Optimization of Confectionery Products Quality Indicators

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Abstract. Proper nutrition of a modern person, taking the physiological state, age and gender into account, is essential for maintaining the population health and a preventive measure to maintain the optimal population physical form. The predominance of simple carbohydrate-rich food in the Russians’ diet leads to an increase in the proportion of the population that is overweight and has associated diseases. In this regard, the development of confectionery products recipes, taking into account the specifics of the traditional population grocery basket, while having, in comparison to analogues prepared according to classical recipes, a low calorie content, is a relevant task. The article provides data on the optimizing organoleptic indicators of the flour confectionery products quality, considering the processing characteristics of raw materials. The list of raw materials used as a substitute for white sugar in the production of a specialized product for dietary and preventive nutrition has been scientifically substantiated. The recipe and quality composition of a new food product has been determined, which meets modern medical and biological requirements for products of this category. The relation between the substitute of sugar with sweetener and the confectionery organoleptic characteristics has been established. It has been experimentally proven that the use of the results obtained in the course of work will reduce the energy value of high-calorie foods. The use of the developed recipe base will make it possible to reduce the content of simple carbohydrates in the population diet, increasing the product consumer value for the nutrition of various population groups.

1. Introduction
Gingerbread is one of the traditionally Russian confectionery products. The assortment of gingerbread products is rather wide – there are both custard and gummy ones, and products with various fillings and without them. It has been found that gingerbread confectionary is characterized by an average energy value and digestibility, reduced biological and physiological values and biological effectiveness [1].

The main ways to reduce the calorie content of flour confectionery products used by manufacturers are: adding vegetable components (bran, fruit and vegetable additives, vegetable pulp, etc.), reducing the proportion of white sugar, animal and vegetable fats in the formulations, or replacing them with indigestible carbohydrates (for example, pectins). Also, in order to reduce the amount of added sugar, it is possible to use sweet vegetable syrups which do not reduce the taste of the final product, as well as extend their shelf life [2].

Sweeteners and sugar substitutes have become important components of the confectionery products production. The assortment of this food additives category allows us to consider the technological properties of raw materials used for producing a wide variety of food products. The most common sweeteners used in modern confectionery production, both in the production of flour and sugar confectionery products are lactitol, sodium saccharinate, erythritol and stevioside [3].
Stevioside is a sweet substance derived from the leaves of a stevia plant (Stevia rebaudiana), found growing in the wild in northern Paraguay. Another name for this plant, reflecting its organoleptic properties, is “honey herb”. One of the disadvantages of stevioside, extracted from the stevia natural form, is its distinct bitter taste. Recently, however, this disadvantage has been largely neutralized by breeding new plant forms, as well as through the use of membrane separation and purification processes [4]. Currently, no other disadvantages limiting the wide distribution of this species have been identified.

In this regard, a number of applied studies are being carried out aimed at studying the effect of introducing stevioside into confectionery products on their quality indicators. Therefore, studies have been carried out on using stevia in jam production [5], positive results have been obtained using this type of sweetener in muffins production [6]. A functional ice cream recipe, which is not inferior in taste characteristics to a standard ice cream recipe, has been developed [7].

It is remarkable that in addition to imparting a sweet taste, diterpene glycosides obtained from stevia rebaudiana (Eupatorium rebaudianum) have anticancer, antioxidant, antihyperglycemic and a number of other positive effects on a human body. Food products made with stevia are enriched with vitamins, amino acids, and have a therapeutic effect [8].

Another option which allows to reduce the confectionery energy value, while increasing its nutrition value, is the replacing top-grade wheat flour in the recipe with rye flour. The energy value of medium rye flour is 10.8% lower than that of top-grade wheat flour. This alone will significantly reduce the total calorie content of the final product [9]. In addition, wheat flour is poorer in minerals, vitamins and dietary fibers. Complete substitution of wheat flour with rye flour does not have a significant negative effect on the organoleptic characteristics of final products, while their nutrition value increases [10].

In the view of the above, replacing white sugar and top-grade wheat flour in the gingerbread recipe and the optimization of their quality indicators is a relevant task. The production of such food products will contribute to the expanding the range of dietary food products, which, in turn, will allow the population to comply with the rational nutrition rules and prevent a number of alimentary-dependent diseases associated with excess weight, without significant restrictions in the diet.

2. Objects and methods of research
The object of the study was rye gingerbread with stevioside. The calculation of its nutrition value has been carried out according to the tables “Chemical composition of food products” using Microsoft Excel 2016. Statistical processing of the results has been carried out using Microsoft Excel 2016.

3. Results and discussion
Research on the optimizing the recipe of rye gingerbread with stevioside has been carried out at the Department of Production Technology and Processing of Agricultural Products of the Yaroslav-the-Wise Novgorod State University.

Optimization of the gingerbread products quality indicators has been carried out according to the nutrition value of the product obtained during the product development, as well as on the basis of the prototypes tasting analysis data. For this purpose, a step-by-step assessment of the possibility of replacing the ingredient components of the “Festivalnye” gingerbread control sample formulation has been carried out.

At the first stage of research, the entire volume of top-grade wheat flour in the control sample recipe has been substituted with medium rye flour. Identification of organoleptic indicators has been carried out according to GOST 5897-90. In the course of the tasting analysis being conducted, it has been identified that the taste, structure and fracture view in the prototypes have changed, this is determined by the technological properties of the raw material – rye flour. However, these changes did not have a negative impression on the tasting participants, which is confirmed by the prototypes’ high ratings (figure 1).
Calculation of the nutrition value of gingerbread obtained after the first recipe modification has shown that when rye flour was added to the recipe, the protein content in the final product increased by 14.3%, dietary fibers – by 15.9% compared to the control sample. The proportion of satisfying the daily requirement for protein has been calculated, it is 2–4% for different population groups (when using 100 g of the product) and 3–5% – in dietary fibers, when using the same amount of gingerbread (the norms of physiological needs according to MP 2.3.1.2432-08, developed by the Rospotrebnadzor Federal Hygiene and Epidemiology Centre, have been used for calculations).

At the next stage of the research, the optimization of stevioside application has been carried out. For this purpose, product samples with different stevioside proportions have been made – 0.23%, 0.25 and 0.27% by flour weight. According to the data obtained, in the course of assessing the structure, colour, fracture view, surface condition and shape of the samples obtained, all evaluated objects have been almost equally evaluated, i.e. the stevioside application had no effect on these indicators. The results of assessing the effect of different stevioside proportions on the gingerbread taste are presented in figure 2 (figure 2).

In the course of assessing the energy value of gingerbread samples made according to the classic recipe, using white sugar, and gingerbread made using stevioside, it has turned out that replacing sugar has made it possible to reduce the calorie content of the final product by 9.4%, which allows us to say that the new product is a more dietary analogue of traditional gingerbread.

**Figure 1.** Results of the gingerbread samples tasting analysis.

**Figure 2.** Results of assessing the gingerbread samples taste characteristics.
4. Conclusion
As a result of the study, it has been found that replacing top-grade wheat flour in the gingerbread recipe with medium rye flour and simultaneously using stevioside in the recipe has made it possible to reduce the energy value of a new gingerbread type by 16.4% and increase the content of protein and dietary fibers in them. The optimization of the recipe composition has been carried out using the tasting analysis methods. According to the data of the research carried out, the replacing some of the raw materials in the traditional gingerbread technology has made it possible to create a new food product of increased consumer value. The results obtained in the course of the study are used as the basis for the methodology of dietary confectionery creation.

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