Zephyr: original Russian confectionery product

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Abstract: Zephyr is one of the most favorite sweets in Russia: tender and airy. So, in 2017, the share of zephyr accounted for 23.5% in the segment of sugary confectionery products in Russia, which in physical terms amounted to 251.5 thousand tons. Its popularity among consumers is facilitated by the fact that natural fruit raw materials are used in the manufacture of zephyr. The modern industrial technology of zephyr is developed on the basis of folk recipes for pastila, which was made from apples and honey as a way of preserving apples. Zephyr is a pastila type confectionery of a foamy structure, the mass fraction of fruit raw materials in which is not less than 11%, the density is not more than 0.6 g / cm^3. The use of a large amount of fruit raw materials in zephyr increases the nutritional value and enriches it with macro- and micronutrients. Pectin gives additional beneficial properties to zephyr, since it is able to bind heavy metals and radionuclides. The mass fraction of pectin in zephyr is in the range from 3% to 9%, which turns zephyr into a source of dietary fiber. To preserve the unique Russian dessert, the Research Institute of the Confectionery Industry has developed a method for determining the mass fraction of fruit raw materials in pastila products based on

the ratio of the mass fraction of organic acids and macronutrients, the values of which are determined using the method of capillary electrophoresis. 34 samples of zephyr presented in the retail chains of the Russian Federation were studied for compliance with the requirements of the state standard for the content of fruit raw materials. High content of fruit raw materials from 11 to 60% was confirmed for most samples.

Keywords: confectionery, zephyr, pastila, fruit raw materials, macronutrients, organic acids, capillary electrophoresis, pectin.

Introduction: Zephyr is a traditional Russian popular confectionery. Only apples that grow in certain regions of central Russia, characterized by a relatively high content of malic acid (more than 0.5 - 0.8%) are used in the manufacture of classic zephyr and pastila. It is this component that determine the characteristic and unique taste, smell and structure of zephyr.

Delicate and fluffy zephyr is one of the most popular confectionery products in Russia and in nearby countries such as Belarus, Ukraine and Kazakhstan. The share of zephyr in Russia in the segment of sugary confectionery accounted for 23.5% in 2017, which in physical terms was 251.5 thousand tons [1]. Its popularity among consumers is facilitated by the use of raw fruit materials in the manufacture of zephyr [2].

The progenitor of zephyr is pastila. They belong to the group of pastila type confectionery. The first mention of Russian pastila dates back to the 14th century. It was the villagers' way of preserving apples and was made from Antonov apples and honey (Figure 1).

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Figure 1 – Homemade pastila

In the 15th century, housewives began to add egg whites to pastila to improve the appearance [3].

In the 19th century, the Tula merchant Ambrose Prokhorov introduced the Belovskaya pastila to the whole world (Figure 2). He opened "Plant of canned vegetables" on Ulanova Gora in the Tula region in 1888, where the production of apple pastila was put on stream. Honey was replaced by sugar, and apples were used from Prokhorov's vast personal apple orchards.

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Figure 2 – Belovskaya pastila

Heat-treated apples were used for the manufacture of Belovskaya pastila and a steam locomotive furnace was adapted for drying [4]. Four trenches twenty steps long each ended with an improvised stove. Trees were laid in the trenches, the ends of which burned in the furnace. After heat treatment, the apples were crushed in puree, mixed with sugar and protein, and left to dry. By the beginning of the 20th century, Belovskaya pastila was known all over the world: it was sold in Warsaw, Riga, USA and etc [5, 6].

The modern industrial technology of pastila was developed in the Soviet years; it differed from Belovskaya in that the recipe used apple puree instead of baked apples (Figure 3).

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Figure 3 – Industrial pastila

Later, based on the recipe for industrial pastila, zephyr was developed, the classic shape of which is a hemisphere with a characteristic ribbed pattern (Figure 4).

Figure 4 – Zephyr

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Zephyr is a pastila type confectionery of a foamy structure, the mass fraction of fruit raw materials in which is not less than 11%, the density is not more than 0.6 g / cm^3 [7]. The weight of one product is 30-50 g.

Under the conditions of the socialist way of management, enterprises produced zephyr and pastila according to four developed unified recipes [8]. The recipe included sugar, molasses, fruit puree (mainly apple), egg white, jelly forming agent, citric or lactic acid and flavors. The mass fraction of apple puree in the products was 18-30%.

The popularity of zephyr led to the development of new recipes, and the collection of standardized recipes in 1974 already included 34 recipes [9].

According to modern technology, zephyr is prepared by whipping fruit puree with sugar and egg whites. Hot agar-sugar syrup is used to fix the finely porous foamy structure. Other gelling agents are also used, for example, obtained from plant sources pectin [10, 11]. Zephyr is molded by jigging in the form of separate hemispherical or oblong halves with a relief pattern on the surface. Then it is dried in the workshop for 3-4 hours and in drying chambers for another 5-6 hours. After that, the zephyr halves are sprinkled with powdered sugar and glued together with flat surfaces [12]. Zephyr is also produced glazed with chocolate or confectionery glaze (Figure 5).

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Figure 5 – Zephyr glazed with chocolate glaze

The whipped structure of the zephyr makes it similar in appearance to the popular in many countries marshmallow [13, 14]. However, the fundamental difference between these types of confectionery is that zephyr, unlike marshmallow, is made using fruit raw materials.

According to the traditional Russian recipe zephyr contains a large amount of fruit raw materials, which increases its nutritional value and enriches it with macro- and micronutrients. The mass fraction of pectin in zephyr is in the range from 3% to 9%, which turns zephyr into a source of dietary fiber. Among other things, pectin gives zephyr additional beneficial properties, since it is able to bind heavy metals and radionuclides, increase the absorption of magnesium and calcium, bind bile acids, etc. [15, 16, 17, 18, 19]

Zephyr and pastila are popular in Russia and nearby countries such as Belarus, Ukraine, Kazakhstan and others (Figure 6).

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Figure 6 – Zephyr production: A) Belarus, B) Ukraine

The transition to a market economy has stimulated the development of their own unique recipes by enterprises based on classical technology and the expansion of the range of zephyrs. New types of zephyrs have appeared with the addition of various berries and fruits, for example, black currants, cranberries, strawberries, as well as zephyrs with fillings (Figure 7) [20].

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Figure 7 – Zephyr with the addition of: A – cranberry, B – cherry, C – black currant, D – orange, E – apricot, F – strawberry filling.

Apple puree is the most common type of fruit raw material in Russia and, despite the variety of additives, it is mainly used in the recipes of all pastila type confectionery. In order to preserve the unique Russian dessert and prevent a decrease in the content of fruit puree, the content of the fruit part has been regulated as the main identification feature of zephyr since 2009. In 2014, the Research Institute of the Confectionery Industry developed the interstate standard GOST 6441-2014 “Pastila type confectionery. General specifications", which regulates the content of the mass fraction of fruit raw materials for pastila at least 20%, and for zephyr at least 11%.

At the same time, the employees of the Scientific Research Institute of the Confectionery Industry developed a methodological basis for the analytical

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determination of this indicator. The method for determining fruit raw materials is based on the determination of organic acids and macronutrients by capillary electrophoresis and subsequent calculation based on their characteristic ratio in fruit raw materials. This technique allows you to determine the actual content of fruit raw materials in zephyr and evaluate the compliance of zephyr with identification characteristics.

Methods: Objects of research - 34 samples of zephyr, purchased in the trade network.

The determination of the mass fraction of organic acids was carried out in accordance with the state standard GOST 34123.1-2017 “Confectionery. Methods for determination of mass fraction of fruit and vegetable raw materials. Part 1. Determination of organic acids the mass fraction”, the mass fraction of macronutrients was determined in accordance with the state standard GOST 34414-2018 “Confectionery. Methods for determination of mass fraction of fruit raw materials. Part 2. Determination of the presence of macroelements".

Sample preparation included the preparation of aqueous solutions of samples, extraction of the analyte from an aqueous solution in an ultrasonic bath, filtration of the obtained extract and centrifugation.

The content of organic acids and macronutrients was determined by capillary electrophoresis method, which consists in separating the components of a complex mixture in a quartz capillary in an electroosmotic flow under the action of an applied electric field.

The calculation of the content of fruit raw materials in zephyr was carried out in accordance with the "Method for determination of mass fraction of fruit raw materials in confectioneries" MVI 36-00334675-2013 (in terms of apple puree), developed at the Research Institute of the Confectionery Industry. This technique was tested on various samples of marmalade and allowed them to be successfully identified in accordance with the requirements of the state standard GOST R 53041-2008 “Confectionery and half-finished products of confectionery manufacture. Terms and definitions” [21, 22].

Results and discussions: The mass fraction of fruit raw materials in confectionery products was calculated according to the method [23] by the formula:

$$M_{Apple\ puree} = 174{,}4 \cdot W_o + 0{,}12 \cdot W_m,$$

W_o- Mass fraction of organic acids in the product, %;

W_m - Mass fraction of macronutrients in the product, % × 10^{-3};

174.4 - Constant of the criterion for the mass fraction of organic acids;

0.12 - Constant of the criterion for the mass fraction of macronutrients.

Conducted a study of the mass fraction of fruit raw materials in 34 samples of zephyr presented in the trade network of the Russian Federation (Figure 8).

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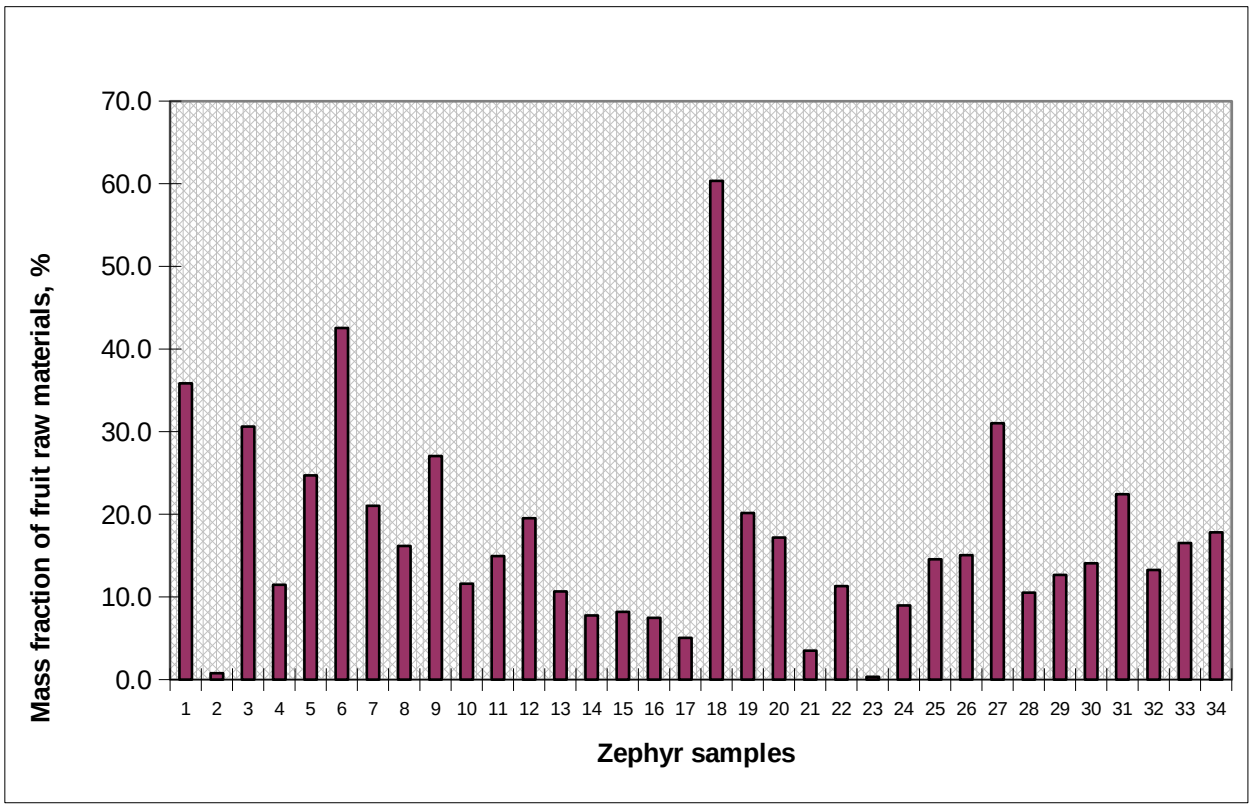

Figure 8 – Mass fraction of fruit raw materials in zephyr samples

Studies have confirmed a high content of fruit raw materials from 11 to 60% for most samples. At the same time, the content of fruit raw materials was found to be less than 11% for some of the investigated products, which does not meet the requirements of regulatory documents [7]. To eliminate this discrepancy, a more thorough control of the original fruit raw material is required.

Conclusions: Zephyr, made according to the traditional Russian recipe, contains up to 60% of fruit raw materials, which increases its nutritional value, enriches it with essential macro- and micronutrients. The fruit part content is regulated as the main identification marker of zephyr in accordance with the interstate standard GOST 6441-2014 developed at the Research Institute of the Confectionery Industry in 2014. The study of the mass fraction of fruit raw materials in 34 samples of zephyr, presented in the trade network of the Russian

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Federation, confirmed the high content of fruit raw materials from 11 to 60% for most samples. The mass fraction of pectin substances in zephyr is in the range from 3% to 9%, whereby it has additional beneficial properties and is a source of dietary fiber. The zephyr recipe mainly uses apple puree as a fruit component, which is the most common type of fruit raw material in Russia. New types of zephyr have appeared on the confectionery market with the addition of various berries and fruits, for example, black currants, cranberries, strawberries, as well as filled zephyr and zephyr glazed with chocolate glaze.

Declarations:

Availability of data and materials:

All data and materials are available and presented in the manuscript.

Competing interests:

The authors declare that they have no competing interests.

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