



# Solving the Problem of Serum Utilization in Kazakhstan

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## Abstract

The article presents the results of experimental studies of serum beverage enriched with pine bark extract as a source of polyphenols. The effect of pine bark extract is investigated, its use in the production of serum beverage is justified, and the increase of essential amino acids, namely phenylalanine and tyrosine, is established. Enrichment with specially selected herbal components of the serum will allow the creation of new technologies of products with a given therapeutic and preventive direction.

**Keywords:** milk and dairy product, serum, plant components, beverages

## 1. Introduction

The current level of development of the dairy industry in Kazakhstan and abroad, as well as the state of the raw materials base, require a more rigorous approach to the problem of using secondary resources.

The problem of reasonable use of serum exists in all countries with a high stage of development of the dairy industry. In countries characterized by a modern technical base (France, USA, Sweden, Germany, Canada), the dairy industry processes 50-95% of milk serum [1, 2]. Domestic production processes about 20%. The rest is poured into the sewer without treatment, thereby harming the surrounding environment.

Moreover, along with the unfavorable influence of anthropogenic and technogenic factors, the increasing content of food additives of artificial origin in food raw materials and foodstuffs comes to the forefront.

A promising solution to this problem is the production of serum-based products with natural ingredients that benefit human health, actively fight various diseases, and are able to improve a variety of physiological processes in the body.

The urgency of the work lies in solving the problem of utilization of the production waste - curd whey with further production of the beverage with additives from the wild derivatives of Northern Kazakhstan.

Vegetable medicinal derivative is represented as a source of the intake of fiber, vitamins and other biologically active substances into the human body, it is established by a number of technological properties. These types of raw materials open a lot of directions in the production of food products based on serum, as raw materials provide an opportunity to satisfy the food industry in these types of raw materials and the creation of products with their use does not create the prerequisites for the emergence of various allergic diseases associated with the use of unaccustomed imported food and drink. Recently, a lot of research has been carried out on the creation of new types of products from phytochemicals in order to more fully preserve biologically active substances, for their subsequent use by food industry enterprises. In the production of serum

products leavened wort, dyes, flavors, natural sorbents are introduced [3, 4, 5].

To improve the organoleptic parameters, fruit and berry and vegetable juices are widely used. It is these beverages that are popular with consumers. There are few studies using herbs and medicinal derivatives [6].

The authors of this article also conducted studies and received serum beverages based on the use of sea-buckthorn syrup, herb decoction (valerian, dog rose, St. John's wort), and kefir starter [7, 8, 9]. It is established that the broths of medicinal derivatives are sources of biologically active substances.

Currently, the world market offers the consumer a wide range of non-alcoholic beverages, various in their composition, energy and nutritional value, organoleptic characteristics, etc.

According to Busines Stat statistics, until recently, per capita consumption of beverages in Kazakhstan varied from 12 to 42.7 liters per year for different regions. For comparison, in many European countries this indicator exceeds 100 liters per year and more (Poland - 182 liters, Czech Republic - 200 liters, Germany - 195 liters); and for the USA this figure is more than 300 liters.

Statistics show that the category of beverages was not considered by Kazakh consumers as essential products, and their daily purchase began only when they reached a certain level of income or informed consumers of usefulness information. And initially the choice was made in favor of inexpensive beverages containing artificial food additives (flavors, dyes, preservatives) and, as a rule, less useful.

Currently, both abroad and in Kazakhstan, there has been a trend, accompanied by an increase in the supply and quantity of non-alcoholic beverages consumed [10].

According to experts from BusinesStat (LLC Business Statistics, 2012-2014), the annual increase in the production of beverages in Kazakhstan is about 10%. According to available data, the domestic beverage market is segmented as follows: 37% for carbonated non-alcoholic beverages, 36% for bottled water, 25% for juices, nectars and juice drinks and 1% for tea, sports and energy beverages (Figure 1). Otherwise, the world market of this group of goods. It is represented by five segments, one of which (13%) includes "new types" of healthy beverages, using ingredients that impart functional properties to products (Figure

2).

As you can see, the main segments of the market of non-alcoholic beverages, both in Kazakhstan and abroad are: juices and juice drinks, mineral water. However, many directions of functional beverages are widely represented on the foreign consumer market

(Figure 2), whose task is to saturate the body with vital micronutrients (vitamins, phenolic substances, mineral elements, essential amino acids, probiotics, prebiotics, etc.), and also reduce the risk of various diseases, improvement or correction of body functions [11].

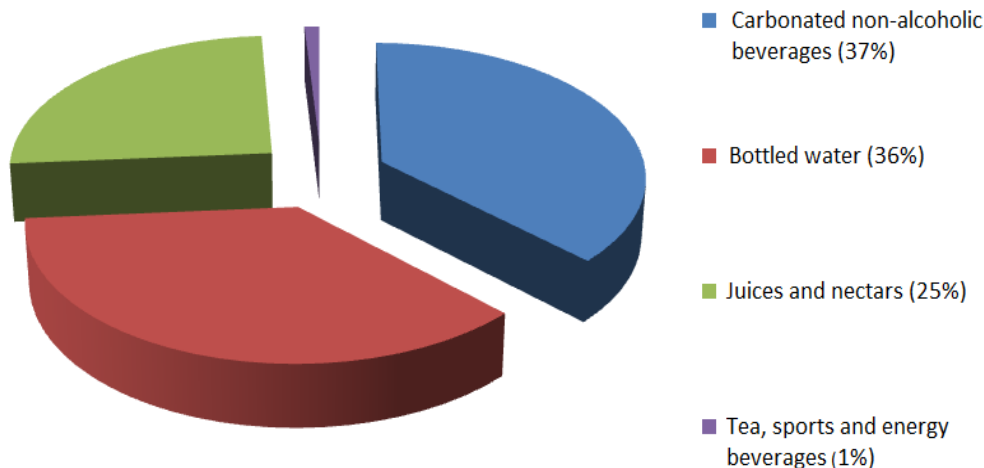


Figure 1. Structure of consumption of non-alcoholic beverages in Kazakhstan, % (according to BusinesStat)

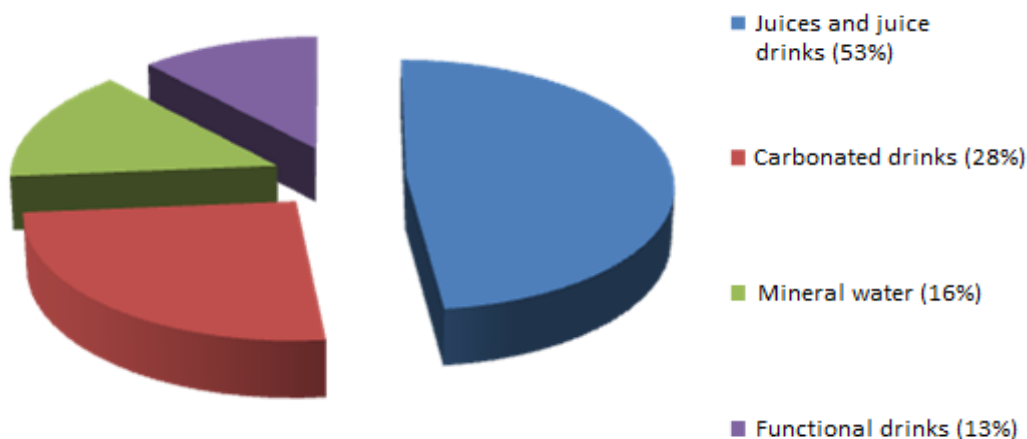


Figure 2. Structure of consumption of non-alcoholic beverages abroad, % (according to BusinesStat)

Nutriceutic beverages are characterized by increased nutritional value and have a pronounced biological activity by enriching them with additional functional ingredients: vitamins, microelements, phospholipids, essential fatty acids, dietary fibers and other components [12]. Beverages of this type include fruit and vegetable juices "V8Splash" (USA), "Rapp's Guten Morgen", "Rapp's Taglich Fit" (Germany), "South Beach", "Red Ap" juices, dry beverages with vitamins, mineral substances and prebiotics (Valetek Prodimpex) [13,14].

In Europe, the most well known vitamin beverages "ACE" series, received its name on a range of their constituent vitamins: provitamin A ( $\beta$ -carotene), C and E ( $\alpha$ -tocopherol). Beverages of this series contain not less than 20% juice (orange-carrot-lemon, orange-cherry, cranberry-apple and et al.), and can also include dietary fibers,  $\omega$ -3 unsaturated fatty acids and group B vitamins (B6, folic acid), which contribute to the prevention of cardiovascular, gastrointestinal, oncological and other diseases [15,16]. ACE-beverages concept gave rise to the production of a series of new beverages, the production of which is mastered by many companies around the world - appeared on the market ALL-

beverages enriched with vitamins B, C and E and the CBS-beverages with vitamin C and dietary fiber. [17] Currently, the production of fortified non-alcoholic beverages widely adopted the use of premixes which structure except for vitamins include various mineral elements, aminoacids, and others.

## 2. Objects and Methods of Research

In recent years, wild-growing derivatives have become an increasingly important and demanded raw material for the production of beverages of a functional orientation.

Wild raw materials of Northern Kazakhstan are of value, due to a specific combination of biologically and pharmaceutically active components. Such substances are difficult to create artificially, they are well tolerated by the human body, have a curative and preventive effect. In this regard, the purpose of the proposed study is the development of technology for beverages based on curd whey with the use of phytoderivatives. As additives, syrup of rose hips and pine bark extract are used.

The scientific novelty of this work is that for the first time in the technology of dairy products the pine bark extract is used as a source of resveratrol. Resveratrol is the strongest antioxidant that can prevent oncological diseases, reduces the risk of osteoporosis, reduces the risk of diseases of the nervous system, is effective for the prevention and treatment of diabetes, Alzheimer's, Parkinson's, bronchial asthma, radiation injuries.

The authors of Ramos LR, Santos JS, Dagher H, Valesse AC, Cruz AG, Granato D, also discuss the latest developments in the dairy sector with regard to new products with herbal extracts, as well as the effect of plant extracts on the quality characteristics of yogurts, cheeses, fermented milk and ice cream [18].

The new technology of production of serum beverages based on phytoderivatives proposed in this article will expand the range of dairy products, increase biological value and promote the creation

of a new line of dairy products with pronounced antioxidant properties.

At present, the useful properties of natural antioxidants are widely known and confirmed by many authoritative medical organizations of different countries: the World Health Organization, the National Cancer Institute in the United States, the US, England, Russia Institute of Biochemical Physics RAS. N.M. Emanuel [18, 19]. In this regard, many countries are developing programs of antioxidant protection of the population.

Experimental studies were carried out on the basis of the research laboratory of the department "Technology of food and processing industries" and at the Kazakh Academy of Nutrition "Nutritest" LLP. The general scheme of the work is presented in Figure 3. The studies were carried out in stages.

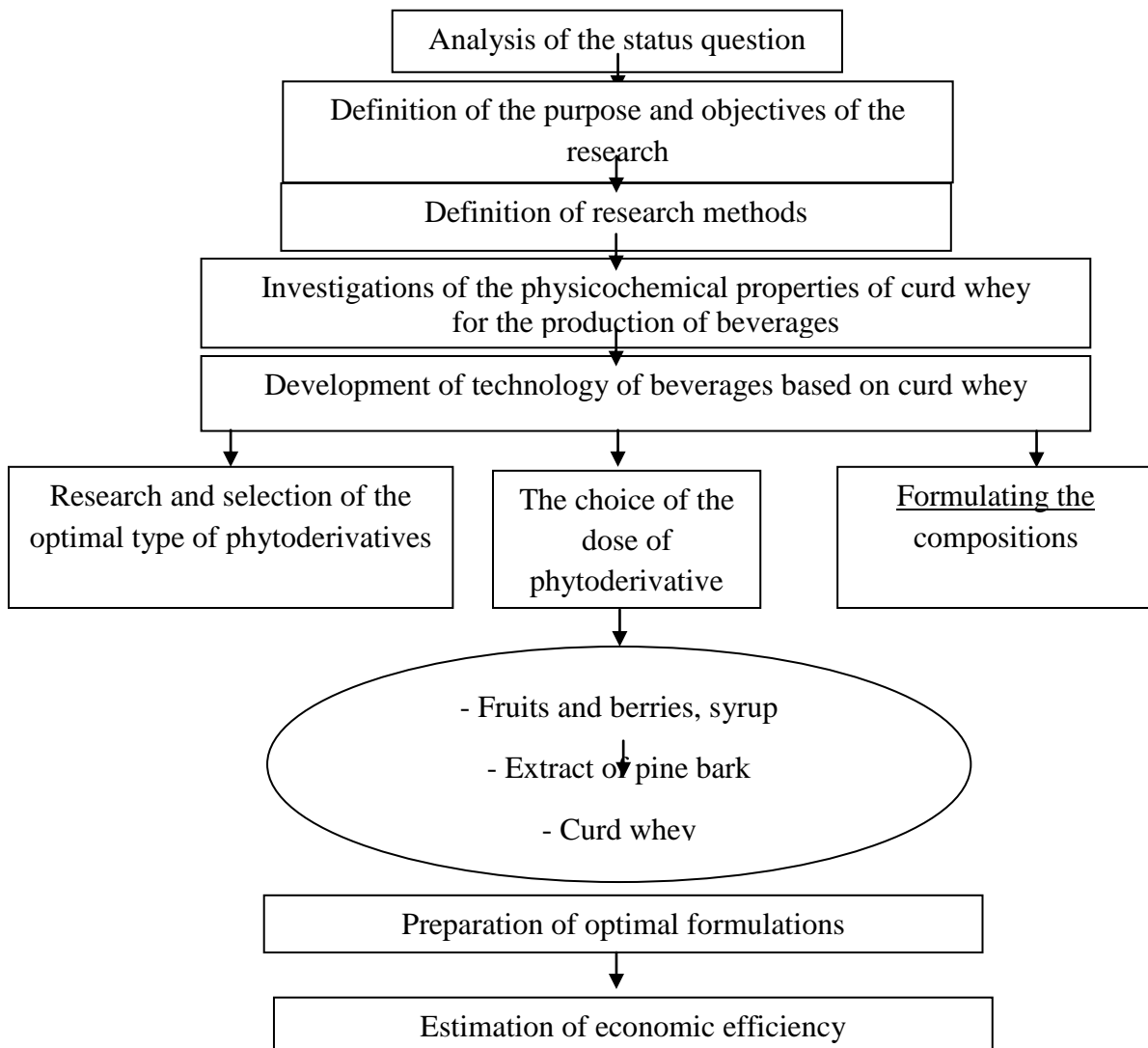


Figure 3. Block diagram of the algorithm for performing experiments

As a raw material, curd whey was used. As fillers were used:

- rose hips syrup; infusion of St. John's wort
- extract of pine bark;
- curd whey;
- sugar;

To determine the physico-chemical characteristics of the objects of research, conventional and standard methods were used. The

experiments were carried out in triplicate with subsequent processing of the data.

At the initial stage of the work, a physicochemical and organoleptic analysis of the curd whey was performed, which met all the requirements, the data are shown in Fig. 4. The correspondence of the serum under study to the norm makes it possible to further apply it as an object of study.

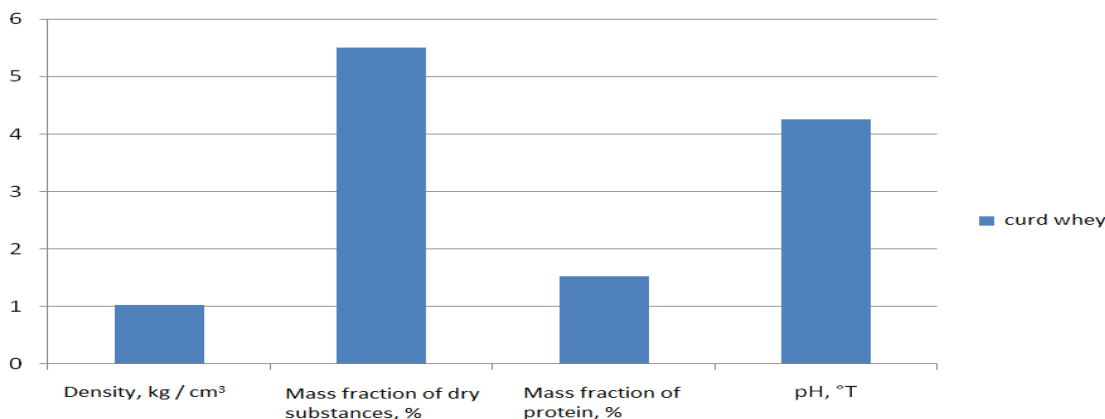


Figure 4. Physicochemical parameters of curd whey

In the technology of serum beverages, we decided to apply pine bark extract as a source of resveratrol, which is the strongest antioxidant, it is able to prevent oncological diseases [19]. Resveratrol activates the sirtuin gene. Thanks to the activation of this gene, there is an increase in the number of ribosomes in the cell responsible for the synthesis of protein and mitochondria, which are the energy stations of the body.

Water extract of the pine bark is used to prevent and treat hypo- and avitaminosis C. The pine bark contains vitamins C, K, B<sub>1</sub>, B<sub>2</sub>, P, carotene, tannins, organic acids. Tumors in the human body in very many cases are born due to diseases of the vascular system, medicine has proved that infusion of the pine bark perfectly restores the vessels and removes radionuclides, eliminating the cell from poisonous substances [20, 21]. Figure 5 shows the chemical composition of the pine bark.

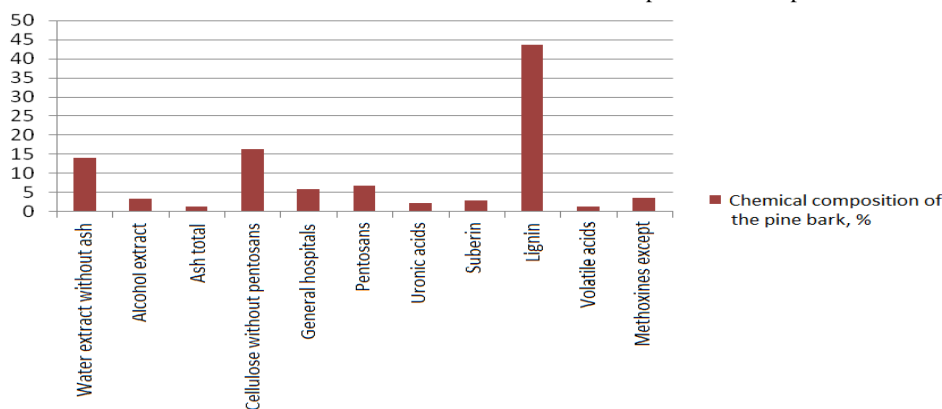


Figure 5. Chemical composition of the pine bark

The main feature of the bark - the content in it of a large number of extractive substances that can be extracted by various solvents.

### 3. Results and Their Discussion

To date, the problem of increasing cancer in the population of Akmola region is very acute. Table provides data on mortality from oncology diseases in Astana in 2016. Out of 864 people, 337 had diseases of the digestive system. Thus, research in the field of food products with anti-cancer diseases is highly advisable, especially in the northern regions of Kazakhstan. The high level of

oncological diseases is due to the fact that in this region the consumption of meat and meat products averages 64 kg per year per person, whereas the consumption rate is 48 kg. Thanks to the beneficial properties of resveratrol, adding it to food, it becomes possible to reduce this type of disease. And this justifies our choice of this raw material, as the main beneficiary.

Adding pine bark to the serum gave a slightly bitter taste, and it was decided to add the estimated amount of rose hips to increase the attractiveness of the taste. In the resulting serum beverage the necessary physicochemical analyzes were carried out, the results of which are given in Table 1.

Table 1. Effect of aromatic components on the quality of beverages based on curd whey

Name of conditional beverages	Density, kg / cm <sup>3</sup>	Acidity, °T	Dry substances, %	Mass fraction of protein, %	Mass fraction of lactose, %
Serum with bark of oak and rose hips syrup	1.019	25	13	1.1508	3.5

Thus, the whole complex of plant components was investigated for physicochemical properties and organoleptic indices, as a result of the research syrup of rose hips was selected, the combination of which with pine bark showed the most optimal indices and harmonious taste.

We tested different varieties of beverages containing syrup, pine bark infusion and serum in the following ratios: 5:30:65 (Sample 1), 10:30:60 (Sample 2), 20: 5: 75 (Sample 3). Based on the conducted organoleptic studies and chemical analyzes, the highest

score was obtained with beverages with the ratio of syrup: extract: serum - 10:30:60.

Thus, the dose of rose hips syrup is 10%, pine bark extract is 30%. This serum beverage was called "Karagai".

A curd whey beverage with a rose hips syrup composition and pine bark extract was prepared as follows: the curd whey was filtered, heated to a temperature of 93 ± 2 ° C, held for 30 minutes and cooled to 35 ° C for 5-6 hours for clarification, again filtered

and mixed with syrup and extract, cooled to a temperature of  $4 \pm 2$  °C.

A ready-made drink based on curd whey was examined for amino acid composition. Table 2 presents the amino acid composition of

curd whey and "Karagai" beverage. The investigations were carried out in the laboratory at a temperature of 18-210 °C, and a humidity of 68-72%.

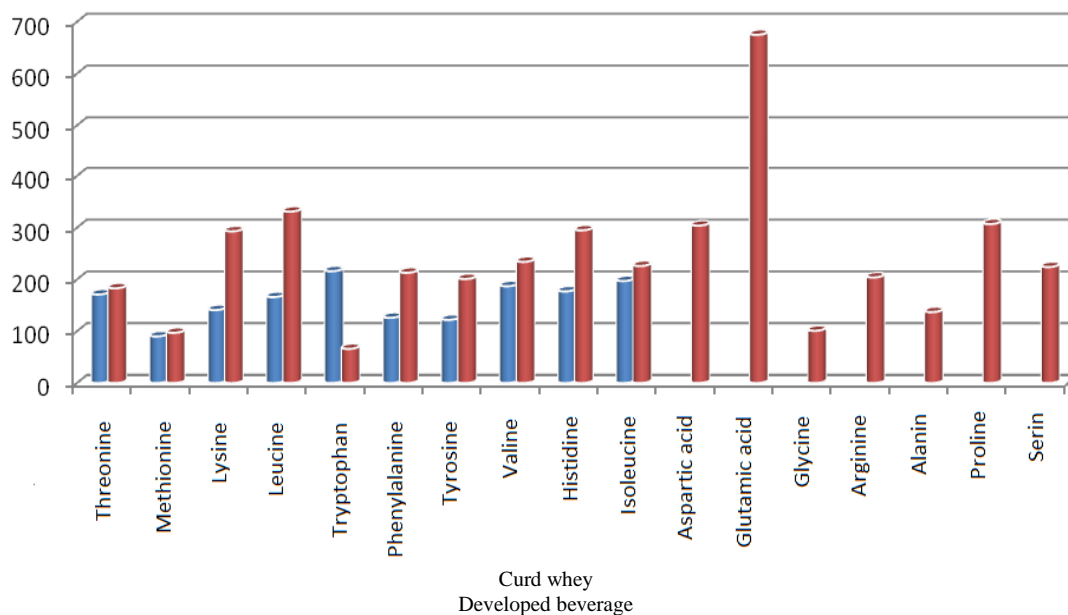
**Table 2.** Comparison of the amino acid composition of curd whey and "Karagai" beverage mg/100g

Amino acid composition, mg/100 g	Curd whey	"Karagai" beverage
Aspartic acid		304
Glutamic acid		675
Serin		224
Histidine	177	295
Glycine		101
Threonine	171	183
Arginine		204
Alanin		137
Tyrosine	122	201
Cysteine	39	40
Valine	187	234
Methionine	90	97
Phenylalanine	126	213
Leucine	166	331
Isoleucine	197	226
Lysine	141	293
Tryptophan	216	62
Proline		307
Total	1632	4128

Resveratrol, contained in the pine bark, is in the form of polyphenol-lignin. In the process of biosynthesis, lignin increases the content of essential amino acids, such as phenylalanine and tyrosine. That is, the data from Table 2 and Figure 6 indicate that the main component of the extract of pine bark has a beneficial effect on the composition of the serum beverage, increasing its essential amino acids several fold.

## 4. Conclusion

Making a conclusion on the results set forth in the table, the developed serum beverage with enrichment of pine bark extract and rose hips syrup, meets all standards and is safe for consumption in the human diet. Consequently, it can be argued that this product has a positive effect on human health.



**Figure 6.** Comparison of the amino acid composition of curd whey and the developed beverage "Karagai" mg/100 g

The developed technology of production of serum beverage with the enrichment of rose hips syrup, pine bark extract allows to improve the population nutrition structure due to the use of functional components that contribute to the satisfaction of human needs in food substances, as well as the expansion of the assortment of beverages in the consumer domestic market.

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