UDC 664.1
DOI: 10.15587/1729-4061.2023.288226

ESTABLISHING THE REGULARITIES OF BLENDING FUNCTIONAL PURPOSE JUICES BASED ON WATERMELON JUICE

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The objects of the research are fruit and berry juices from watermelon, rosehip, apples and pumpkin. The influence of the physico-chemical parameters of fruit and berry juices on the process of storage and blending is investigated. It has been found that quantitative regulation depending on the physico-chemical parameters of fruit and berry juices during the development of blended juice technology makes it possible to develop a drink with a long shelf life. The developed juices should satisfy the body's needs for vitamins and minerals in food necessary for the normal development of the body. Based on research, watermelon-pumpkin-rosehip juice is recommended.

However, the consumer properties of natural juices depend on the variety and climatic conditions of growth. The climatic conditions of growth and the variety significantly affect the physico-chemical parameters of the juices obtained from them. All this allows us to assert that it is advisable to conduct a study devoted to establishing the influence of the physico-chemical parameters of fruit and berry juices based on watermelon juice on the process of storage and blending.

Juices are the most technologically advanced product for creating new types of functional nutrition. In addition, they contain a complex of vitamins and minerals in their composition.

In connection with the above, the development of technology and the organization of the production of functional purpose juices are the solution to problems related to nutrition.

It is found that the resulting new product – watermelon-pumpkin-rosehip drink will allow you to get a new product with high quality indicators and expand the range of fruit and berry drinks based on watermelon juice

Keywords: melon crops, watermelon juice, rosehip juice, processing of melons, juice blending

Received date 24.05.2023
Accepted date 14.08.2023
Published date 30.10.2023

***How to Cite**: Zhumaliyeva, G., Chomanov, U., Tultabayev, M., Aktokalova, G., Tultabayeva, T., Kenenbai, G., Kasymbek, R., Tultabayev, N. (2023). Establishing the regularities of blending functional purpose juices based on watermelon juice. Eastern-European Journal of Enterprise Technologies, 5 11 (125)), 57–66. doi: https://doi.org/10.15587/1729-4061.2023.288226*

1. Introduction

In many farms (30–40 %), watermelons grown annually remain unrealized on melon sites [1, 2]. For example, according to the Statistics Committee of the Ministry of National Economy of the Republic of Kazakhstan, in 2019, the acreage of all agricultural crops amounted to 22.2 million hectares, of which vegetable crops –261.1 thousand hectares [2].

Everyone knows that each product has its own nutritional value [3] thanks to the presence of essential amino acids in it,

their cleavability and ratio to other, interchangeable, amino acids [4].

The creation of multicomponent products is dictated by the possibility of regulating the chemical composition of products in accordance with the temporary requirements of nutrition science [5].

Melon crops, in particular watermelon, are a rich source of many vital nutrients for the human body [6], primarily vitamins [7], carbohydrates [8] and minerals [9]. At the same time, the shelf life of watermelon is limited [10], therefore, the processing of watermelons on an industrial scale [7] and the production of various food products from it [11], namely canned products and juices [12], is of great importance. Juices that retain a large amount of useful nutrients, including vitamins, in their composition during cold bottling [13] deserve special attention [14].

Watermelon juice is very nutritious and perishable [15]. Recently, it has become popular among consumers due to its unique refreshing taste and various health benefits [16]. Since it has a pH close to a neutral value and high water activity, this makes it an ideal environment for the growth of microorganisms. These microorganisms make it difficult to store juice for a long time [17]. For longer storage, watermelon juice must be processed to minimize water activity and inactivate microorganisms and enzymes that cause spoilage [18].

On average, watermelons consist of 41 % juice, 8 % pulp, 1 % seeds and 50 % peel, depending on the variety [19], season [20] and growing environment [21]. Watermelon juice contains a high level of potassium, which is a response to a possible component of the diuretic properties of watermelon [22]. Watermelon juice is also a good source of vitamin C [23]. Watermelon juice contains 20 % of the daily value of vitamin C [24]. Watermelon juice is reported to reduce the risk of chronic diseases such as asthma, atherosclerosis, diabetes, cancer and age-related degenerative pathologies due to its powerful antioxidant and saturated acidic bioactive substances [25, 26]. The beneficial properties of watermelon juice are related to its possible antioxidant, antifungal and vasodilating effects [27].

Watermelon juice also has a protective effect on the liver, kidneys and brain tissues, due to its antioxidant activity [28].

Studies [29] have confirmed that watermelon juice can favorably affect the improvement of glycemic status and vascular dysfunction in obesity – type II diabetes. Watermelon has a high content of carotenoids and reduces the risk of myocardial infarction [30]. Lycopene is the main carotenoid of watermelons with red pulp, having a positive effect on health [19, 31]. Cane sugar was added to the produced watermelon juice [32] to reach 11–13°Brix. Watermelon juice in bags has been developed and patented [33], which includes water, malic acid, polysaccharide, sweetener and natural ingredients.

Watermelon juice contains a small amount of protein [34] and fat [35], carbohydrates – including a lot of sugars [36], and dietary fiber [37]; organic acids [38] and a lot of pure natural water [39]. Vitamins – beta-carotene, PP, A, groups B, C, E; trace elements – potassium, sodium, calcium, magnesium, phosphorus, iron [40].

It is reliably known that just one glass of watermelon juice is quite enough to satisfy the daily need of a healthy person for such a vital trace element as magnesium [41]. Due to this property, nutritionists strongly recommend including watermelon juice in the diet of people with arterial hypertension [42]. Like the pulp of watermelons [43], their juice is useful to all people – at any age [44]: it removes toxins and slags, normalizes digestion [45], improves metabolism, quenches thirst and strengthens the immune system [46]; relieves the condition of intestinal atony [47], hypertension, renal and cardiovascular diseases [48]. Due to the insufficient provision of the population with vital nutrients, the creation of new types of functional drinks is of particular relevance [49]. Therefore, studies devoted to the establishment of the regularities of blending functional juices based on watermelon juice are relevant.

2. Literature review and problem statement

A wide range of studies has been established on the processing of watermelons [42], melons [50], and other agricultural crops to produce various food products from them. The influence of non-thermal technologies on the shelf life of fruits and products from them has been studied [51]. Formulations of a protein complex with the addition of vegetable raw materials have been developed [52]. The possibility of using fruit and berry juices in the production of functional products is presented [44]. However, in these works there are no data on the mechanism of blending of components. In the work on the development of juice production technology, it was noted that the technology for the production of watermelon juice differs in that first 0.2–0.8 % organic acid is added to the ordinary juice purified from the seeds of watermelon pulp, and the pH is adjusted to ideal acidity. Then 0.002–0.01 % antiseptic is added, then heating, sterilization, cooling and sterile filling are carried out in a sterile container, as well as storage in a sealed mode. Secondly, the production process includes the following stages: watermelon cleaning, watermelon slicing, pulp removal, seed removal using a machine, mixing (adding sugar syrup, organic acid and antiseptic) [53]. A method is known [54] for making watermelon juice. It is noted that this method not only preserves the taste and nutritional value of watermelon, but also makes watermelon juice crystal clear, tasty and refreshing to quench thirst, and suitable for long-term storage [55]. In this work, the issues of blending remained unresolved. A watermelon juice concentrate has been developed [43], which has increased shelf life and reduced transportation and storage costs. The process of juice concentration worsens the nutritional components and organoleptic qualities of the juice. The concentrate was compared with thermal concentrate and freshly squeezed juices, as well as commercially available chilled watermelon juices in terms of the content of lycopene and citrulline, total amount of soluble phenols, antioxidant activity and organoleptic properties. Watermelon juice concentrate had statistically similar ($p<0.05$) levels of all nutrients of interest. The recovered concentrate retained the same antioxidant activity as the original juice, which was 45 % higher than that of the original juice. The result was a very favorite juice, and it surpassed the restored thermoconcentrate in organoleptic parameters [56]. This work demonstrates the possibility of producing high-quality watermelon juice. However, there is no data on the effect of concentration of blended juices and their shelf life.

An invention has been patented relating to a complex drink made from watermelon juice, which has a stable color and solves problems related to the taste of the prepared product and light aroma, as well as to the method of its preparation [4]. It is shown that watermelon is taken as the main component, and a composite drink of watermelon juice contains the following components: 50–90 % watermelon juice, 5.0–15 % passion fruit puree, 3.0–10 % sweetener, 0.05–0.2 % stabilizing agent, 0.05–0.3 % acidic agent, 0.02–0.05 % preservative, 0.01–0.02 % antioxidant and purified water balance. You can

also use fresh watermelons or frozen watermelons. Passion fruit puree is prepared by grinding passion fruit or by defrosting frozen passion fruit before use. The main drink from watermelon juice is prepared through the following stages: washing, defrosting, juicing, filtration, dosing, homogenization, degassing, sterilization, canning and cooling, etc. The product does not have a boiled taste and has a beautiful color without the addition of any pigments and essences. The quality guarantee period can reach one year at normal temperature, obvious delamination and precipitation phenomena do not occur during this period and the product is suitable for industrial production. But there were unresolved issues related to the establishment of regularities of blending of functional purpose juices based on watermelon juice. The reason for this may be significant differences in the physico-chemical parameters of watermelon juices, depending on the variety and climatic conditions of growth. An option to overcome this may be to study the physico-chemical parameters of watermelon juices, depending on the variety, climatic conditions of growth and the possibility of the influence of these indicators on the storage and blending process. This approach is used in the work [53], however, there are no data on blending of various juices. All this suggests that it is advisable to conduct a study on the establishment of the influence of the physico-chemical parameters of fruit and berry juices based on watermelon juice on the process of storage and blending. Functional juices are not offered to consumers yet, since the market of "ordinary" juices has not yet reached its saturation and is not ready for significant diversification. Today's juice market is segmented mainly by price and taste. As the market analysis shows, there are practically no melon processing products on the shelves of stores in the Central Asian region [44]. One of the main reasons is the lack of equipment and technology for storing watermelon and melon. Currently, in the Republic of Kazakhstan, as well as in a number of Central Asian republics (Uzbekistan and Turkmenistan), watermelon and pumpkin fruits are processed practically only in one direction – obtaining dried products [57]. In this regard, marketing research on developments has shown that there are very few soft drinks and juices with a functional purpose. Therefore, the task of this work is to develop the technology of functional drinks.

Thus, based on the knowledge of the body's needs for vitamins and minerals contained in food, it is necessary to develop recipes for blended drinks from fruit and berry juices for the normal development of the body. Also, the introduction of new technologies of fruit and berry juices will ensure the production of import-substituting drinks of high quality.

3. The aim and objectives of the study

The aim of the study is to identify the influence of the physico-chemical parameters of fruit and berry juices on the process of storage and blending of functional purpose juices based on watermelon juice.

To achieve the aim, the following objectives have been accomplished:

– to conduct an organoleptic assessment of the quality of a watermelon drink with different ratios of apple and pumpkin juice and rosehip tincture;

– to conduct a physico-chemical analysis of juice with different ratios of watermelon, apple and pumpkin juices and rosehip tincture;

– to develop a recipe for blending functional purpose juices based on watermelon juice with a long shelf life.

4. Materials and methods of research

The objects of the research are fruit and berry juices from watermelon, rosehip, apples and pumpkin. The main hypothesis of the research is that quantitative regulation of the physico-chemical parameters of fruit and berry juices during the development of blended juice technology will make it possible to develop drinks with a long shelf life. However, it should be borne in mind that the physico-chemical parameters of fruit and berry juices differ depending on the region of growth and cultivation.

A physico-chemical analysis was carried out. Total soluble dry substances were determined using a SNEL-104 refractometer. To do this, a small portion of the product sample was placed on the lower prism of the refractometer. The test product was monitored to evenly cover the glass surface, after which the lower prism was covered with the upper prism. After reaching the temperature equilibrium (approximately 30 °C), measurements were carried out in accordance with the operating instructions of the device. It is important that the temperature remains constant throughout the measurement process. The mass fraction of sucrose as a percentage up to the first decimal place was determined on the scale of the device.

The active acidity of the juice was determined using a Testo 206 pH 1 meter and titrated acidity. To determine the active acidity on the pH meter, the electrode was lowered into the juice and waited until the readings of the device stabilized. Titrated acidity was determined by titration with sodium hydroxide, based on malic acid.

The content of the mass fraction of moisture of raw materials and products was determined using an MX-50 moisture meter. The measurements were carried out according to the instructions: 5 grams of the sample were taken, distributed in a uniform layer on the cup and dried at a temperature of 130 °C.

The rosehip tincture was processed on a Bandelin Sonopuls UW 2200 homogenizer with an ultrasonic transducer with an oscillation frequency of 20 kHz and a torque of 70 Nm and heated to 65–75 °C.

The technological cycle of juice preparation included the following processes – ripe watermelon and pumpkins were washed under running water at a temperature of 20–25 °C, manually cut into slices and peeled. Then, the pulp of watermelon and pumpkin was cut into large pieces and the seeds were removed. The resulting pieces of watermelon and pumpkin were passed through a juicer and centrifuged for 20 minutes at 1000 rpm. Then filtered and pasteurized at a temperature of 85–90 °C for 10–12 minutes. Pasteurized juices were poured into sterile containers, pre-washed and sterile, then rolled up and cooled to a temperature of 18–20 °C and sent for storage at 3–4 °C. Also, the mature apples and pears used were washed and peeled from the core and the juice was squeezed out on a juicer. Rosehip berries after washing were crushed and processed on a Bandelin Sonopuls UW 2200 homogenizer with an ultrasonic transducer with an oscillation frequency of 20 kHz and a torque of 70 Nm and heated to 65–75 °C. Pasteurization is designed to suppress microbial activity and enzymatic inactivation, thereby ensuring long-term storage of products. During pasteurization, the juice had a cloudy color with precipitation, the taste and aroma characteristic of watermelon and pumpkin, thereby allowed to preserve most of the useful properties of freshly squeezed juice.

Preparation of a prescription mixture.

To perform the work, experimental watermelon and pumpkin juices of direct extraction were previously made.

Direct-pressed juice is freshly squeezed juice that has been preserved and packaged for long-term storage. Only fresh, ripe, unspoiled vegetables and fruits were used to obtain direct-pressed juice, which is made only from local fruits and vegetables during the harvest period.

When developing juice formulations, watermelon, pumpkin, rosehip, apples and pears, sugar and preservatives (ascorbic and citric acids) were used as components. To develop the formulation and determine the optimal amount of added apple, pear and rosehip tincture juices, samples of juices with different input ratios were prepared. Laboratory juice samples were prepared with the following ratios:

– sample 1 – control watermelon juice;

– sample 2 – watermelon juice+apple juice (10 %);

– sample 3 – watermelon juice+apple juice (20 %);

– sample 4 – watermelon juice+apple juice (30 %);

– sample 5 – watermelon juice+rosehip tincture (5 %);

– sample 6 – watermelon juice+rosehip tincture (10 %);

– sample 7 – watermelon juice+rosehip tincture (15 %);

– sample 8 – watermelon juice+pumpkin juice (25 %);

– sample 9 – watermelon juice+pumpkin juice (50 %);

– sample 10 – watermelon juice+ +pumpkin juice (75 %).

5. Results of the study on the influence of the physico-chemical parameters of fruit and berry juices on the process of storage and blending of functional purpose juices based on watermelon juice

5. 1. Results of the organoleptic evaluation of the quality of a watermelon drink with different ratios of apple and pumpkin juice and rosehip tincture

The results of the organoleptic evaluation of the quality of a watermelon drink with different doses of apple and pumpkin juice and rosehip tincture are presented in Table 1.

During the organoleptic evaluation, the consistency of all the obtained juice samples was opaque with precipitation, the smell and taste with an increase in the dosage of apples, rose hips and pumpkins, respectively, became more pronounced, the color was uniform, homogeneous from light pink to pronounced orange. All the mixtures were cloudy, not clarified, but this is quite acceptable and is well perceived by most consumers.

5. 2. Results of the physico-chemical analysis of a watermelon drink with various doses of apple and pumpkin juice and rosehip tincture

Table 2 shows the results of the physico-chemical parameters of watermelon juice with different ratios of apple and pumpkin juice and rosehip tincture.

Table 2

Physico-chemical indicators of juices

Indicator	Sample 1 (control)	Samples with different ratios of apple, pumpkin juice and rosehip tincture, %								
		Apple juice			Rosehip tincture			Pumpkin juice		
		10	20	30	5	10	15	25	50	75
Acidity, (*T*, °C)	0.9	0.9	1.0	1.2	0.9	1.1	1.6	1.2	1.3	1.4
Active acidity, units, etc	4.4	4.4	4.2	4.3	4.3	4.1	4.0	4.3	4.1	4.1
Density, $d_{20/20}$	1,031	1,031	1,033	1,035	1,031	1,034	1,036	1,035	1,038	1,041
Content, soluble solids, (°Brix)	8.1	8.3	8.6	8.8	8.4	8.5	8.7	8.4	8.8	8.9

According to the results of the data obtained, it can be seen that all juices are within the permissible norm in terms of quality indicators. With the addition of 15 % rosehip tincture, the acidity of the juices increases by 0.7 %, compared with other samples, and accordingly the active acidity decreases and the color of the juice darkens slightly. The addition of apple juice in an amount of up to 30 % practically does not affect the appearance, color, taste and smell of the product, and when more than 30 % is added, the juice darkens slightly, a slight taste of apples is felt. When adding pumpkin juice in an amount of up to 75 %, the color becomes orange, the taste and smell of pumpkin are felt, and when adding 75 % or more, the taste is pronounced and the color becomes saturated, orange.

Table 1

Organoleptic assessment of the quality of watermelon juice with different ratios of apple and pumpkin juice and rosehip tincture

Indicator	Samples with different ratios of apple and pumpkin juice and rosehip tincture, %									
	sample 1	with apple juice			with rosehip tincture			with pumpkin juice		
		sample 2	sample 3	sample 4	sample 5	sample 6	sample 7	sample 8	sample 9	sample 10
Taste	watermelon	watermelon	watermelon, light taste of apples	not sour pronounced watermelon-apple flavor, sour	watermelon	watermelon	watermelon, sour	watermelon light, delicate taste of pumpkin	watermelon-pumpkin flavor, not sour	pronounced pumpkin flavor
Appearance and consistency	opaque, without pulp with precipitation									
Color	homogeneous throughout the mass, light pink	homogeneous throughout the mass, light with a brownish tinge	uniform throughout the mass, pink	homogeneous throughout the mass, dark pink	homogeneous throughout the mass, pink with a slight orange tint	homogeneous throughout the mass, pink with a slight orange tint	homogeneous throughout the mass, pink with a slight orange tint	uniform throughout the mass, pink with a rich orange hue	homogeneous throughout the mass, orange	homogeneous throughout the mass, orange

5. 3. Development of a recipe for functional purpose blended juices based on watermelon juice

As a result of the conducted research, juices obtained on the basis of watermelon with the addition of 20 % apple juice, 10 % rosehip tincture and 50 % pumpkin juice received a favorable assessment. Based on the obtained optimal options, watermelon-pumpkin-apple-rosehip juice was developed. The mixture of watermelon-pumpkin-apple-rosehip juice turned sour due to the addition of apple juice and the color was dirty greenish and unattractive. Based on the analysis of the results obtained, juice with a recipe in the ratio of watermelon (40 %) – pumpkin (50 %) – rosehip juice (10 %) is recommended.

Watermelon-pumpkin-rosehip juice has a natural and well-pronounced aroma. Thanks to the optimally selected dosage of fillers, it has a pleasant taste and a homogeneous consistency. Table 3 shows the physico-chemical parameters and carbohydrate composition of juices.

Table 3 shows that watermelon juice is in the lead in terms of carbohydrate content, all juices are within the normal range in terms of titrated acidity, and pumpkin juice, respectively, in terms of beta-carotenoids. The composition of the analyzed object is directly influenced by the method of juice preparation. The technology of preparation of blended juices from watermelon and pumpkin has been developed (Fig. 1).

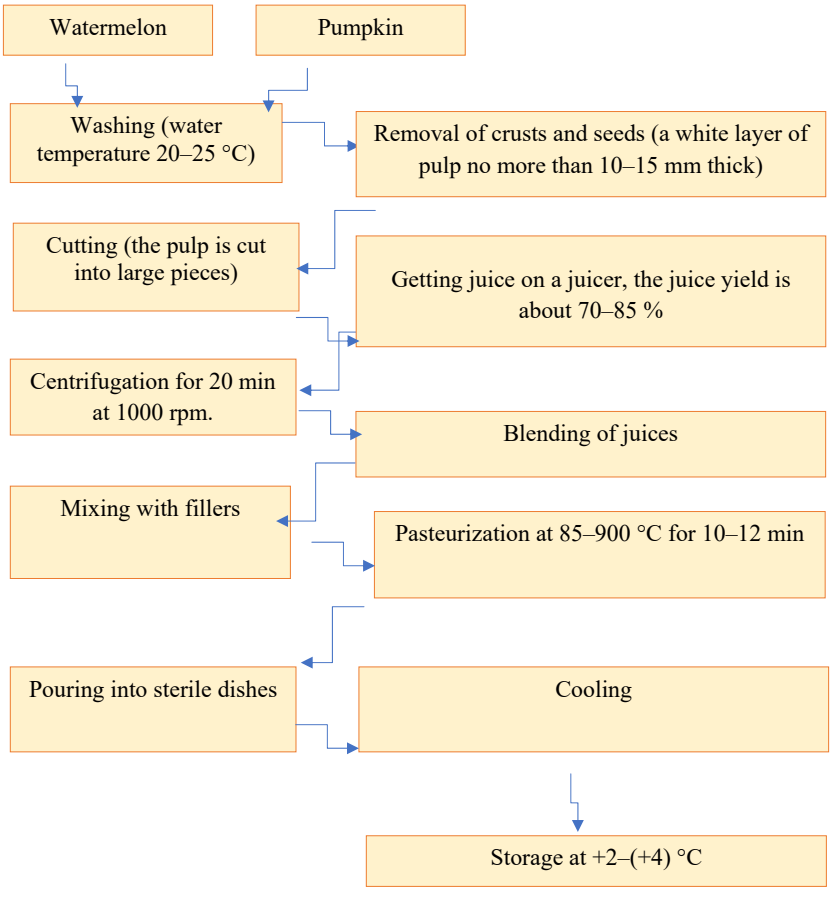

Fig. 1. Flow diagram of preparation of watermelon and pumpkin juice using natural additives

Table 3

Physico-chemical parameters and carbohydrate composition of juices

Indicator	Watermelon	Pumpkin	Watermelon-pumpkin-rosehip
Titrated acidity, °T	1.18	1.40	1.60
Content of β-carotenoids, mg/100 g	0.073	1.21	0.753
Sucrose, g/100 g	5.5	3.7	4.95
Glucose, g/100 g	1.27	0.303	–
Fructose, g/100 g	11.54	8.23	4.0

Microbiological safety indicators of the obtained juices were investigated (Table 4).

Table 4

Microbiological indicators of juice safety

Indicator, unit of measurement	Watermelon juice	Pumpkin juice	Watermelon-pumpkin-rosehip
KMAFAnM CFU/cm^3 (g), no more	$4*10^1$	$5*10^1$	$2*10^1$
BGCP (coliforms) in 0.01 g of the product	not detected	not detected	not detected
Yeast, CFU/cm^3(g)	1	3	1
Mold, CFU/cm^3 (g)	not detected	not detected	not detected

The results show that mold and coliform were not detected, the content of yeast and CMAFAnM are within the normal range [44].

In order to establish the regularity of the influence of the physico-chemical parameters of juices on the process of blending functional purpose juices, their storage periods were investigated. In order to establish the regularity of the blending of functional purpose juices, their storage periods were investigated. The effectiveness of the heat treatment of the juice, in order to prevent fermentation, was evaluated during storage. The research is based on the study of changes in acidity and dry water-soluble substances in juice during storage. Heat treatment (pasteurization) of juices was carried out at a temperature of 85–95 °C, processing time 10–15 min. Then the juice was poured into a sterile glass container, sealed with a metal lid and stored. Changes in titrated acidity were carried out for 1, 30, 60, 90, 120, 150 and 180 days. The content of organic acids in samples heated for 10–15 minutes at a temperature of 85–95 °C during storage increased by only 0.10 T relative to the initial content. This treatment mode allowed inactivating enzymes and stopping fermentation, the juice had a cloudy shade and a watermelon-pumpkin flavor (Table 5).

Thus, the shelf life of the obtained juices at a temperature of +4–6 °C from the date of manufacture in a glass package is recommended for up to 6 months.

Table 5

Effect of heat treatment at a temperature of 85–95 °C on the titrated acidity of juices during storage

Samples	Storage period, day						
	1	30	60	90	120	150	180
Varieties of juices	Titrated acidity, °T						
Watermelon	1.0	1.1	1.1	1.1	1.2	1.2	1.2
Pumpkin	1.3	1.3	1.3	1.4	1.4	1.4	1.4
Watermelon-pumpkin-rosehip	1.5	1.5	1.5	1.6	1.6	1.6	1.6

Next, the nutritional and biological value of the prepared juices was determined (Fig. 2–5).

According to the research results, it was revealed that the content of essential amino acids in watermelon juice is 0.46 %, in pumpkin juice – 1.164 %, watermelon-pumpkin-rosehip – 0.858 %.

It was found that the content of interchangeable amino acids in watermelon juice is 0.247 %, in pumpkin juice – 0.0256 %, watermelon-pumpkin-rosehip – 0.171 %.

It was found that the protein of watermelon juice contains: alanine (0.093 %), arginine (0.073 %), threonine (0.072 %), histidine (0.080 %), phenylalanine (0.088 %); vitamins (mg/100 g): C – 2.27; B1 – 0.022; B2 – 0.017; B6 – 0.01; B3 – 0.015; B5 – 0.004; mineral elements (mg/100 g): iron – 0.60.

It was shown that the protein of pumpkin juice contains: threonine (0.109 %), arginine (0.148 %), valine (0.062 %), methionine (0.093 %), phenylalanine (0.639 %); vitamins (mg/100 g): C – 3.62; B1 – 0.021; B2 – 0.016; B6 – 0.0081; B3 – 0.012; B5 – 0.004; mineral elements (mg / 100 g): iron – 0.37.

It was found that the protein of watermelon-pumpkin-rosehip juice contains: threonine (0.043 %), arginine (0.678 %), alanine (0.038 %), tyrosine (0.030 %), proline (0.045 %); vitamins (mg/100 g): C – 3.34; B1 – 0.025; B2 – 0.011; B6 – 0.0079; B3 – 0.02; B5 – 0.0018; mineral elements (mg/100 g): iron – 0.48.

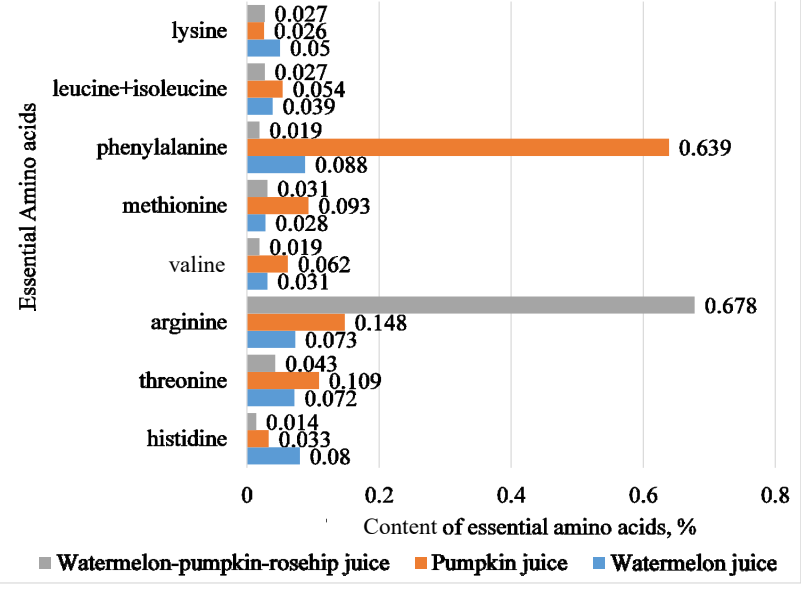

Fig. 2. Content of essential amino acids in ready-made juices

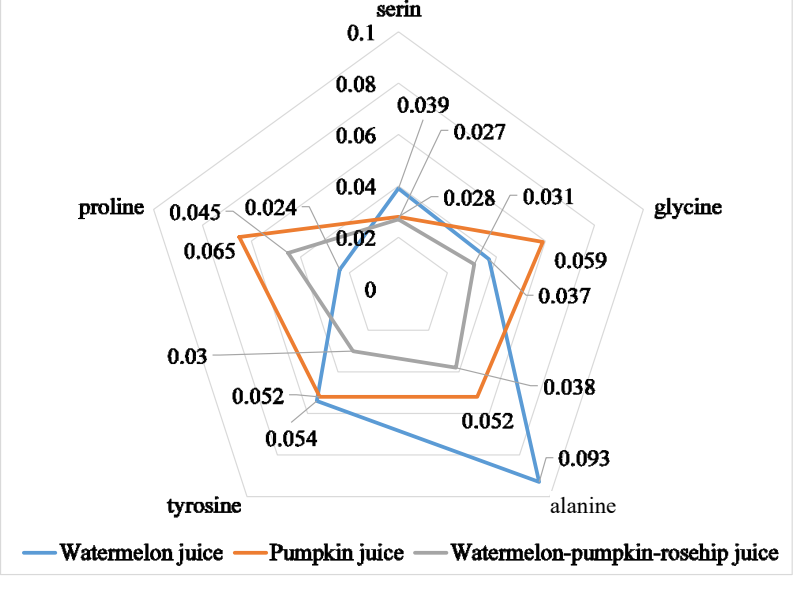

Fig. 3. Content of interchangeable amino acids in ready-made juices

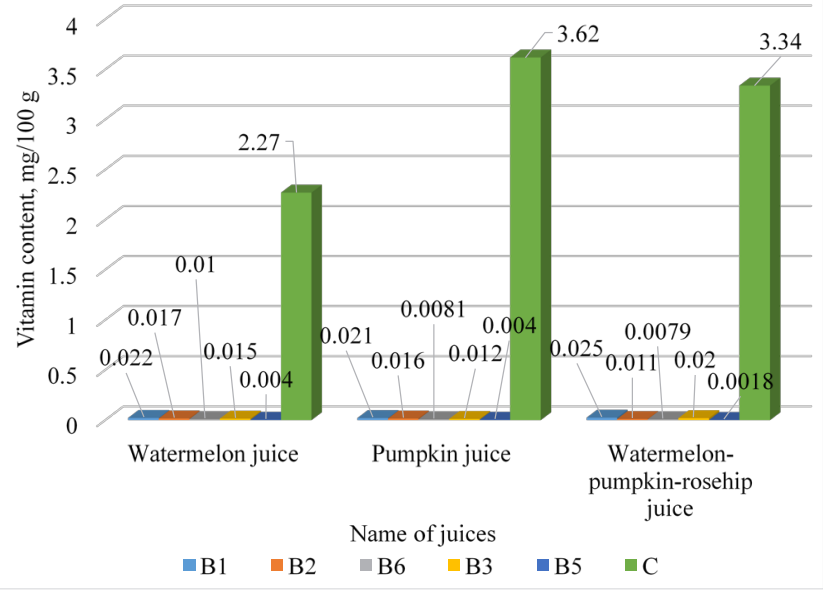

Fig. 4. Content of macro- and microelements in the studied juices

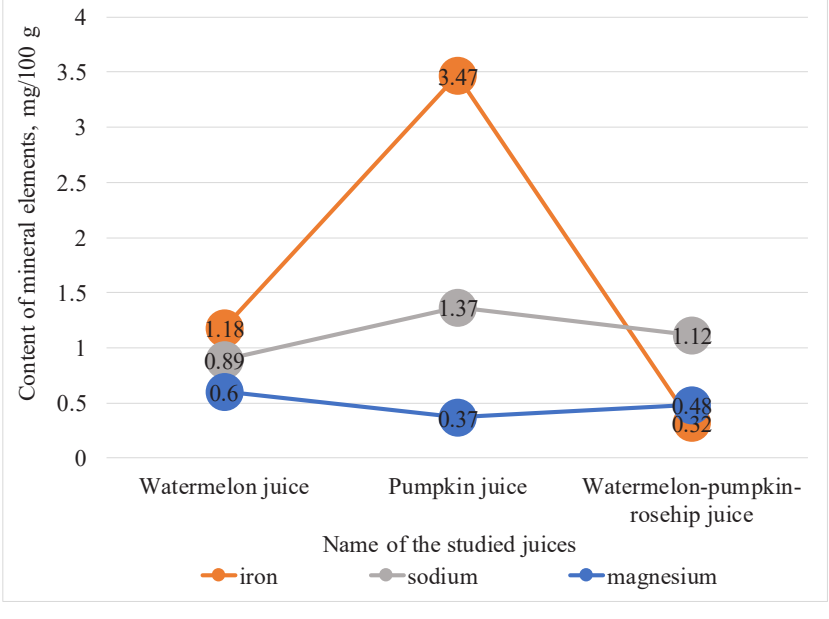

Fig. 5. Content of mineral elements in the studied juices

6. Discussion of the results of the study on the influence of the physico-chemical parameters of juices on the storage and blending process

The organoleptic evaluation of the obtained juice samples meets the requirements of consumers (Table 1).

According to the results of the physico-chemical analysis, it is clear that all juices are within the permissible norm in terms of quality indicators (Tables 2, 3).

Microbiological indicators of juice safety are within the norm (Table 4).

Recommended storage periods of the obtained juices at a temperature of +4–(+6) °C from the date of manufacture in a glass package up to 6 months have been established (Table 5).

The developed juices are characterized by a high content of mineral elements (Fig. 3–5). A high content of L-arginine in watermelon-pumpkin-rosehip juice has been established, which positively affects the body of patients with type 2 diabetes and is necessary for proper nutrition of athletes (Fig. 2).

The use of melon processing products in the production of juices, purees and confectionery products contributes to their enrichment with such substances useful for the human body as fiber, zinc, magnesium, phosphorus, calcium, iron, proteins, vitamins E, B, C and PP, which will significantly increase the nutritional value of the finished product (Table 3).

The obtained results of the physico-chemical parameters and carbohydrate composition of juices are characteristic of the samples of melons under consideration. Samples grown in other geographical and climatic conditions may have completely different indicators. Also, in further studies, additional research is needed on the digestibility and the possibility of allergic effects of blended juices.

7. Conclusions

1. Based on an organoleptic assessment of the quality of watermelon juice with the addition of apple and pumpkin juice and rosehip tincture, it was found that all the juice samples obtained had an opaque consistency with precipitation, the smell and taste with an increase in the dosage of apples, rosehip and pumpkin, respectively, were more pronounced, the color was uniform, homogeneous from light pink to pronounced orange colors. All the mixtures were cloudy, not clarified, but this is quite acceptable and is well perceived by most consumers.

2. Based on the physico-chemical analysis of a watermelon drink with various ratios of apple and pumpkin juices and rosehip tincture, it was found that all the juices obtained are within the permissible norm in terms of quality indicators. With the addition of 15 % rosehip tincture, the acidity of the juices increased by 0.7 %, compared with other samples, and accordingly the active acidity decreased and the juice darkened slightly in color. The addition of apple juice in an amount of up to 30 % practically did not affect the appearance, color, taste and smell of the product, and when adding 30 % or more, the juice slightly darkened and a slight taste of apples was felt. When adding pumpkin juice in an amount of up to 75 %, the color became more orange, the taste and smell of pumpkin were felt, and when adding more than 75 %, there was a pronounced taste and color with a rich orange hue.

3. On the basis of knowledge about the body's needs for vitamins and minerals in food necessary for the normal development of the body, watermelon-pumpkin-rosehip juice is recommended with a recipe in the ratio: watermelon – 40 %, pumpkin – 50 % and rosehip – 10 % juices.

Conflict of interest

The authors declare that they have no conflict of interest regarding this research, whether financial, personal, authorship or otherwise, that could affect the research and its results presented in this paper.

Financing

The materials were prepared within the framework of the project BR10764970 "Development of equipment and technology for storage and complex and deep processing of melons (watermelon, pumpkin, etc.) for the production of concentrates for juices and baby food (puree), confectionery" within the framework of "Program-targeted financing of scientific research and activities" of the Ministry of Agriculture of the Republic of Kazakhstan on 2021–2023.

Data availability

The manuscript has no associated data.

Acknowledgments

We express our sincere gratitude to the staff of the Kazakh Research Institute of Processing and Food Industry for their assistance in conducting and preparing the paper.

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