Prospects for the use of fruit enhancers in bakery technology for healthy diet

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Abstract. Bread is a useful biological product that remains high in the human diet and contains a large amount of substances necessary for the human. A rational way to expand the range of functional bakery products is to integrate natural plant-based ingredients into the formulation, which will increase the nutritional value of products, improve their sensory and physicochemical characteristics, create a group of new varieties, boost production, advance the quality of raw materials with low properties and save the critical and accessory raw materials. The paper discusses the effect of fruit enhancers on the physical and chemical properties of dough and finished bakery products. The paper proposes optimal dosages of fruit powders.

1. Introduction

Health is a state of complete physical and mental well-being in the absence of disease. It is formed throughout a human life under the influence of both objective external conditions and subjective factors associated with human individual characteristics and lifestyle [1-3].

Healthy eating habits rest on foods that can ensure growth, development of life. It is composed of such elements as a wide range of foods, the economic capabilities and the level of human nutrition awareness. Healthy eating is aimed at promoting human health and preventing disease.

Constant renewal of the human body requires continuous consumption of nutrients and energy that are necessary to ensure normal functioning of the body. Moreover, food should be digestible, appetizing, varied, harmless and impeccable in sanitary and epidemiological terms, have good sensory characteristics, and saturate the body. Since food is one of the principal pleasures in human life, it is necessary to know and follow the benefits of a proper, healthy diet [4, 5].

Undoubtedly, essential nutrients are required to promote sound metabolism, growth and development of the body, protect against diseases and harmful environmental impacts and ensure all vital functions. Unfortunately, our body does not synthesize and does not store micronutrients for any long time, thus requiring their regular supplies in a set and in quantities corresponding to the physiological needs of a person.

Public health tends to worsen steadily, accompanied by lower life expectancy, growing cardiovascular and oncological diseases that are somehow related to eating habits. Today, it is important to understand the role of nutrients and other food components essential in promoting health and preventing diseases, to study the way they are consumed, assimilated, transferred, utilized and excreted from the body, to determine food preferences and implications for human health [1, 5].
Herbal powder-like ingredients can be used to make functional bakery products based on various types of dough, while, depending on the chemical formula and physicochemical properties of the dough and additives, the functional indicators of the finished products will differ markedly [4,6].

With this in view, it is vital to come up with new technological solutions and plant-based enhancers that simultaneously promote the biological value of products and the stability of quality factors. To produce a new range of functional rye-wheat bread, the paper presents fruit ingredients selected as having a high antioxidant value that is attributed to their rich vitamin profile, availability, renewability and relative cheapness [5-9].

The paper aims to study the effect of fruit enhancers on the physicochemical properties of bakery products.

The objects of research are stolichny rye-wheat bread, fruit ingredients: Titan mountain ash, Vitaminny rose hip, plant-based powders, prototypes of a new range of rye-wheat sourdough bread enriched with functional fruit powders with high antioxidant properties.

2. Materials and methods

The physical and chemical quality indicators of the dough and finished products were examined using standard generally accepted methods of analysis to determine structural and mechanical properties, chemical and sensory features of the target objects.

Acidity emanating from all acid-reacting substances of flour, additives and waste yeast and bacteria products was specified as per GOST 5670-96 Bakery Products. Methods for Acidity Determination. The method implies extracting organic acids from a sample of bread with subsequent titration with an alkali solution.

Moisture (and dry substances) content – as per GOST 21094-75. Bread and Bakery Products. Moisture Determination Method – by drying to constant weight at a temperature of 130 °C.

Bread porosity was determined as per GOST 5669-96 Bakery Products. Method for Porosity Determination, using Zhuravlev’s device, followed by calculation according to the appropriate formulas and tables.

3. Results and Discussion

The use of herbal ingredients derived from local raw materials is an urgent trend for formulating functional products. Enhancers are used to align the characteristics of raw materials available, facilitate the production and make finished products much more functional [11-12].

For experimental modeling an innovative range of rye-wheat bread with functional ingredients, each functional powder enhancer was added into a recipe for stolichny rye-wheat bread, where some portion of the 1st grade wheat flour was replaced with fruit powders.

In order to optimize the dosage, the enhancers were added in 2% increments. The functional powders were mixed into the dough to study changes in the physicochemical parameters of both the dough and finished bread samples. The rheological behavior of test samples of dough and bread were evaluated against moisture, acidity, gas-forming ability and porosity.

The mountain ash and rosehip powder enhancers added into the dough to replace 1st grade wheat flour led to an increase in both the initial and end acidity, as well as an increase in moisture in the samples with additives (Table 1).

The effect of dosages of mountain ash and rosehip powder on the quality of finished products was determined by physical and chemical indicators: acidity, moisture and porosity. Quality assessment was provided 16 hours after baking (Table 2).
Table 1. Chemical indicators of the dough enhanced with mountain ash and rosehip powders

| No. | Dough sample                  | Acidity, °T | Humidity, % |
|-----|-------------------------------|-------------|-------------|
|     |                               | initial     | end         |             |
| 1   | control (plain)               | 3.2±0.1     | 4.7±0.1     | 54.3±0.2    |
| 2   | with 1% mountain ash powder   | 3.3±0.1     | 4.8±0.2     | 54.5±0.1    |
| 3   | with 3% mountain ash powder   | 3.5±0.2     | 4.9±0.1     | 54.9±0.2    |
| 4   | with 5% mountain ash powder   | 3.7±0.1     | 5.0±0.2     | 55.5±0.2    |
| 5   | with 1% rosehip powder        | 3.3±0.1     | 4.9±0.2     | 54.2±0.1    |
| 6   | with 3% rosehip powder        | 3.4±0.2     | 4.9±0.1     | 54.4±0.2    |
| 7   | with 5% rosehip powder        | 3.5±0.1     | 4.9±0.2     | 54.8±0.2    |
| 8   | with 7% rosehip powder        | 3.6±0.1     | 5.2±0.1     | 55.1±0.1    |

Table 2. Chemical indicators of the quality of bread enhanced with mountain ash and rosehip powders

| No. | Bread sample                  | Humidity, % | Acidity, °T | Porosity, % |
|-----|-------------------------------|-------------|-------------|-------------|
| 1   | control (plain)               | 41.9±0.1    | 4.1±0.2     | 58.0±0.2    |
| 2   | with 1% mountain ash powder   | 42.5±0.2    | 4.2±0.1     | 60.0±0.2    |
| 3   | with 3% mountain ash powder   | 42.9±0.1    | 4.4±0.2     | 64.0±0.1    |
| 4   | with 5% mountain ash powder   | 43.2±0.2    | 4.5±0.2     | 62.0±0.2    |
| 5   | with 1% rosehip powder        | 42.3±0.2    | 4.3±0.1     | 61.0±0.2    |
| 6   | with 3% rosehip powder        | 42.5±0.1    | 4.4±0.2     | 62.0±0.1    |
| 7   | with 5% rosehip powder        | 42.8±0.2    | 4.6±0.2     | 64.0±0.2    |
| 8   | with 7% rosehip powder        | 43.6±0.1    | 4.9±0.1     | 61.0±0.1    |

The enhancers increased moisture in the control samples, due to the fruit dietary fiber that retains moisture in a bound state. The acidity index in the samples with mountain ash increased from 0.1 to 0.4 degrees, due to the high acidity of the powder and the presence of its own sugars that activate the yeast in the mountain ash powder. The porosity index of new products increased from 1 to 5% in the samples with the mountain ash powder, due to hydration and swelling of the polymer structure, dissociation of organic acids and amino acids of the mountain ash powder. When 5% was added, this indicator decreased to 62.0%, which is apparently associated with the tightening of the dough.

In the samples with rosehip powder, there was an increase in moisture and acidity. The first can be explained by the water-holding properties of rosehip powder, and the second – by the initially high acidity of the ingredient, but the acidity index, when applied up to 5%, did not go beyond the permissible norms.

Once added, the rosehip powder contributed to an increase in acidity by 0.1-0.5 degrees, humidity by 0.3-1.0%. The best dough indicators were observed when rosehip powder was added in an amount of 5%. Besides, there was a rise in acid accumulation by 0.2 degrees. The 7% rosehip powder worsened the quality indicators as compared with the previous trial.

The findings indicate that the quality indicators of bread prepared with optimal dosages of rosehip powder 1-5% had the best indicators compared to the control sample. The powder added in an amount below 5% contributed to the fact that the biochemical and microbiological processes were active enough to ensure sustainable improvement of the biotechnological properties of semi-finished and finished products.

The use of an additive of more than 5% led to the fact that the increased concentration of the nutrient medium contributed to a decreased activity of the fermenting microflora and, as a result, to a deterioration in the biotechnological parameters of semi-finished products and the quality of finished products.
4. Conclusion
The plant-based powders added into the recipe for stolichny rye-wheat bread instead of part of the 1st grade flour had a positive effect on its functional and technological characteristics. Based on the findings, an optimal dosage of mountain ash powder of the Titan variety should be considered 3%, of the Vitaminny variety – 5%.

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