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RESEARCH OF RHEOLOGICAL INDICATORS OF THE USING THE FLOUR OF GERMINATED LEGUMES

The object of research is biscuit dough using flour from sprouted legumes with varying proportions of replacement by reducing wheat flour. The effect of legume flour with a replacement rate of 5, 10, 15, 25 % is studied. The importance of the research is due to the fact that biscuits are high-calorie foods. This is what determines the creation of new types of products with a high content of protein, vitamins, minerals and a low content of simple carbohydrates. At the same time, it is important not only to improve the nutritional composition, but also to preserve the rheological properties of the biscuit dough, which depend on the internal structure of the system.

One of the most problematic places is that when the flour raw material changes, even in small quantities, the rheological characteristics of the dough and, as a consequence, the finished flour products change. When preparing the biscuit, it is recommended to use wheat flour with low or medium quality gluten, otherwise the pulp of the finished product will be dense with poorly developed porosity. One of the possible solutions to this issue is the use of flour of sprouted legumes, enriched with microelements that can be used in biscuit production technologies.

The indicators characterizing the rheological properties of the dough are investigated: dough formation time, dough stability to kneading, dough dilution degree after 10 minute after the start, the dough dilution degree after 12 minutes after the maximum. The obtained experimental studies make it possible to determine a comprehensive quality indicator using a farinograph.

It is found that in the manufacture of biscuit dough it is rational to use 5–10 % flour of sprouted legumes by reducing wheat flour. The use of legume flour in the specified concentrations improves the rheological characteristics of the biscuit dough, which is associated with a decrease in the amount of gluten in the dough.

The prospect of further research is the study of the structure-forming indicators of the finished biscuit.

Keywords: *flour of sprouted legumes, biscuit dough, rheological parameters, flour mixture, flour raw materials.*

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1. Introduction

The priority role in the development and creation of innovative food products belongs to flour products, which are the most common food products accepted by all groups of the population [1]. Flour products occupy an important place in the daily human diet, since they occupy the largest share of the world market, and most 39–43 % of the total production of products [2]. The rheological properties of the dough from which they are made [3] have an important influence on the quality indicators of finished flour products. The rheological properties of the dough are a complex indicator that describes the state and behavior of the dough during mixing and throughout the entire technological process. Having information about the time of formation of the dough, its resistance to kneading, the rarefaction degree, it is possible to determine a complex quality indicator using a farinograph, analyzing the results of which one can judge the characteristics and quality of the finished flour product [4].

Expanding the range of flour raw materials by identifying alternative sources that can partially or completely replace wheat flour for the purpose of its rational use in the bakery industry is relevant, which is confirmed by a number of studies [5–7]. It is known that for the preparation of biscuit it is recommended to use wheat flour with low or medium quality gluten [8], otherwise the pulp of the finished product will be dense with poorly developed porosity. One of the possible solutions to this issue is the use of flour of sprouted legumes, enriched with microelements [9, 10], which can be used in technologies for biscuit semi-finished products.

Thus, *the object of research* is biscuit dough using flour from sprouted legumes with varying proportions of replacement due to the reduction of wheat flour. And *the aim of research* is to study the rheological parameters of dough using flour from sprouted legumes.

2. Methods of research

The rheological properties of the dough were studied using a Brabender AO farinograph (Germany). To assess the effect of flour of sprouted legumes on the rheological properties of the dough, samples of flour mixture were made with the replacement of 5, 10, 15, and 25 % wheat flour for flour of sprouted legumes in a ratio of 1:1. The control was dough made of wheat flour. The indicators characterizing the rheological properties of the dough were determined: the time of dough formation, the stiffness of the dough to kneading, the degree of dough dilution

after 10 minutes after the start, the dough dilution degree after 12 minutes after the maximum, a complex indicator of quality by farinograph.

3. Research results and their discussion

Table 1 shows the results of a study of the dependence of changes in the farinographic indicators of the dough for the use of flour of sprouted legumes.

Table 1

Dependence of changes in farinographic parameters of the dough using flour of sprouted legumes

% ratio of flour from sprouted legumes to wheat flour (1:1:X)	Dough formation time, (DDT) min	Dough resistance to kneading (S), min	Dough dilution after 10 minutes after the start of DS, EF	Dough dilution after 12 minutes after maximum DS (ICC), EF	Farinograph quality index with FQN, mm
0	2:27	7:36	42	60	71
5	5:18	9:02	25	50	106
10	4:49	7:07	36	62	90
15	5:20	5:13	52	80	80
25	5:18	3:58	49	87	75

From experimental data it is found that the introduction of flour of sprouted legumes into the flour mixture affected all indicators of the rheological properties of the dough. It is found that the highest value of the quality index according to the farinograph corresponds to the sample with the addition of flour of sprouted legumes in the amount of 5 %. However, it should be noted that adding any amount of sprouted legume flour to the mixture instead of wheat flour increases the quality index according to the farinograph. For a sample with 25 % bean flour added instead of wheat flour, the dough formation time is 5 min. 18 s, which is more than double the dough formation time for the control sample. In [11], it is described that this is associated with a decrease in the amount of gluten. At the same time, the duration of homogenization of the mixture components increases and the protein and carbohydrate fractions of the flour of sprouted legumes do not require an increase in the time for hydration. The resistance of the dough to kneading when replacing 5 % with flour of sprouted legumes shows an increase due to a decrease in wheat flour, but when analyzing dough samples with a high content of flour of germinated legumes, the indicator of dough resistance to kneading decreases. Scientists [12] who studied similar systems associate this with a change in the structure of protein fractions, which change when germinated legumes are introduced into the flour system, thus forming a stable framework. However, with an increase in the proportion of flour replacement of sprouted legumes from 15 %, the balance of protein fractions is disturbed and, as a result, the resistance of the dough to kneading decreases.

4. Conclusions

The rheological parameters of the dough with the use of flour of sprouted legumes have been investigated. It has been found that in the manufacture of biscuit dough it is rational to use 5–10 % flour of sprouted legumes by reducing wheat flour. The use of legume flour in the indicated concentrations improves the rheological characteristics of the biscuit dough. The prospect of further research is the study of the structure-forming indicators of the finished biscuit.

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