Quality improvement and shelf life extension of functional bakery products with the use of stevia

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Abstract. With the use of stevia water extract, the production technology and range of functional bakery products have been developed. The analysis of the laboratory - baked pan and hearth bread of the reference sample and samples with the addition of different amounts of stevia water extraction was carried out. It is found that the preparation of bakery products according to the developed formulas contributed to the shelf life extension of bread. The positive effect of stevia extract on keeping bread fresh has been revealed. Conducted tests have shown the applicability of developed bakery products in diet composition for people with insulin dependence and overweight.

For dietary and diabetic nutrition of patients and people at risk, as well as for improvement the food culture, many countries are searching for natural sweeteners and preservatives [6]. Among such plants stevia (Stevia rebaudiana Bertoni), the leaves of which contain low-calorie sugar substitutes - stevioside and rebaudioside, is one of the most advanced. The sweetening power of stevioside is estimated to be by 250 ... 300 times higher than sugar, and rebaudioside - by 400 ... 00 times. The taste of stevia leaves is 3- ... 50 times sweeter than sugar. Stevia is the youngest crop in modern crop production. The value of stevia is that it contains a natural nonnutritive sweetener. Stevia leaves contain glycosides, which break down without insulin and stimulate its secretion. That is, the leaves of this crop contain a natural sugar substitute for diabetics - stevioside, which does not have a sugar lowering effect on healthy people [1].

The agro climatic conditions of the Stavropol region are suitable for successful cultivation of a new sugar crop - stevia. The variety of stevia Stavropol Slastyona is able to form a high yield of leaf mass in the conditions of the Central zone of the Stavropol region and its cultivation is lucrative [3].

The honey grass stevia is cultivated and used in the food industry of many countries in South America, Southeastern Asia and Europe. By now, the possibility of using stevia leaves, concentrate based on these and sweeteners for food production has been studied and experience has been gained. Formulas for the preparation of sauces, seasoning, pickles, spices, bread and canned goods have been developed. It has found wide application in Vietnam, Indonesia. In recent years, technologies for creating functional products with the use of stevia have been developed in Russia [6].

Bread is one of the most popular foodstuffs. Components with therapeutic and preventative properties included in its formula have a significant impact on the qualitative and quantitative composition of the
human diet, makes it possible to effectively solve the problem of the prevention and treatment of various diseases connected with a deficiency of some or other certain substances [6].

The range of bread has hundreds of items. However, organoleptic qualities are characterized by common features [4].

Laboratory trials of pan and hearth bread baking were carried out using different amounts of stevia water extract, an organoleptic evaluation was made, physical and chemical indicators were compared and the cost-effectiveness of baking bread with the stevia addition was compared with the standard formula.

Water extract made from the stevia variety Ramonskaya Slastyona was used as a sugar substitute. To prepare water extract, 1 liter of water and 10 g of dry stevia leaves were brought to the boil, held for 1 hour on a boiling-water bath, and drained [5].

To recalculate sweet substances, 10 g of sugar corresponds to 30 ml of stevia water extract.

Bread samples obtained in accordance with the experiment scheme (figure 1), served as the research material.

![Figure 1. Appearance of laboratory-baked bread samples: 1- control; 2 – 0.5 norm of stevia; - 1 norm of stevia; 4 – 1.5 norms of stevia; 5 - 2 norms of stevia.](image)

The shape of all pan bread samples made with the addition of stevia water extract corresponds to the bread form in which they were baked, with a slightly raised upper crust, with no side leaks; all hearth bread samples are rounded, not loose, without kissing crust. The crust color of all bread samples corresponds to GOST (Russian National Standard): from light yellow to light brown. The lighter color — yellow of pan bread and light yellow of hearth bread with the addition of stevia — is explained by the absence of sugars in these samples responsible for the formation of color.

All laboratory-baked samples of pan and hearth bread with the addition of stevia water extract of various concentrations, as well as controls are thoroughly baked, the crumb is not sticky and not wet to the touch. The bread is elastic; the crumb takes initial shape after light finger pressure. The mix in all samples is good – with no flour lumps and traces of the unthorough mix. The porosity of all laboratory-baked pan and hearth bread samples is developed, thin-walled, with no cavings and seals (figure 2).
All laboratory-baked bread samples had the smell peculiar to this type of product, without foreign smell. To taste, laboratory - baked samples with the addition of 2 norms of stevia water extract had a sweetish taste of stevia.

The weight of the pan bread control sample was 520 g, a variant with the addition of 1.5 norms of stevia was at the same level, while having a volume of 1.0% more control, and this is due to the greater gas-generating and gas-holding capacity of this sample. Having an even greater mass (527 g), the sample with the addition of 2 standards of stevia has the smallest volume - 1.1% less control.

Shape stability close to high 0.44 mm was in the variant with the addition of 1 standard of stevia water extract.

The acidity of all samples complies with GOST 5670-96 for bakery products made from straight white wheat flour. The acidity in the pan and hearth bread samples with the addition of 2 norms of stevia water extract is slightly higher than the control (by 0.3 degrees) due to the excess amount of sweet substances which accelerates the fermentation of yeast.

The porosity of all bread samples comply with GOST 5669-96 for wheat bread (fig. 3). The porosity of the hearth bread sample with the addition of 1 standard water extract stevia equal to the porosity of the control sample (57%). For the remaining samples with the addition of stevia, the porosity is 1-2% lower than the control.
The moisture content of laboratory – baked pan bread made from straight white wheat flour of all variants with the stevia addition and of the control sample is 44.5%, which corresponds to GOST 21094-75 - not more than 45%.

The research findings have shown that the use of stevia water extract makes it possible to completely replace sugar in bread while maintaining its quality. The optimal dosage of stevia water extract in baked goods with traditional taste is 2 liters per 100 kg of flour, and for functional types of products 10 liters per 100 kg of flour. The shelf life of bread with the addition of stevia increased to 5-7 days. Bread with the use of stevia water extract corresponds to the standard, has a high volume and shape stability, elastic thoroughly baked crumb, sweetish taste and aroma. The addition of stevia in dosage for optimal taste increases the biotechnological properties of yeast, accelerates the mature of semi-processed products and improves their quality. The developed bread formula with the addition of stevia water extract can be used by mini bakeries. Functional bakery products can be recommended for diet and preventive nutrition of people suffering from diabetes and overweight [5, 6].

Thus, it can be expected that bread with the addition of stevia water extract will take its place in the bakery market, since this product has high consumer properties and meets all the requirements for bread quality today. Toxic substances and mutagens are not detected in stevia leaves; they have no age limit and can be successfully used for therapeutic nutrition of children and adults, as well as in technological processes during baking.

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