Study on the biochemical indicators of carrot varieties and their scientific and practical importance in the preparation of juice in industry

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Abstract. In this article, agrobiological characteristics of local and foreign carrot varieties, their chemical composition, the method and recipes of juice preparation, the importance of homogenized and non-homogenized methods in juice extraction, the determination of tannin in the raw materials using a 3% iron (III) chloride solution, and its industrial importance in the preparation of various juices, information on the determination of total carbohydrate and acid content of juice using refractometer and saccharometer and pH meter equipment is given. Also, scientific and practical results and conclusions on the technological scheme and technology of preparation of "Parkhezbop", "Popular", "For children" with addition of special ingredients (ginger, natural honey, lemon juice) are described.

1. Introduction

In recent years, people's diet has changed radically, and the amount of natural and medicinal products in their diet has decreased. They are being replaced by artificially prepared and chemically synthesized products. As a result, obesity, atherosclerosis, diabetes, hypertension, heart attack, stroke and other such diseases of civilization are increasing due to consumption of emotionally satisfying and semi-manufactured foods in all countries, including our republic. To eliminate these factors, to ensure health and longevity, it is important to feed the cells of the body with natural products, and more than 600 substances necessary for the human body should be filled with natural food products, including vegetable products. Fruit and vegetable products are important due to the presence of irreplaceable amino acids, protein, pectin substances, nitrogenous compounds, mineral substances, organic acids, tannin and vitamins [1]. Vitamins and minerals important for the human body are mainly found in natural fruit and vegetable products, which are consumed directly and in the form of processed products for daily needs [11, 15]. According to medical standards, 1500 mg of phosphorus, 5000 mg of potassium, 1000 mg of calcium, 7000 mg of chlorides and 2,5 mg of vitamin A, 2,0 mg of thiamine, 3,0 mg of riboflavin and pyridoxine, 70 mg of ascorbic acid, 20 mg of tocopherol, 26 mg of rutin, and 25 mg of oxacin are present in natural fruit and vegetable products and are important in strengthening the human body [6, 9]. Especially in young children and adolescents, the need for such important substances and vitamins are high. Natural juices made from carrot roots have important scientific and practical value in meeting these demands and needs. According to the medical standard, it is established that 113 kg of vegetables per capita should be consumed per year, including 20 kg of cabbage, 26 kg of tomatoes, 18 kg of carrots, 18 kg of onions, 6-8 kg of cucumbers and other types of vegetables. In order to grow vegetable crops rich in natural vitamins in different periods, it is necessary to implement measures that ensure their biological characteristics and ecological purity during cultivation [3]. Carrot root contains 15-16 mg of protein, 65-80 mg of sugar, 0.2-0.3 mg of iodine, 0.2-0.4 mg of potassium, magnesium, phosphorus and iron, as well as 80-100 mg of ascorbic acid, 90-120 mg of provitamin. Due to the presence of elements such as 0.8-1 mg of thiamine, 0.6-1 mg of tocopherol, they are important in strengthening human health.

Carrots are grown on 149.1 thousand hectares in the regions of our republic, and 3.1 million tons are harvested. 35-40% of these products are grown in the early period and use for direct consumption. The remaining 60-65% of products is used for storage, and the remaining parts are used for canning and drying in processing industries. The adoption of the Decision of the President of the Republic of Uzbekistan "On additional measures for deep processing of agricultural products and further development of the food industry" on the issues of processing of fruit and

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vegetable products shows that it is an urgent issue. In order to ensure the fulfillment of the priority tasks defined in this Resolution, in 2022-2023, in a number of farms in Chortoq district of Namangan region and in the scientific laboratory of Namangan Institute of Engineering and Technology "Scientific-Research Diagnostic Center" in accordance with the program on agrobiological characteristics, chemical composition and processing of carrot root. A number of scientific research works were carried out.

2. Methods

In the course of the research, a number of local varieties "Kizil Mirzoyi", "Sarik Mirzoyi" and more than 10 promising carrots from Russia, Ukraine, Germany, "Shantene royal", "Rote-risen", "Vitaminnaya-6", "Koroleva oseni", "Nanteze", "Losinoostrovskaya-13", "Yaroslavna" elite seeds were brought, 0.1 area was allocated for each variety and planted in three replicates in the early and late periods, and their biological and chemical properties, differences from each other, biometric indicators, factors affecting product quality were studied. In studying the growth and development phases of the varieties, the general methods adopted at the Research Institute of Vegetables and the Research Institute of Plant Science were used. Methods and technology of extracting juice were used in industry (E.P. Shirokov 1974) [20]. Refractometer, saccharometer, pH meter equipment were used to determine total carbohydrates and organic acids in the product [18], Neibaur and Leventhal methods were used to determine the quantity and quality of tannin in juice, and with 3 % iron (III) chloride solution was used for quality analysis in laboratory conditions. Pectin is determined by the method adopted in the processing industry, by cleaning the ground and crushed mass in the first step with 96%, and in the second step with 80% alcohol and acetone. Irreplaceable amino acids in ginger are determined using UV Basic spectrophotometer according to the methodology. Technological scheme of preparation medicinal juice from carrot root is shown in Fig. 1.

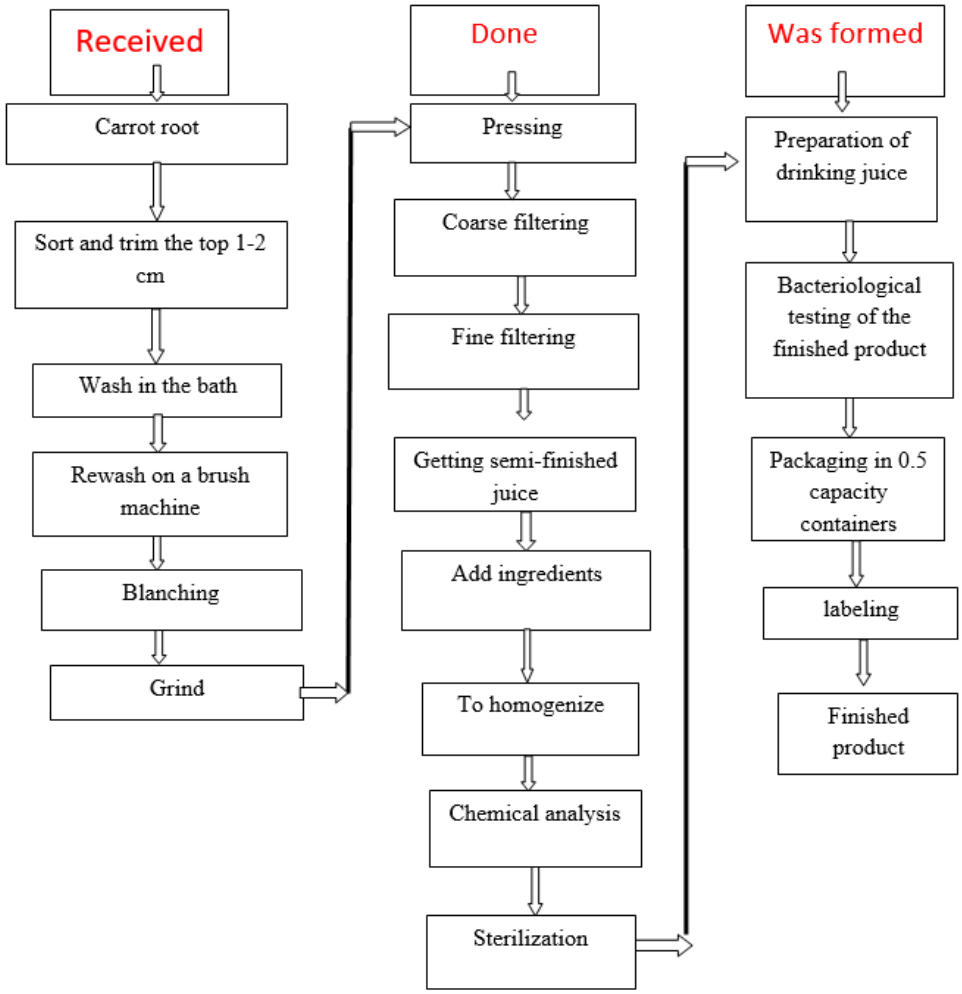


Fig. 1. Technological scheme of preparation medicinal juice from carrot root

3. Results

According to the results of the preliminary research, domestic and foreign varieties were grown in the early and late periods, and their biometric indicators were comparatively analyzed. According to the analysis, the average weight of the roots of the foreign varieties was 210-230 grams, and the yield was 43-48 t/ha, this indicator compared to the control variety. An excess of 12 t/ha was found. Chemical analysis of freshly ripened rhizomes revealed the presence of 7.5-11% total carbohydrates and 4.2-6% organic acids. It was determined that the stem and leaves of the plant are resistant to powdery mildew, false powdery mildew and black aphid and rhizome diseases. When comparing these indicators with local varieties, the weight of the root fruit is 70-130 grams, the yield is 30-35 t/ha, and it is observed that it is 8-12 t/ha less than foreign varieties. It was found that the amount of total carbohydrates in the fruit is 0.5-1% more, and the amount of organic acid is equal to 5% (Fig. 2).

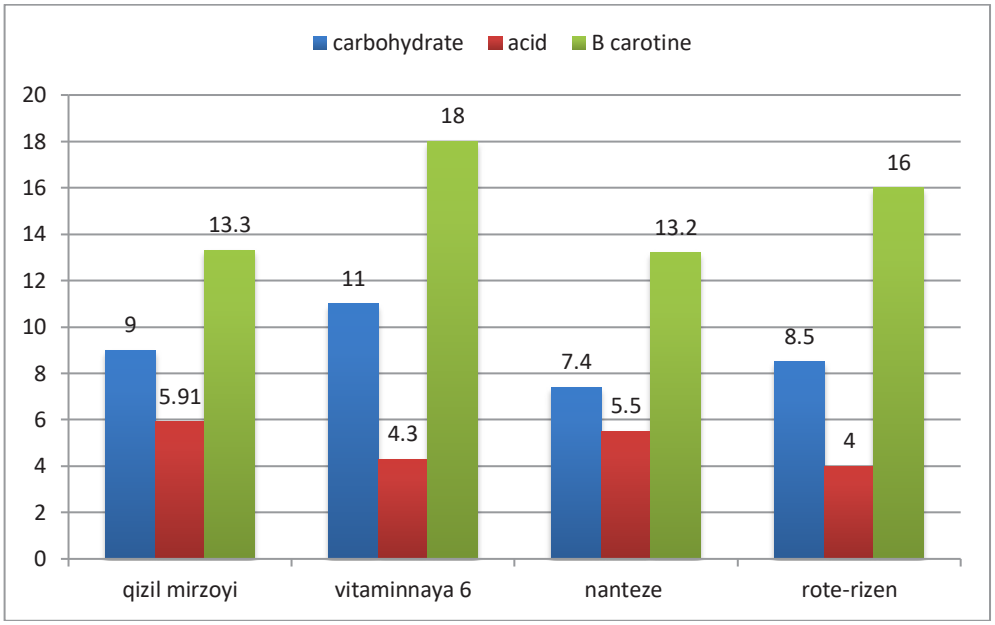
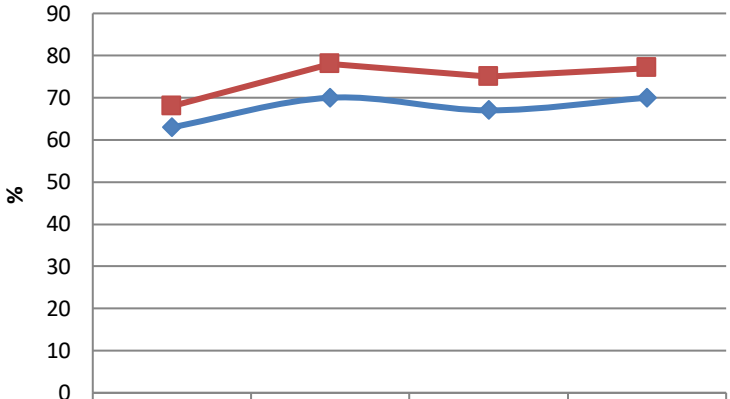


Fig. 2. Chemical composition of domestic and foreign carrot varieties

Homogenized and non-homogenized methods were used in terms of the level of juice release and retention of biologically active substances from carrot root. For this, one-kilogram samples were taken from all varieties of carrots, and juice samples were taken in two ways in laboratory conditions. According to the laboratory analysis (Fig. 3), the foreign "Rote-risen" and "Koroleva oseni" varieties of carrot had a juice yield of 68-70%, and the amount of total carbohydrates and β-carotene was 11-12 mg % when the juice was extracted in a non-homogenized method. It was found that the output level is 72-78% and the amount of total carbohydrates and β-carotene is 12-17 mg% (Table 1).

Table 1. Quality indicators of carrot juice in relation to varieties and methods: comparative analysis

Varieties	non-homogenized method (control)			homogenized method			The difference in the level of juice output compared to the standard ±
	rate of juice output %	Total		rate of juice output %	Total		
		Carbohydrate	acid		Carbohydrate	acid	
Qizil mirzoyi (control)	63	8.5	5.91	68	9	5.5	+5
Foreign varieties							
Shantene royal	65	7.5	6.2	70	7.8	5.5	+5
Rote-rizen	67	8.5	4.0	75	9	3.5	+8
Vitaminnaya 6	65	11	4.3	72	12	4	+7
Koroleva oseni	70	7.5	5.5	78	8	5	+8
Nanteze	67	7.4	5.5	70	8	5	+3
Losinoostrovskaya 13	65	8.5	4.2	72	9.2	4	+7
Yaroslavna	70	8.5	4.6	77	9	4.2	+7



	qizil mirzoyi	koroleva oseni	rote-rizen	yaroslavna
non-homogenized method %	63	70	67	70
homogenized method	68	78	75	77

Fig. 3. Rate of juice yield from 4 varieties (qizil mirzoyi, koroleva oseni, rote-rizen, and yaroslavna)

Determination of the amount of chemical substances, levels of acidity, additives and pectin content in the preparation of juice from root vegetables has important practical significance in the preparation of juice in industry. $FeCl_3$ solution was used in laboratory conditions to determine the nutrients contained in carrot roots. According to laboratory analysis, domestic and foreign varieties contain 0.01-0.02% tannin. If the product contains more than 0.02% tannin, when 1-2 drops of $FeCl_3$ solution are added, the juice will turn blue or dark (Fig. 4).

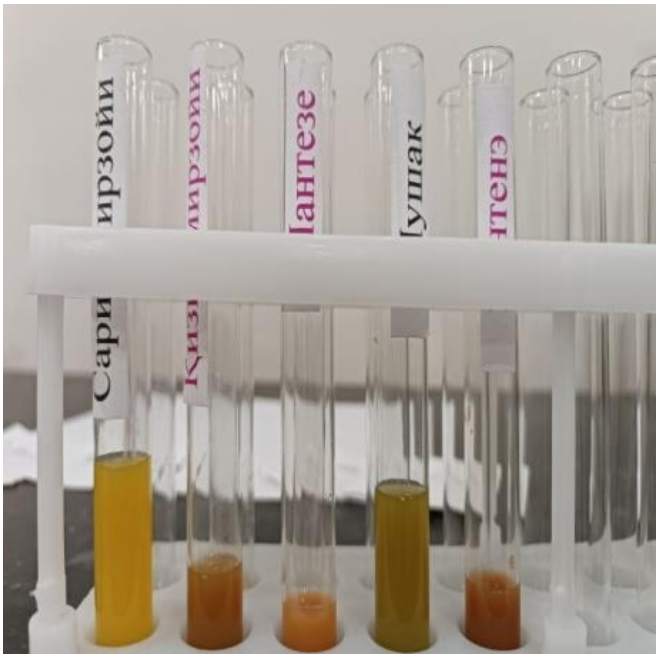


Fig. 4. Juices made from carrot root

In order to obtain high-quality juice from carrot root, its content, including tannin, is important. Tannin material reacts with free oxygen and under the action of enzymes, it forms phenolic acid and forms a proteinaceous precipitate. This condition negatively affects the quality of the juice. In the industry, it is necessary to blanch the cleaned carrot root with the help of steam to ensure the clearness and transparency of the juice. Blanching is achieved by reducing the release of tannin into the cell layer to the point of coagulation. According to the developed technology, the preparation of the juice by adding natural honey to the recipe in order to reduce the bitterness of the

juice increases the healing and aroma of the product. The color, taste, aroma, clarity and nutritional value of juices, storability of the products is considered the main criteria of consumer demand. In this regard, before juice preparation, the primary chemical substances in carrot and ginger root nodules, as well as lemon fruit, including pectin, pH level and sugar content, were determined in laboratory conditions based on the methodology. For this, product samples were taken in three repetitions, and the amount of sugar, vitamins and macro-microelements in them was analyzed. The amount of sugar in the initial products was determined using a saccharometer, and the pH indicator Benchtop 210. Carrot root juice samples contain 9.2-10% sugar and acidity (pH) up to 4.8-6.0%, ginger root nodule contains 4-5% carbohydrate, 6% acid, lemon juice contains 7.5-8% citric acid and 1.9-3 the presence of sugar was determined.

Based on the technological scheme and technology developed for the preparation of healing natural juices from carrot fruits, the products were washed and sorted in a washing machine in two stages and cleaned of industrial waste. The net weight of the purified products was determined by reweighing. Scientific research work was carried out at a temperature of 22ºC and a humidity level of 75%. The sorted product was blanched using a blancher at 85-90ºC and grated. The ground mass was compressed under strong pressure using a pressing device, and the juice was extracted. The obtained semi-finished juice was passed through coarse and fine filters. The yield of juice was 75-80%, and the number of secondary products was 20-25%. According to the recipe developed for the preparation of juice samples, it is prepared by adding lemon juice and ginger syrup in different proportions as ingredients, and the finished product is homogenized. Before pouring the product, samples were taken from them, the levels of sugar and pH, satiety power were determined. The finished product is sterilized for one hour at a temperature of 85-90ºC, with a small capacity of the product samples were packed in 0.2; 0.3- and 0.5-liter bottles and bacteriologically tested. In order to increase the usefulness of the juice types, recipes were developed for the preparation of three types of juice samples "Popular", "Parkhezbop", "For children" by adding ingredients such as a solution of ginger rhizome powder in water, lemon juice, natural honey to the prepared juice samples [10,12,16].

The characteristic value of the ginger plant that distinguishes it from other root fruits and vegetables is that it contains fructose, glucose, irreplaceable amino acids from carbohydrates, including Omega-3, Omega-6, vitamins E, K, S, B_3, B_5, B_6, gingerol from glucosides, iron from minerals, It is distinguished by the presence of magnesium, phosphorus, potassium, zinc, copper and manganese and germanium elements. According to scientific sources, the root of the ginger plant has an important practical value in the treatment of various diseases in medicine, especially in the prevention and treatment of viral diseases such as colds, flu, and covid, as well as in increasing the immune properties of the body. Lemon fruit and its juice have been recognized to be of great importance in the prevention and treatment of heart disease in medicine [8]. Various juices were prepared from root juice, including "Popular" by adding 70% carrot juice as the main product, 10% ginger syrup, 10% lemon juice and 10% honey. Its main type of product for juice preparation "Parkhezbop" was prepared by adding 70% carrot juice, 15% ginger syrup, 10% lemon juice and 5% honey. The basic type of juice preparation “For children” is prepared by adding 75% carrot juice, 5% ginger syrup, 5% lemon juice and 15% honey (Table 2).

Table 2. Recipes for making different juices

variants	Natural ingredients %			
	Carrot juice	Ginger syrup	Lemon juice	Honey
Popular juices	70	10	10	10
Parkhezbop juices	70	15	10	5
For children	75	5	5	15

4. Conclusion and Recommendations

In 2022-2023, the following conclusions were drawn according to the results of scientific and practical research and laboratory analyzes on the biological properties of carrot root and the preparation of various juices:

a) In the conditions of Namangan region, it was found that the biological characteristics of local and foreign varieties, including growth and development phases, do not differ
b) It was found that the rate of juice extraction in the homogenized method from carrot roots is 5-10% higher than in the non-homogenized method.
c) In order to increase the usefulness of juices, it is recommended to add ingredients such as a solution of ginger rhizome powder in water, lemon juice, and natural honey to ready-made juices.
d) "Popular" juice is prepared by adding 70% carrot juice, 10% ginger syrup, 10% lemon juice and 10% honey as the main product.
e) "Parkhezbop" juice is prepared by adding 70% carrot juice, 15% ginger syrup, 10% lemon juice and 5% honey.

f) It is recommended to make the basic type of juice preparation for "young children" by adding 75% carrot juice, 5% ginger syrup, 5% lemon juice and 15% honey.

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