The effectiveness of the using new raw materials in the production of confectionery products

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Abstract. The article deals with the efficiency of the producing confectionery products with increased organoleptic properties and reduced energy value due to the introduction of developed technologies for the production of texturates from wheat grain, by partially replacing sunflower seeds. It was found that the introduction of a texture from extruded wheat grain into the recipe of halva as a grated mass (by partially replacing sunflower seeds) increases the organoleptic characteristics of the product. The economic efficiency of technologies for the preparation of confectionery products (halva) using textured wheat grain is considered.

Calculations of the production efficiency of confectionery products (halva) showed that the profit from the sale of finished developed products is higher than in the production of products according to the control recipe by 10.5 %, the profitability of new products was 31.5 %.

1. Introduction
The confectionery industry is an important branch of the food industry. It produces food products of high caloric content and digestibility. These properties are inherent in confectionery products due to the using many types of high-quality raw materials for their production, such as sugar, caramel molasses, fats, dairy and egg products, cocoa beans, nuts, fruits, flour, etc. The main task is to saturate the market with confectionery products and strengthen the positions won by expanding the range of products. The demand for halva is determined based on the prospective population size and the average annual consumption rate.

The task of increasing the range of confectionery – halva with high consumer characteristics is achieved by introducing a halva recipe as a shredded mass of texturates from extruded wheat (by partial replacement of sunflower seeds).

New technology for confectionery products developed during the research helps the use of new raw materials for the production of confectionery products with improved organoleptic properties and reduced energy value, increase production efficiency.

In this paper, the economic efficiency of technologies for the preparation of confectionery products (halva) using textured wheat grain is considered [1-4]. Calculations of the production efficiency for confectionery products (halva) showed that the profit from the sale of 1 ton of finished developed products is higher than in the production of traditional gingerbread, the profitability of new products was 22.3 % [5-8].

2. Research methods
The calculation of the consumption of raw materials and semi-finished products coming from the side
is made according to recipe books on summary tables. All calculations for the consumption of raw materials and semi-finished products are carried out separately, and then the total consumption for the enterprise is calculated [9-12].

To calculate the company's need for raw materials, in warehouses for storing raw materials, it is necessary to find the amount of raw materials that is required to obtain the used semi-finished products at the enterprise. The calculation of raw materials warehouses is made according to the norms of raw materials stocks, storage standards for each type of raw material or product per 1 m² of area by multiplying them. The stocks to be stored in the warehouse are determined by multiplying the daily consumption of each type of raw material (in tons) by the standard storage period (in days).

Auxiliary materials in confectionery production include packaging materials used for wrapping and packaging of confectionery products (paper, cardboard, labels, various types of plastic films, starch, etc.).

After determining the type of wrapping and packaging for each group of products and the number of wrapped and packaged products, the need for packaging materials per shift is calculated.

In the production of halva, the following technological scheme is used: sunflower seeds and nuts are fed into the hopper by noria and, as necessary, in accordance with the production cycle, by auger and noria – into the air-screen separator, where they are cleaned from dust and extraneous impurities. After that, the seeds are fed by auger for size calibration in separators. Calibrated large, medium and small seeds and nuts are crushed separately in the crushing machines. The collapsed seed is fed by the noria to the seed machine for separation into fractions.

Sunflower kernels are fried in open roasters with fire heating, with continuous stirring. The duration of the heat treatment process in the roaster is 30-40 minutes. The temperature of the kernels after the final roasting is 110-120 °C, the humidity of the roasted kernels is 1.0-1.2 %.

After roasting, the sunflower kernel should be quickly cooled to 50°C to prevent deterioration of its quality under prolonged exposure to high temperature. The cores can be cooled in the cooling drum, as well as in the shaft coolers when cold air is supplied to them. When blowing the kernels with air, the husk is partially removed. The temperature of the cooled cores is 30 °C. Next, the core is sent for re-collapse in the crushing machine. The resulting rushank is fractionated in a second sieve machine. At the exit from the latter, the core is loaded by a bucket elevator into a roller machine for pre-grinding, which separates the husk particles that adhere to the seed kernels. The grits are cleaned from the husk on a vibrating sieve.

The grits obtained from the fat-free kernel, cleaned from the husk, are ground on a five-roll machine. If there is insufficient fat content in the grits, sunflower oil is added during grinding, so that the fat content in the resulting grated mass is 60-61 %. For maximum release from the husk, the grated sunflower mass is pumped by a pump with a gear pump and passed through a wiping machine with a diameter of sieve holes: the first – 1.5 mm, the second – 0.8 mm. The residual amount of husk in the grated mass should not exceed 1.4 %.

The finished grated mass is pumped by a pump into a collector with a stirrer, where it is stored at a temperature of 45-50 °C. The mass is constantly mixed to prevent its stratification.

To prepare a decoction of soap root, dry soap root is thoroughly washed with water from the earth and dust in a container and soaked in a container for 10-24 hours in clean hot water at a temperature of 60-80°C for softening.

Softened rootstocks are cut into pieces of 3-4 cm in size and no more than 1 cm in thickness on a root cutter. The sliced root is loaded into an open cooking pot, installed under the exhaust hood with an enhanced exhaust draft and boiled 3-4 times in fresh portions of water. The resulting extracts are combined in an intermediate collection. Finally, they are boiled in the digester to a density of 1040-1050 kg/m³. For the preparation of caramel syrup, a syrup-making unit is used, in which the mass is boiled under excessive pressure. The components of the recipe mixture for the preparation of caramel syrup (molasses, water) are dosed into the mixer with plunger pumps-dispensers from the collections, in the following order: molasses, water. The granulated sugar from the hopper is also loaded into the mixer using the chipboard dispenser. In it, the recipe mixture is heated to a temperature of 65-70 °C. From the
mixer, the recipe mixture in the form of a mush-like mass with humidity of 17-20% is dosed into a coil cooker, where the syrup is boiled to a humidity of 14-16%. Caramel syrup after filtration is fed to the collection. The caramel mass is obtained in a coil vacuum device of continuous action. Caramel 36 syrup is boiled in a vacuum apparatus at a steam pressure of 0.5-0.6 MPa and a rarefaction of at least 80 kPa.

To obtain a whipped caramel mass, the boiler is heated before loading, then a portion of the caramel mass is loaded, a dose of a decoction of a foaming agent is added in an amount of up to 2% to the mass of the caramel mass and a stirrer is turned on. The duration of whipping is 15-20 minutes with a simultaneous loading of 100-150 kg of product and a rotation speed of the shaft with blades of 100 minutes caramel mass during whipping 105-115°C.

The kneading of halva is carried out in kneading machines. First, a portion of the grated mass is loaded into it at a temperature of 45-50°C. Then the additives (vanillin) are dosed. After that, a dose of whipped caramel mass is loaded from the boiler. All components are dosed according to the recipe. After turning on the kneading blade, the kneading is carried out continuously until the caramel threads are evenly drawn out. The finished halva mass is unloaded onto a conveyor that transfers it to molding and packaging.

3. Results

The rationale for the need to develop the technology for the enterprise is based on the necessary increase in the production capacity of halva plants to meet the needs of the population in confectionery products for the future 5-10 years [13-18]. Different types of raw materials used in confectionery production, according to their physical and chemical properties, require different temperature and humidity conditions during storage. Warehouses are divided: warehouse of basic raw materials; warehouse of fruit and berry raw materials; warehouse of flavoring and coloring substances; warehouse of perishable raw materials; molasses storage; warehouse of containers and packaging materials; warehouse of finished products; expedition. Therefore, when developing new products, it is necessary to take into account all the costs of the enterprise for production, including the efficiency calculation of using various types of raw materials, the cost of storage facilities [19-24].

The components of the halva recipe are used in the following ratio, mass %: sunflower seeds 40.08; molasses 30.93; granulated sugar 16.4; texture of extruded oats 11.72; decoction of soap root 0.84; vanillin 0.03 (table 1).

| Component                  | The composition of the prototype (control version) | The declared limit (new recipe) |
|----------------------------|---------------------------------------------------|---------------------------------|
| Sunflower seeds            | 51.8                                              | 40.08                           |
| Molasses                   | 30.93                                             | 30.93                           |
| Granulated sugar           | 16.4                                              | 16.4                            |
| Extruded Wheat Grain       | -                                                 | 11.72                           |
| Texturature                |                                                   |                                 |
| Decoction of soap root     | 0.84                                              | 0.84                            |
| Vanillin                   | 0.03                                              | 0.03                            |

The presence of texturates from extruded wheat grain increases the biological value of the finished product by enriching it with B vitamins, which are necessary for the normal functioning of the entire nervous system. The biological value of halva also increases due to the content of micro- and macroelements, especially silicon, which is necessary for the body to form and maintain the structure of connective tissue. Increasing the organoleptic properties and biological value of halva is achieved by increasing the content of vitamins, micro- and macronutrients, reducing fat and introducing texturate from wheat grain, which improves the taste and aroma of products [25-27].
From the table 1 we can see, halva made according to the developed recipe has a sweet taste, the texture is well balanced with other components.

Based on the presented data on the value of the components in the composition of the product production recipe (table 1), we will calculate the production costs for the control version and the proposed recipe using texturate from extruded wheat grain, the cost of which is calculated in the works of the author [28]. The cost of production is calculated according to the calculation items for the entire volume of production and is presented in table 2.

**Table 2.** Calculation of the total production cost, thousand rubles.

| Calculation articles                      | The composition of the prototype | The declared limit |
|------------------------------------------|---------------------------------|--------------------|
| Main and additional raw materials        | 69043.88                        | 65203.40           |
| Container and packaging materials        | 3916.53                         | 3916.53            |
| Fuel and electricity for technological needs | 712.93                        | 712.93             |
| Salary fund                              | 40606.57                        | 40606.57           |
| Contributions to social funds            | 12181.97                        | 12181.97           |
| Depreciation and amortization            | 3202.96                         | 3202.96            |
| Routine repairs and maintenance          | 2232.66                         | 2232.66            |
| General expenses                         | 19784.63                        | 19208.55           |
| Other operating expenses                 | 1714.67                         | 1664.74            |
| Production cost                          | 153396.80                       | 148930.32          |
| Non-production expenses                  | 30679.36                        | 29786.06           |
| Total cost of commercial products        | 184076.15                       | 178716.38          |

Analyzing the data in table 2, we note that the total cost of halva with texturate from wheat grain raw materials amounted to 178716.38 thousand rubles and in comparison with the control sample is lower by 2.9 %, due to a reduction in raw material costs by 5.6 %.

To assess the economic efficiency of the developed recipe for the production of halva, it is necessary to consider the production and economic indicators for the control and proposed options (table 3).

**Table 3.** The main technical and economic indicators for the production of products (halva).

| Indicator                                      | The composition of the prototype (control version) | The declared limit (new recipe) |
|-----------------------------------------------|--------------------------------------------------|-------------------------------|
| Production output, t / year                   | 703.8                                            | 703.8                         |
| Volume of commercial products, thousand rubles| 235090.3                                         | 235090.3                      |
| Total cost of commercial products thousand rubles | 184076.15                                    | 178716.38                      |
| Cost of 1 ton of products, thousand rubles    | 261.55                                           | 253.93                        |
| The costs for 1 ruble of commercial products, rubles | 0.78                                         | 0.76                           |
| Profit from products sales, thousand rubles   | 51014.15                                         | 56373.92                      |
| Product profitability, %                      | 27.71                                            | 31.54                         |
| Capital investments, thousand rubles          | 107601                                           | 107601                        |
| Payback period of capital investments, years  | 2.11                                             | 1.91                          |

When producing products in the amount of 703.8 tons / year, the profit from sales when using the new recipe will be 56373 thousand rubles which is higher by 10.5 % compared to the control version, the profitability level of products using texturate from extruded wheat grain will be 31.51 %. The invested funds in this project will amount to 107,601 thousand rubles, which will be fully paid off within 1.9 years.
4. Conclusion
The issues of the producing confectionery products efficiency with increased organoleptic properties and reduced energy value due to the introduction of developed technologies for the production of texturates from wheat grain, by partially replacing sunflower seeds were considered. It was found that the introducing a texture of extruded wheat grain into the recipe of halva as a grated mass increases the organoleptic characteristics of the product. Calculations of the production efficiency for confectionery products (halva) showed that the introduction of halva into the recipe reduces the caloric content of the finished product and increases the amount of B vitamins.

The production cost of products according to the new recipe will be reduced by 5359.8 thousand rubles due to a reduction in the cost of basic raw materials by 5.6 %. The cost of 1 ton of products will be 253.93 thousand rubles, which is lower than the control version by 2.9%. The profit from the sale of products will increase by 10.5 %, and the profitability of the producing halva with the addition of textured extruded wheat grain will be 31.54 %, which is higher by 3.8 % compared to the control version.

Thus, the new technology of confectionery production, developed in the course of scientific research, helps the use of new raw materials for the production of halva with increased organoleptic properties and reduced energy value, and to increase the economic efficiency of its production.

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