

# The use of a food additive based on Stevia Rebaudiana Bertoni components in the production of confectionery

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**Abstract.** The article proposes an analysis of research work on the use of a food additive based on the components of Stevia Rebaudiana Bertoni plant in the production of a confectionery product. The substitution of sugar with sweetener "Stevioside" in the amount of 10 % and 30 % did not significantly affect the organoleptic characteristics of the finished product, however, at 50 % substitution, a mild bitter taste and herbal odor were observed, which was inherent in this sweetener at high concentrations. There were also bursts of the biscuit semi-finished product and its greater crumbling at 50 % substitution. According to the results of the work, the production of a roll with 30 % sweetener "Stevioside" was the most optimal one. The introduction of a sweetener did not in any way affect such indicators as the layer thickness, moisture content, and dry matter content. All of them corresponded to GOST 14621-78. Based on the experiments carried out, it is recommended to substitute sugar with sweetener "Stevioside" in the amount of 30 % when producing "Spring" roll, as this allows to increase the amount of the product produced by reducing the technological process and will increase the level of profitability.

## 1 Introduction

Now, there is a trend in the Russian Federation towards an increase in the output of bakery and confectionery products, the production of which has almost doubled, compared with a decade ago. This allows to conclude about the importance of this direction of production. New technologies are being introduced, equipment in food production is constantly being updated, new recipes are being introduced into food production [1, 2, 3].

New food and confectionery improvers and additives are being actively introduced, and the production of sugar substitutes is growing. The decrease of sucrose substituted with various substances in recipes is caused by the need for its high energy value and high digestibility by the human being. Therefore, the introduction of ecologically safe sugar substitutes into confectionery products is a priority in the food industry, and has great prospects [4, 5, 6, 7].

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*Stevia Rebaudiana* Bertoni is a plant with a sweet taste, containing substances based on a glycosidic form, that is 200 times sweeter than sugar. In this regard, there was a study of the possibility of using its components in the production of flour confectionery products as an environmentally friendly sweetener [8, 9, 10].

*Stevia* (*Stevia Rebaudiana* Bertoni) is characterized as a perennial herbaceous crop from the sunflower family. It is a very highly branched shrub. It grows mainly in a moderately humid subtropical climate. This plant was brought to Russia at the beginning of the last century by Academician Vavilov. It is grown in the Central and Southern Federal Districts of the Russian Federation. This plant is 25 times sweeter than sugar and therefore one of the sweetest sweeteners. The plant becomes as sweet as possible when the buds appear. *Stevia* contains eight different sweet substances. Of these, the highest content in this herb is "Stevioside". That is why it is used as sweetener "Stevioside".

When using the most common sugar substitute today, aspartame, people have many unpleasant side effects, such as memory loss, the development of brain tumors, loss of vision and hearing, increased sugar, damage to nerve cells, but "Stevioside" is absolutely safe.

"Stevioside" has a low-calorie content and is not a substrate for the reproduction of bacterial and parasitic pathogens. Moreover, it has antifungal and antibacterial properties.

## 2 Materials and methods

The purpose of the work was to improve the technology of "Spring" roll in the conditions of Bakery No. 1 in the city of Ryazan by introducing sugar substitute "Stevioside" into the recipe.

The research was carried out in the conditions of the production and technological laboratory of Bakery No. 1 in Ryazan, as well as in the educational laboratory of the Department of Agronomy and Agrotechnologies at Ryazan State Agrotechnological University Named after P.A. Kostychev.

It should be noted that "Spring" roll is a biscuit confectionery product, covered with jam and formed in the form of a roll. There is a layer of sugar powder on top of the roll. This product is in great demand among the population of Ryazan and Russia.

Roll recipe in kg is as follows: premium wheat flour - 100; granulated sugar - 100.3; mélange - 167.2; essence - 1; powdered sugar - 3.35; apple jam - 126.5.

Biscuit semi-finished product, covered with a layer of filling, is rolled up. The roll is cut into pieces and sprinkled with powdered sugar. After that, the finished rolls are delivered to the finished product warehouse [11, 12, 13].

"Stevioside" refers to a group of sweeteners in the food industry, which is produced from *Stevia Rebaudiana* Bertoni by the extraction method. Formed concentrated juice is filtered and purified, later it is evaporated and dried. "Stevioside" is a product of a mixture of diterpene tetracyclic glycosides, which constitute more than 70 % of basic substances in terms of an anhydrous base, and is highly soluble in water. "Stevioside" is a white, hygroscopic powder, odorless and having a pronounced sweet taste.

The chemical composition of "Stevioside" in % is as follows: protein - 0.65; carbohydrates - 4.0; ash - 0.15; glycosides - 72.8; sodium - 27.2; calcium - 74.7; magnesium - 221.0; vitamin B1 - 0.42 mg, % and B2 - 1.85 mg, %.

"Stevioside" is officially included in the list of food additives that are allowed in the production of food products in Russia and is labeled E960.

The studies used the following dosages of "Stevioside": 1) control (without any sugar substitute); 2) 10 % sugar substitution by "Stevioside"; 3) 30 % sugar substitution by "Stevioside"; 4) 50 % sugar substitution by "Stevioside".

The analysis of flour quality was carried out in accordance with the requirements of GOST R 52189-2003 "Wheat flour. General technical conditions" and in accordance with the requirements of GOST on methods for determining quality indicators. The quality assessment of the finished rolls was carried out according to organoleptic and physicochemical indicators in accordance with GOST 14621-78 "Biscuit rolls. Technical conditions".

### 3 Results

A biscuit was baked for a roll using various doses of sweetener and their quality was assessed.

The shape of the product and the sectional view in variants the control, 10 % and 30 % of sugar substitution with "Stevioside" corresponded to this product name. There was no damage and an even edge. While the variant with 50 % sugar substitution was characterized by a gap during the formation of a biscuit into a roll and the sectional view was coiled into a crumbling semi-finished product, uneven in thickness, well baked, without hardening and traces of impermeability.

The surface of all investigated variants corresponded to the given product.

Analyzing the organoleptic indicators, one can see that the use of sweetener "Stevioside" in the amount of 10 % did not affect the quality of the finished product in any way, the introduction of 30 % sweetener improved the taste and smell of the finished product and with 50 % of the sweetener in the product, a slightly pronounced bitter taste and herbal odor were observed, that is typical for "Stevioside". The biscuit also turned out to be crumbly and when it was formed into a roll, breaks were observed. This was due to the fact that when the concentration of the sweetener was more than 30 %, the biscuit semi-finished product turned out to be denser.

In a case of a lower sugar content, the stability of the dough decreased, because it was sugar that in-creased the viscosity of the mélange when fluffed (Table 1).

**Table 1.** Physical and chemical characteristics of the roll

Characteristic	GOST 14621- 78	"Stevioside" content				HCP <sub>05</sub>
		Control	10 % (50 g)	30 % (150 g)	50 % (250 g)	
Layer thickness, mm	6-9	7.2	7.2	7.1	7.3	-
Moisture, %	25±3	25.6	24.9	25.0	25.8	0.80
Dry matter content, %	-	74.4	75.1	75.0	74.2	0.33
Mass fraction of sucrose, %	-	34.9	31.6	24.5	17.6	1.94

Table 1 indicates that the introduction of a sweetener does not in any way affect such characteristics as the layer thickness, moisture content, and dry matter content. All of them corresponded to GOST 14621-78. However, the mass fraction of sucrose with the introduction of "Stevioside" decreased in all variants by 3.37; 10.4 and 17.35 %.

Summarizing the organoleptic, physical-chemical data on the quality of the finished product, one can note that the most optimal variant is 30 % use of "Stevioside", since the purpose of developing a less-calorie product. In addition, when adding a sugar substitute, the time for fluffing the mélange decreases. This is due to the fact that sugar substitute dissolves faster than sugar, thus there is an opportunity to increase the daily productivity of the enterprise when using the same equipment.

The nutritional value of a confectionery product mainly depends on the chemical composition of the product, its biological and energy value (Table 2).

**Table 2.** The chemical composition and the degree of satisfaction of the daily requirement of the product

Food substance	Control		30 % "Stevioside"	
	Chemical composition 100 g	Nutritional value, %	Chemical composition 100 g	Nutritional value, %
Water, g	14.6	-	19.7	-
Protein, g	10.9	12.8	10.9	12.8
Fat, g	8.3	8.2	8.3	8.2
Digestible carbohydrates, g	56.4	14.7	45.9	12.0
Starch and dextrans	21.4	-	18.4	-
Mono- and disaccharides	34.9	69.9	27.5	55
Indigestible carbohydrates, g	1.8	5.0	1.8	5.0
Organic acids, g	0.2	-	0.2	-
Minerals, mg:				
K	177.50	7.10	177.50	7.10
Ca	43.77	5.47	43.81	5.48
Mg	17.06	4.27	17.17	4.3
P	143.06	11.92	143.06	11.92
Fe	3.23	23.05	3.23	23.05
Vitamins, mg:				
B <sub>1</sub>	0.08	5.16	0.08	5.3
B <sub>2</sub>	0.23	11.96	0.24	12.42
PP	0.68	3.6	0.68	3.6
Energy value, kcal	340	12.2	300	10.8

In studies of energy value, it should be noted that the caloric content of the sample with 30 % sugar substitute "Stevioside" turned out to be lower than the caloric content of the control sample by 40 kcal, which made it a more easily digestible food product. The introduction of a sweetener into "Spring" roll also made it possible to increase vitamins and minerals, which allowed the product to be included in the therapeutic and prophylactic group.

The introduction of 30 % of sugar substitute "Stevioside" will allow the company to receive additional profit and increase the level of profitability of products manufactured according to this recipe by 4.84 % for every 100 kg of flour processed.

## 4 Conclusion

Thus, summarizing the research, it is stated that the substitution of sugar with sweetener "Stevioside" in the amount of 10 % and 30 % has not significantly affected the organoleptic indicators of the finished product. However, at 50 % substitution, a weakly pronounced bitter taste and herbal odor has been observed, which is inherent in this sweetener at high concentrations. At 50 % substitution breaks in the biscuit semi-finished product and its greater crumbling were found. The most optimal would be the production of a roll with 30 % substitution of sugar with sweetener "Stevioside".

The introduction of a sweetener did not have not affected on such characteristics as the layer thick-ness, moisture content, and dry matter content. All of them corresponded to GOST 14621-78. However, the mass fraction of sucrose with the introduction of

"Stevioside" decreased in all variants by 3.37; 10.4 and 17.35 %. The caloric content of the sample with 30 % sugar substitute "Stevioside" turned out to be lower than the caloric content of the control sample by 40 kcal, which made it a more easily digestible food product. When adding a sweetener, there was a decrease in the time of fluffing the mélange.

It is recommended to use in the production of "Spring" roll the substitution of sugar with 30 % sweetener "Stevioside", since this allows to increase the amount of the product produced by reducing the technological process and will increase the level of profitability.

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