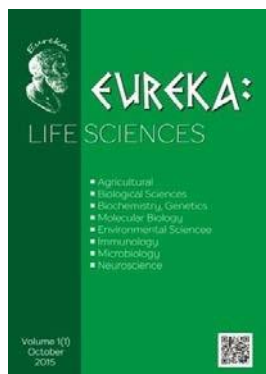


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IMPROVED METHOD OF BREWING PEANUT MOUTH WITH BLENDING FRUIT DRINK OF A HIGH DEGREE OF READINESS

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Abstract

The method of production of peanut paste with blended fruit and vegetable semi-finished products of high degree of readiness based on Jerusalem artichoke and cranberry obtained under conditions of low-temperature concentration has been improved. The production method is characterized by the process of concentration in a rotary-film apparatus at a temperature of 45...50 °C to a content of 28...30 % of dry substances within 1.75...2.00 minutes. The organoleptic evaluation of various recipe ratios of the selected raw materials revealed its optimal content in the semi-finished product (Jerusalem artichoke 65 %, cranberry 35 %), which has a uniform structure, a pleasant aroma of cranberry and Jerusalem artichoke, and its color is red-orange. The obtained fruit and vegetable semi-finished product of a high degree of readiness can be used as a base or additive in various food products of special purpose to increase their nutritional value and provide the products with a health-improving effect.

For the production of health-prophylactic peanut paste, a technological manufacturing scheme is proposed with the addition of Jerusalem artichoke and cranberry fruit and vegetable paste to its composition, which will further increase the health-prophylactic properties of the finished product, eliminate the use of sugar and other synthetic stabilizers in comparison with classical technology. The organoleptic evaluation of the received samples of peanut paste with blended fruit and vegetable semi-finished product of a high degree of readiness revealed a rational amount of the semi-finished product at the level of 25 %, while the product has a structured, homogeneous consistency and a pleasant yellow-orange color. The obtained product can be recommended for therapeutic and preventive purposes, as a cholesterol-lowering and immunomodulating agent.

Keywords: peanut paste, fruit and vegetable semi-finished product, Jerusalem artichoke, cranberry, functional physiological ingredients, concentration.

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1. Introduction

The ecological situation of European countries requires the formation of rational consumption of food products in consumers to strengthen immunity, thus making it necessary to inform the population about the feasibility of using natural nutrients with increased nutritional value [1]. Therefore, it is the provision of rational nutrition that is a necessary component of the food industry in the form of providing consumers with the most natural products, including those based on semi-finished products of a high degree of readiness with physiological ingredients [2].

For example, peanuts are one of the most consumed oilseeds in the world, used raw, cooked, butter, paste (snacks), in energy bars and candies, and added to paste in snacks. Peanuts and peanut products have positive effects on human health due to their nutrients (lipid profiles) and bioactive compounds such as phytosterols, phenolic compounds, stilbenes, lignans and isoflavonoids. These ingredients protect against cardiovascular disease, type 2 diabetes and cancer. In particular, in the dietary model of dietary approaches “Stop Hypertension”, the consumption of peanuts is recommended 4–5 times a week. In addition, peanuts are part of traditional Mediterranean diets, and their daily consumption is recommended [3]. Peanuts are also rich in water-soluble and oil-soluble trace elements [4]. Peanuts contain large amounts of B vitamins (thiamine, riboflavin, niacin, folic acid, and vitamin B6), vitamin E, and fiber, and they do not contain cholesterol [3].

The use of natural raw materials as a source of therapeutic and preventive nutrients due to blending increases the nutritional value, minimizes the synthetic component in food recipes and forms original organoleptic and structural properties during blending [4, 5]. It should be noted that the maximum preservation of natural nutrients is possible when using resource-efficient technologies based on low-temperature processing. In particular, the improvement of methods of production of semi-finished products of a high degree of readiness due to the blending of fruit and berry raw materials ensures the production of a competitive assortment of health products [6], especially in conditions of low-temperature processing during various technological operations [7]. Blanching and concentration of natural raw materials deserve special attention, especially when processing multi-component blended fruit and berry semi-finished products, since each raw material is characterized by its own processing feature, neglecting which will lead to the destruction of natural nutrients [8].

Peanut paste is a protein spread popular around the world that is made from roasted peanuts by grinding them into a homogenous mass that contains significant amounts of beneficial nutrients and nutrients that can provide health benefits. However, it is important to check the ingredients on the label when buying peanut butter. Today, many brands, especially foreign manufacturers, add ingredients such as sugar, vegetable oil and trans fats, which significantly reduce the nutritional value of the product. The production of natural peanut paste without various emulsifiers and synthetic ingredients, sugar and palm oil will allow to get a high-quality multifunctional health product, which will be characterized by the content of vitamins E, B6, ingredients: niacin, manganese, magnesium, etc. With a variety of minerals, it helps support bone health, immune function, and blood vessels. Eating peanut paste due to its high copper content reduces the risk of developing osteoporosis and heart disease. Peanut paste is a source of nutrients and energy that may provide potential benefits to human health. Numerous studies prove that eating peanuts every day can reduce the overall risk of death by up to 21 % – and reduces the number of heart diseases by 38 % [9].

The aim of research is to improve the method of production of peanut paste with mixed fruit and berry semi-finished product of high degree of readiness based on Jerusalem artichoke and cranberry. Peanut paste is a natural source of useful substances, including phytosterols. It is known that free phytosterols have a cholesterol-lowering effect, for example, the use of 0.7...1.0 g of phytosterols per day leads to a decrease in low-density lipoproteins by 5 %, 1.1...2.0 g – by 10...17 %. Also, the presence of phytosterols gives the products immunomodulating, anti-inflammatory, anti-diabetic, antioxidant and anti-cancer properties.

The introduction of mixed fruit and berry semi-finished products into the composition of peanut paste will additionally increase the preventive and health-promoting properties of the finished product, eliminate the use of sugar and other synthetic stabilizers in comparison with classical technology. Jerusalem artichoke is a natural source of various nutrients necessary for the

formation of a healthy diet, and cranberries, in addition to therapeutic and preventive properties, will provide original organoleptic properties. Peanut paste will increase competitive properties, can be used as a sweet product, and to taste with meat products due to the slight sourness of cranberries. In addition, peanut paste is used in a variety of confectionery, bakery and pasta products, ensuring the expansion of the range of health products [10].

In particular, the energy value of 100 g of Jerusalem artichoke is 57.3 kcal. Jerusalem artichoke tubers have a significant content of natural nutrients, including (per 100 g): protein 2 g, inulin 14–20 g, sugar substitute – fructose 2.56 g, phytosterols – 9.0 mg, vitamins (B1, B2, B3, B6, B9, C, RR), etc. [11]. Clinical studies have shown that inulin has pronounced prebiotic properties, is able to lower blood glucose parameters, regulate intestinal pH, ensuring full absorption of calcium. Resource-efficient processing of Jerusalem artichoke into high-quality semi-finished products will be characterized by a high content of nutrients that can act as independent products and recipe components in various food products [11].

Observational and clinical studies to determine the health effects of cranberry consumption are related to phytochemical content. Bioactive substances of cranberries differ from other berries due to A-type proanthocyanidin. Cranberry berries are a rich source of phenolic bioactive substances that can contribute to human health [12], in addition, they have original organoleptic properties.

To achieve the goal of improving the method of producing peanut paste with blended fruit and vegetable semi-finished products of a high degree of readiness based on Jerusalem artichoke and cranberry obtained under conditions of low-temperature concentration. This, in turn, preserves the natural potential of fruit and vegetable raw materials, forms the original organoleptic properties of peanut paste with a simultaneous increase in functional properties. By creating a competitive assortment of health products, for example, peanut paste without the traditional content of sugar, synthetic stabilizers and flavorings, which is relevant in today's conditions for the formation of a strong immune component of the population [13, 14].

2. Materials and methods of research

The research used the own raw material base of the Kharkiv region (2022), namely Jerusalem artichoke tubers of the “Volzhsky” variety, **Fig. 1, a**, and “Stevens” cranberry, **Fig. 1, b**.



Fig. 1. Appearance of fruit and berry raw materials: *a* – Jerusalem artichoke tubers of the “Volzhsky” variety; *b* – “Stevens” cranberry

For the production of blended semi-finished products with a high degree of readiness based on Jerusalem artichoke and cranberry, a schematic diagram was created with a display of the main technological operations (**Fig. 2**). According to the principle scheme for the production of blended semi-finished products of a high degree of readiness, raw fruit and vegetables are sent for washing and inspection. Jerusalem artichoke is pre-sliced with subsequent steam blanching (103...110 °C) for 3...6 min, and cranberries are blanched with water at a temperature of 85...95 °C for 1.0...2.0 min. After that, the raw material is rubbed to 0.25...0.5 10^{-3} m, followed by blending of the puree-like semi-finished product according to the proposed recipe ratio (**Table 1**), taking into account the structural-mechanical, nutrient and organoleptic properties.

Table 1

Recipe ratio of blended multi-component puree-like semi-finished products

| Recipe and component composition, % | Blend | | |
|-------------------------------------|-------|-----|-----|
| | A | B | C |
| Jerusalem artichoke | 55 | 65 | 75 |
| Cranberry | 45 | 35 | 25 |
| Control | 100 | 100 | 100 |

The homogeneous mixed puree-like mass is fed to the rotary-film apparatus [15] for concentration at a temperature of 45...50 °C to a content of 28...30 % of dry substances within 1.75...2.00 min. The resulting paste-like semi-finished product of a high degree is ready for further introduction into the peanut paste recipe, according to the principle technological scheme of production (**Fig. 3**). The use of low-temperature concentration ensures the preservation of natural nutrients in the fruit and vegetable semi-finished product with a high degree of readiness.

Organoleptic studies were carried out by an expert commission of 5 members of the State Biotechnological University. In relation to the conducted organoleptic evaluation, the semi-finished product with the best indicators (blended B) with a Jerusalem artichoke content of 65 % and cranberry content of 35 % was chosen for further experiments. The selected semi-finished product has a uniform structure, a pleasant aroma of cranberry and Jerusalem artichoke, and its color is red-orange.

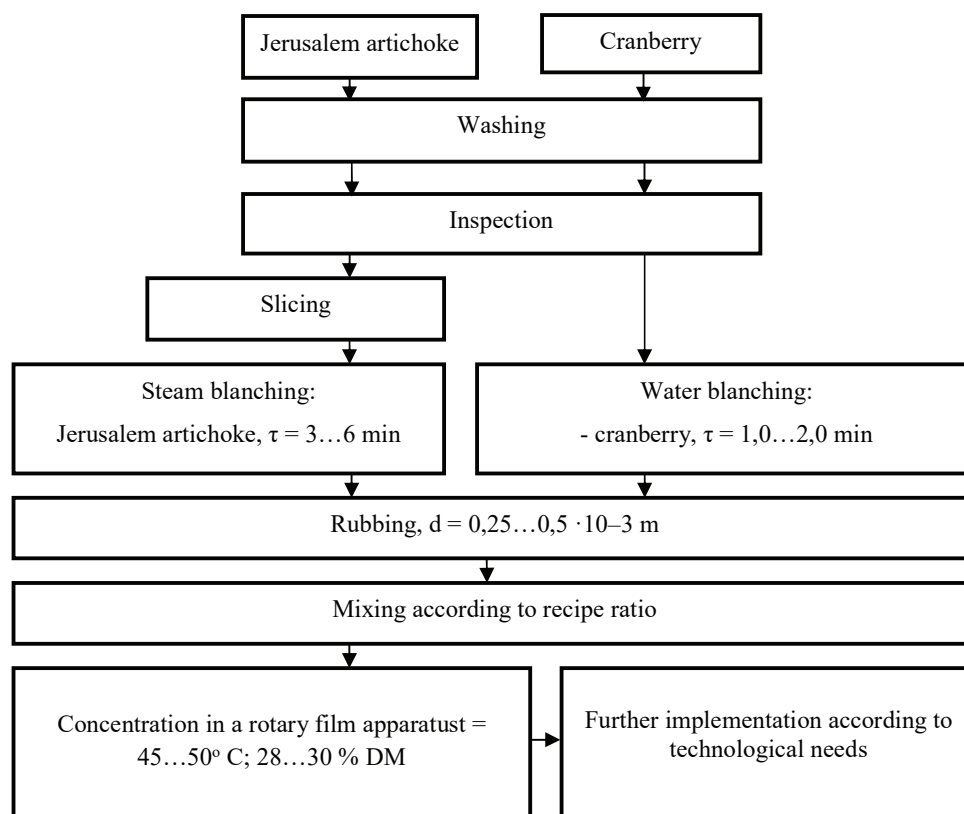


Fig. 2. Schematic diagram of the production of a blended semi-finished product with a high degree of readiness

3. Research results and their discussion

The traditional composition of peanut paste mostly includes: peanuts, sugar, milk powder, various structural and mechanical stabilizers and emulsifiers. Therefore, it is suggested to use only natural components for the production of health-prophylactic peanut paste: peanuts and mixed fruit and berry

paste. For the implementation of an improved method of production of peanut paste with mixed fruit and berry semi-finished plant raw materials, a schematic diagram is proposed (Fig. 3).

According to the proposed scheme, peanuts are pre-inspected, cleaned of husks and various pieces of shell by air blowing.

After that, the cleaned peanuts are roasted at a temperature of 110...130 °C for 25...35 minutes to a content of 10...14 % DM. It is the chosen temperature that allows to implement a gentle frying mode, since overestimating the temperature parameter will inevitably lead to overheating of the core, the formation of a bitter taste and a decrease in useful nutrients. After roasting, the peanuts are immediately air-cooled to 35...40 °C with subsequent fractional grinding according to particle size: 0.2...0.3·10⁻³ m.

After that, the mixing of crushed peanuts and blended semi-finished product of a high degree of readiness based on Jerusalem artichoke and cranberry is implemented. Blended fruit and vegetable paste was added in amounts of 15 and 25 %. After the mixture is uniform in consistency, it enters a two-stage homogenization with a pressure of 8×10⁶ Pa on the first stage and 4×10⁶ Pa on the second stage, preparing the peanut paste for packing. With further sale to consumers or use in various technological processes for the production of health food products.

In order to determine the organoleptic properties of the obtained peanut paste, depending on the recipe ratio, the organoleptic properties were determined (Table 2).

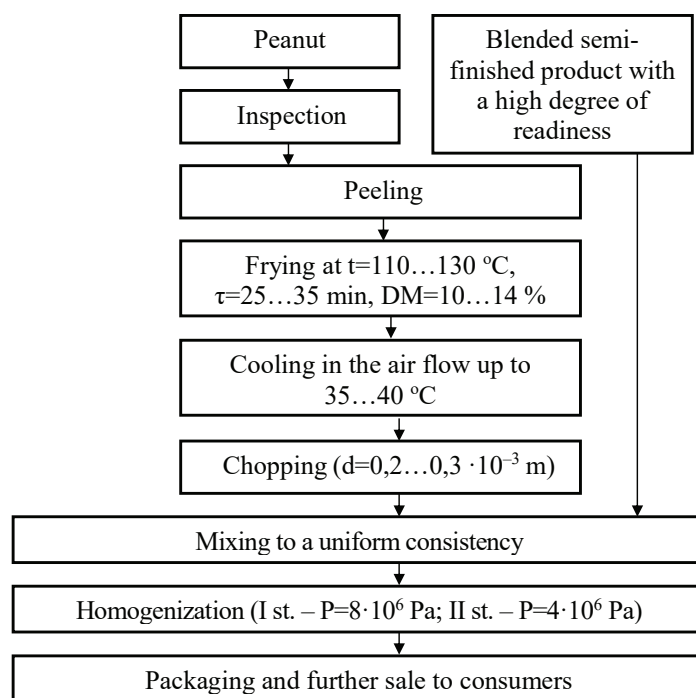


Fig. 3. Basic technological diagram of peanut paste with mixed fruit and berry semi-finished products of a high degree of readiness

Table 2

Comparative properties of organoleptic evaluation of peanut paste with mixed fruit and berry semi-finished products of a high degree of readiness

| Evaluation index | Peanut paste | Peanut paste with fruit blend | |
|------------------|---|---|---|
| | | 15 % | 25 % |
| Appearance | | Homogeneous thick mass | |
| Taste and smell | harmonious taste of peanut paste | Pleasant harmonious taste of Jerusalem artichoke with light notes | Pronounced smell and taste of Jerusalem artichoke and cranberry |
| Color | Inherent in peanuts | Light shade of yellow-orange | Pleasant yellow-orange |
| Consistence | Homogeneous viscous mass with a structured structure that does not spread | | |

Analyzing the organoleptic properties of the obtained samples of peanut paste with blended fruit and berry semi-finished products of a high degree of readiness confirms the provision of a structured homogeneous consistency to all test samples. But in terms of color and taste-aromatic indicators, the sample with 25 % of fruit and vegetable paste, a pleasant yellow-orange color and a pronounced smell and taste of Jerusalem artichoke and cranberry, has the advantage.

The limitation of the above research is the need to follow the method of making fruit and vegetable and peanut paste with further adherence to the recipe ratio of their mixing, as neglecting them will lead to changes in the quality of the obtained products as a whole.

4. Conclusions

A method of production of blended semi-finished product of high degree of readiness based on Jerusalem artichoke and cranberry, mixing useful substances in its composition, is proposed. The production method is characterized by a low-temperature concentration process in a rotary-film apparatus at a temperature of 45...50 °C to a content of 28...30 % of dry substances within 1.75...2.00 minutes. The organoleptic evaluation of various recipe ratios of the selected raw materials revealed its optimal content in the semi-finished product (Jerusalem artichoke 65 %, cranberry 35 %), which has a uniform structure, a pleasant aroma of cranberry and Jerusalem artichoke, and its color is red-orange. The obtained fruit and vegetable semi-finished product of a high degree of readiness can be used as a base or additive in various food products of special purpose to increase their nutritional value and provide the products with a health-improving effect.

For the production of health-prophylactic peanut paste, a technological manufacturing scheme is proposed with the addition of Jerusalem artichoke and cranberry fruit and vegetable paste to its composition, which will further increase the health-prophylactic properties of the finished product, eliminate the use of sugar and other synthetic stabilizers in comparison with classical technology. The organoleptic evaluation of the received samples of peanut paste with blended fruit and vegetable semi-finished product of a high degree of readiness revealed a rational amount of the semi-finished product at the level of 25 %, while the product has a structured, homogeneous consistency and a pleasant yellow-orange color. The obtained product can be recommended for therapeutic and preventive purposes, as a cholesterol-lowering and immunomodulating agent.

Conflict of interest

The authors declare that there is no conflict of interest in relation to this paper, as well as the published research results, including the financial aspects of conducting the research, obtaining and using its results, as well as any non-financial personal relationships.

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Data availability

Data will be made available on reasonable request.

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