

Developing the Technology of Fruit Chips for Dietary Nutrition

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Abstract--- *Fruit chips are an alternative to potato chips and are becoming increasingly popular in human diet. In this paper, a review of the scientific works on the preparation of fruit chips from apples, bananas, pears, peaches and persimmons is conducted. The recipe for making fruit chips from apples and banana with cinnamon and sesame is developed. The technological scheme of preparation and organoleptic evaluation of chips are described. The main useful properties of developed fruit chips are highlighted.*

Key words--- *chips, fruit, apple, banana, recipe, cinnamon, sesame*

I. INTRODUCTION

In food commodity science, chips mean thin slices having a crispy texture. Chips made from potato by deep-frying slices were the first product that is now called snack [1]. Recently, in many countries, fruit and vegetable chips have become increasingly popular. The technology for making fruit chips is different from the technology for traditional potato chips. However, there are some side effect of potato chips consumption for human health: The harm of potato chips is caused by several factors:

- When heated to 160°C, the beneficial fatty acids contained in sunflower oil decompose to form of carcinogenic compounds;
- Potato starch decomposes during frying, and this lead to form acrylamide, a toxin that has a detrimental effect on visual acuity, liver, kidney and nervous system;
- A flavor enhancer, sodium glutamate, is added to the product;
- The salt content in the chips much more than in the usual dishes. Salt has the ability to retain water in the body, which leads to swelling, and increases the secretion of gastric juice. Since the stomach receives dry, completely devoid of vitamins, but high-calorie chips, this increases the likelihood of irritation of the mucous membrane;
- 100g of chips contain 30% of fat, which is equal to two tablespoons [2].

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Fruit chips are dried thin, crunchy, and brittle fruit slices. Apple, pear, pineapple, banana and other types of fruit chips are made [3]. The production of fruit chips is a new direction in the food industry in Kazakhstan. Fruit chips are made from slices of apples, pears, peaches, bananas, oranges, kiwi. Pear chips are prepared using innovative technology that eliminates the use of preservatives and retain all the beneficial properties of fresh fruits. These chips do not contain cholesterol and carcinogens, since they are not fried in oil. They are sweet due to the content of fructose in the fruit. Fruit chips are a good alternative to potato chips. The fruit chips production method is based on slices drying process, but not frying process. For the production of chips, various flavors of sesame, cinnamon, ginger, anise and nuts can be used [4].

Nowadays, scientists are developing recipes and technologies for various types of fruit chips, the range of which is constantly expanding. Nikitenko et al. (2010) developed a method for producing apple chips. It includes slicing raw materials, blanching in a solution containing sucrose, citric and ascorbic acids, and then drying process. This method is different in that the apples are cut into slices or circles with a thickness of 1.5-2.0 mm, blanching is carried out at a temperature of 70-75 °C for 3-5 minutes in a solution containing 35-40 wt. % sucrose, 1.0-1.5 wt. % citric acid and 0.5-1.0 wt. % ascorbic acid, drying is carried out at 50-70 °C for 20-25 minutes, and then at 90-120 °C until the moisture content in the product is less than 8% [5].

II. TECHNOLOGY OF FRUIT CHIPS

A method has been developed for the production of fruit chips from the fruits of red-fleshy apple hybrids. The manufacturing process includes: washing, kernel removal, cutting into slices. The thickness of the slices was 2.5-2.6 mm. Then the slices were dried at 65 °C for 50-120 min, depending on the variety. The fruits were not treated with antioxidant solutions to establish oxidation stability and preserve the natural color [6].

Dobrolovich et al. (2015) developed a method of producing chips from fruit puree. For the manufacture of used apple and banana puree. A mixture was obtained from the ingredients, which was thoroughly mixed, placed on a flat shape and dried in a freeze-drying oven at a temperature of 99 °C and a pressure of 0.033 bar. The quality of products is determined on the basis of organoleptic and physico-chemical indicators [7].

A method for producing pear chips involves inspecting raw materials, sorting, washing, cutting raw materials into slices, and combined radiation convective drying. Combined radiation-convective drying is carried out by infrared rays with a wavelength in the range of 1.16-1.65 μm and a heat flux density of 2.69-5.44 kW/m^2 and convective air blowing with a temperature of 298 K in four time stages. At the first stage, the pears are cut into 1.5 mm thick slices and heated by infrared rays to a temperature of 310 K while blowing air at a speed of 1.7 m/s for 7 minutes. At the second stage, they are heated to a temperature of 320 K at an air flow rate of 1.5 m/s for 8 minutes. In the third stage, it is heated to a temperature of 330 K at an air flow rate of 1.2 m/s for 15 minutes. In the fourth stage, it is heated to a temperature of 340 K at an air flow rate of 0.8 m/s for 15 minutes. Then, dried to a final moisture content of 7-8%, pear slices are dipped in syrup with various flavors [8].

Scientists from Voronezh State Technology Academy developed the method for the production of peach chips. It includes inspection of raw materials, sorting, washing, cutting into slices 1.5 mm thick and radiation-convection drying. In this case, the drying is carried out by infrared rays with a wavelength in the range of 1.16-1.65 μm and a heat flux density of 2.69-5.44 kW/m^2 and convective air blowing with an initial temperature of 293 K in

four time stages. Dried to a final moisture content of 7-8% peach wedges are dipped in sugar syrup with flavoring [9].

Another method for the production of chips is using persimmons. Such method includes inspection of raw materials, sorting, washing, cutting and combined radiation-convective drying with infrared rays with a wavelength in the range from 1.16 to 1.65 μm and a heat flux density of 2.69-5.44 kW/m^2 and convective air blowing with a temperature 291 K in three time steps. At the first stage, persimmons are cut into slices 1.5 mm thick and heated by infrared rays to a temperature of 321 K, while simultaneously blowing with an air stream at a speed of 1.5 m/s for 18 minutes. In the second stage, up to a temperature of 330 K at an air flow rate of 1.0 m/s for 22 minutes In the third stage, up to a temperature of 335 K at an air flow rate of 0.5 m/s for 20 minutes. Dried persimmon slices with a moisture content of 7-8% are poured into the sugar syrup with flavorings [10].

The analysis of scientific and technical information shows that a significant number of publications are devoted to the technology for the production of chips fried in oil. The above mentioned information identified the need to develop a technology for the production of fruit chips with vitamin and mineral supplements with appropriate methods and modes of preparation of ingredients.

The aim of the research work was the development of technology of fruit chips from various fruits.

After conducting theoretical research and analysis of scientific and technical literature, the formulation of fruit chips was developed (Table 1).

Table 1: Fruit chips recipe

Ingredient	Weight, kg
Apple	48,5
Banana	48,5
Cinnamon	1,0
Sesame	2,0
Total	100

The main beneficial properties and chemical composition of cinnamon and sesame are highlighted. Cinnamon stabilizes the digestive tract, removes cholesterol from the blood and lowers sugar. It has antiseptic and anti-inflammatory properties, and enhances the protective function in the body. Cinnamon contains vitamins A, B, C, E, PP, macro and microelements: potassium, sodium, zinc, phosphorus, copper, iron, calcium, magnesium [11].

The main property of sesame seed is its ability to activate the liver enzymes, polyphenols lower the concentration of cholesterol in the blood. The use of sesame seeds in human diet reduces the likelihood of cardiovascular disease. Sesame can prevent anemia because it contains almost all vitamins of B group and copper. Fiber and vitamin PP contribute to better digestion of food. It contains vitamins and macro- and microelements such as A, PP, E and group B, calcium, iron, potassium, magnesium, phosphorus, dietary fiber, fatty acids, phytin, sesamine, phytosterol, polyphenol [12].



A) fruit chips before drying



B) fruit chips after drying

Figure1: Fruit chips before and after drying

The technological scheme for the production of fruit chips is presented in Figure 2.

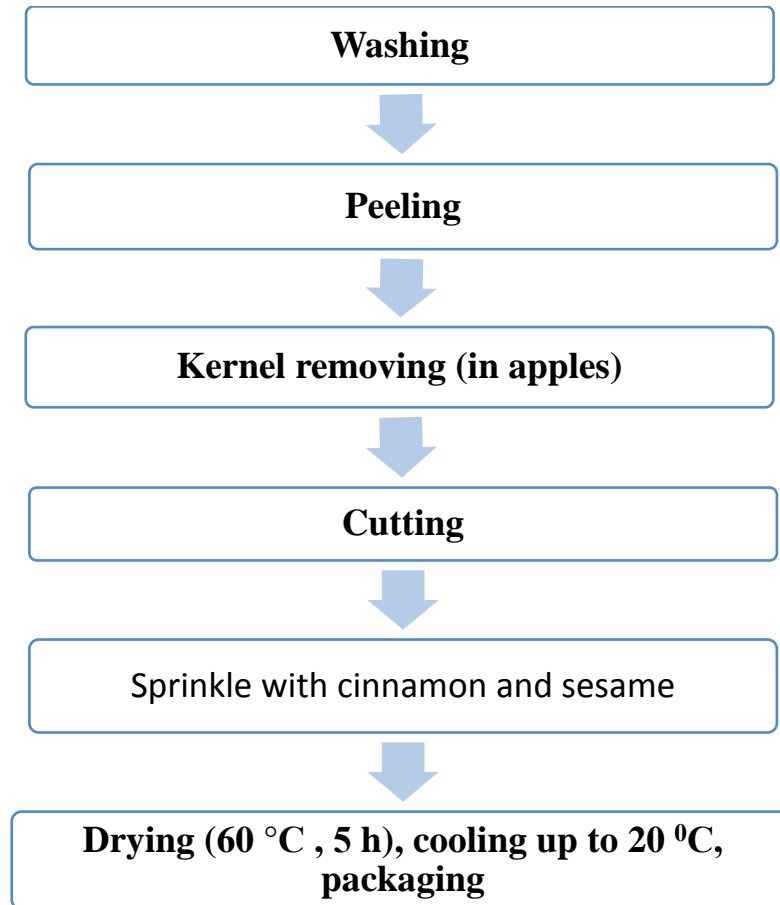


Figure 2: Fruit chips production process line

The quality indicators of fruit chips were investigated. The finished product had an attractive appearance, pleasant taste and texture.

III. CONCLUSION

So, developed fruit chips are a fully ready-to-use product for a quick snack. Compared to potato chips, fruit chips have a number of advantages that distinguish the product among similar ones. For example, fruit chips do not contain harmful preservatives and food colorants. Moreover, there are no carcinogens formed in the process of roasting with vegetable oil, as this method of processing is not used in the preparation of fruit chips. At the same time, eating this kind of snack is guaranteed to benefit the body:- in products all vitamins, minerals and the microcells necessary for a harmonious current of exchange processes are preserved; vegetable fiber helps to normalize the work of the gastrointestinal tract; developed fruit chips have low caloric value; carbohydrates fill the body with energy for the whole day.

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