample was left to ferment at a temperature of 32–34^{0}C for 3.5 hours, and then divided into pieces of a given mass and sent for proofing. The fermentation time of the test samples at a temperature of 32–340 °C was 2.5 hours, since the addition of a flour mixture accelerates the maturation process of the dough due to the intensification of its fermentation and accumulation of organic acids, as well as the

presence in the additive of a large amount of minerals that give an acidic reaction. For this reason, a safe method of dough preparation was chosen (Jankorazov A. M., Sattarov K. K., 2024). Thus, the introduction of a mixture of chickpea and barley flour allowed not only to enrich bakery products with vegetable protein, but also to speed up the production process. The molded bread was baked at 180–200^0 C for 50 minutes in a moistened baking chamber until the crust color changed from golden yellow to golden brown. The quality indicators of the prototypes were determined after cooling in accordance with GOST 5667–65 "Bread and bakery products. Acceptance rules, sampling methods, methods for determining organoleptic parameters and weight of products" During the trial baking, organoleptic studies of the products were performed Table 1.

Table 1. *Organoleptic characteristics of bakery products using a mixture of chickpea and barley flour*

Indicators	Control	The content of a mixture of chickpea and barley flour,%	
Appearance:			
Form	Correct, without pretensions (5)		
Surface	Smooth, without cracks or explosions, with oblique cuts (5.0)		With oblique cuts and small cracks (4.0)
Color	Light yellow uniform (5.0)	Yellow with a small amount of dark spots (4.5)	Brown, large number of dark spots (3.5)
Crumb condition:			
Baking	Baked, not moist to the touch, elastic (5.0)		
Promes	Without lumps and traces of non-wood (5.0)		
Porosity	Uniform, developed, without voids and seals (5.0)		Uneven, undeveloped (3.5)
Taste	Pleasant, without an extraneous taste, characteristic of this type of product (4,5)	Pleasant, with a slight hint of nuts (5.0)	With an unpleasant taste of legumes (3.0)
Smell	Pleasant, odorless, characteristic of this type of product (4,5)	Pleasant light smell of nuts (5.0)	Pronounced unpleasant odor of legumes (3.0)

As a result, Table 1 revealed that with an increase in the amount of a mixture of chickpea and barley flour to 5%, the crumb color deteriorates due to dark inclusions of a mixture of chickpea and barley flour, as well as the color of the upper crust darkened much faster. In addition, there was a negative effect on the taste and aroma of bread, as there was a pronounced taste and smell of legumes. When adding a mixture of chickpea and barley flour in an amount from 1 to 3%, the color does not change much compared to the control, with a flour content of 4%, a light pleasant aroma of nuts appears, which is typical for chickpea and barley flour. Thus, an increase in the amount of a mixture of chickpea and barley flour to 5% of the total amount of flour is impractical, since it leads to a deterioration in the organoleptic characteristics of the product, in particular, a pronounced smell and taste of legumes appears, the color and surface of the finished products change. The results of the physico-chemical parameters of samples with different ratios of a mixture of chickpea and barley flour are presented in Table 2.

Table 2. *Physico-chemical parameters of samples with different ratios of a mixture of chickpea and barley flour*

Indicators	Control	The content of a mixture of chickpea and barley flour,%				
		1	2	3	4	5
Crumb moisture,%	40.7	40.8	40.8	41.0	41.0	41.4
Crumb moisture,%	1.8	2.0	2.2	2.4	2.4	2.7
Porosity,%	78	80	80	82	82	64

A study of the physico-chemical quality indicators (Table 1) of molded bread showed that all indicators are within the limits of the norms established in the standard, with the exception of acidity (no more than 2.5 degrees) and porosity for a sample with a mixture content of 5% of the total amount of flour. The increased acidity is due to the fact that when the dough is fermented using a mixture of chickpea and barley flour, the acid accumulation process is faster. Porosity does not correspond to the indicators of GOST 31805–2018 bakery products. General specifications (at least 65%), since the gluten content in the dough when adding a mixture of chickpea and barley flour over 5% of the weight of wheat is not enough.

As a result of organoleptic and physico-chemical studies of samples of bakery products containing mixtures of chickpea and barley flour, it was concluded that it would be advisable to add it in an amount of no more than 4% by weight of wheat flour.

Conclusions

In the course of the study, a recipe for molded bread was developed with the addition of mixtures of chickpea and barley flour in an amount of 4% by weight of wheat flour. A technology for the production of molded bread with mixtures of chickpea and barley flour has been developed, the use of which has reduced the fermentation time of the dough by 30%. The amount of protein in molded bread added to a mixture of chickpea and barley flour was determined, which increased by 18% compared with bread produced according to the control recipe. The nutritional and energy value (250 kcal) of the developed product is calculated. The shelf life of molded bread with mixtures of chickpea and barley flour (48 hours) has been established, during which the product has high organoleptic and physico-chemical properties, and microbiological parameters comply with these requirements “On Food Safety”

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