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Development Of Technology For Functional Drinks Using Fruit And Berry Raw Materials.

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ABSTRACT

In article are provided the results of research on studying of structure and properties of products of conversion of fruits of feijoa and blackberries and their use as a raw source of physiologically active agents for preparation of beverages of a functional purpose on the basis of grape juice.

Keywords: feijoa, blackberries, grape juice, extract, technology, functional drink.

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INTRODUCTION

In recent years, the world has been widely recognized the new direction of development of the food industry - the production of functional foods. The most perspective functional foods are drinks based on natural fruit juice, enriched with biologically active substances of plant origin. Research and development of such scientists, as G.M. Zajko, L.V. Donchenko, L.Ya. Rodionova, T.G. Prichko, I.A. Ilyin, G.A. Gorelikova, L.A. Maurnikova, E.A. Kazakova, M.V. Palagina, etc., devoted to the technology of their production.

Natural grape juice is one of the most important and valuable food and diet in relation to food component. Due to the fact that in the process of juice production lost part of macro- and microelements, amino acids, organic acids and vitamins, the preparation of drinks based on juice with the addition of physiologically active ingredients from plant material will help to balance the composition of grape juice on the content of biologically active substances and saturate it scarce macro- and micronutrients.

MATERIALS AND METHODS

The production of functional drinks based on grape juice is especially important due to the presence in the South of Russia is diverse and available raw materials base and modern high-performance equipment.

In our research as the bases of grape juice used juice of direct extraction from grapes Levokumsky. The variety is widespread in the south of Russia, and in the Stavropol territory it takes second place on the plantation area. The variety has good sugar content, resistance to various fungal diseases, pests and frost, allows sparing the chemical treatment that increases the environmental friendliness of products derived therefrom.

For juice production scheme was chosen, which provides for the processing of grapes with a short-term infusion mash, wort selection of 60 decalitres out of 1 ton of grapes, the resulting wort clarification by settling and is then pasteurized. The physical and chemical composition of grape juice are shown in Table 1.

Table 1: The physical and chemical composition of the grape juice of direct extraction

The composition of indicators	The juice of direct extraction from grapes Levokumsky
Mass fraction of soluble solids, %	26,81
Mass concentration of sugars, g/100 cm^3	24,05
The mass concentration of titratable acids equivalent tartaric, g / dm^3	3,73
pH	3,71
Density	1,101

In our studies, we used the fruits of feijoa and blackberries as components that have the functional orientation.

Selection of raw materials based on an analysis of published data on its chemical composition and pharmacological properties, the possibility of its harvesting in the south of Russia and the compatibility of organoleptic indicators of plants as part of drinks. Particular attention was paid to the absence of toxic substances, the presence of coloring and aromatic compounds as well as substances having antimicrobial, antioxidant effect.

Using feijoa and blackberries, which grow in the southern regions of Russia in large quantities, allows to expand the raw material base of domestic fruit processing factories, reduce the market share of food products, which include synthetic, chemically synthesized flavorings, reduce the cost of semi-finished products transportation, and hence reduce the cost of beverages of a functional purpose.

To use the pineapple guava and blackberry in the composition of their drink water extracts were prepared and studied their chemical composition.

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Research of feijoa extract showed a high content of vitamin C – 51,8 mg/dm^3, vitamin PP – 140,9 mg/dm^3 and phenol carbonic acids – 576,5 mg/dm^3 (Fig. 1).

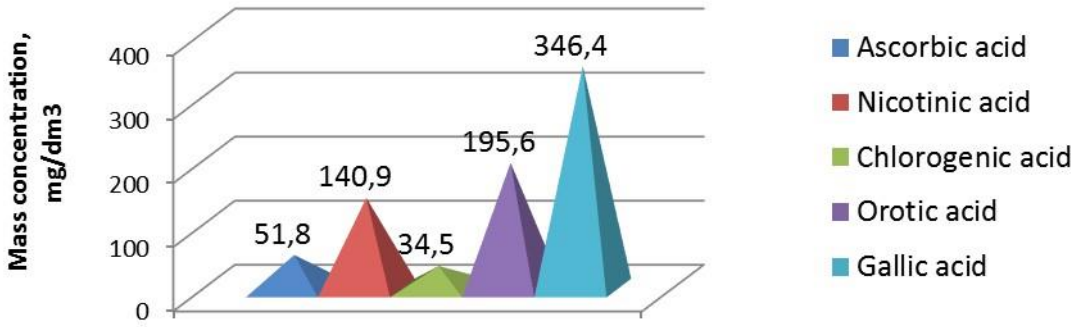

Figure 1: The content of vitamins and phenol carbonic acids in the extract of feijoa, mg/dm^3

The high concentration of the extract feijoa minerals. The potassium content in the test extract was 1648,0 mg/dm^3, calcium – 163,3 mg/dm^3. Furthermore, feijoa extract significant iodine content was found – 0,55 mg/dm^3, which is entirely absent in the grape juice.

A feature of physical and chemical composition of blackberry extract was the presence of a large number of phenolic compounds (1392,9 mg/dm^3), including anthocyanins, which the mass concentration was 143,7 mg/dm^3 (Table 2).

Table 2: The physical and chemical composition of blackberry extract

Name of indicator	The value of the indicator.
Mass fraction of soluble solids,%	5,01
Mass concentration of sugars, g/100 cm^3	4,00
Mass concentration of titratable acids in terms of malic acid g/dm^3	5,50
pH	3,77
The total amount of phenolic substances, mg/dm^3	1392,9
Anthocyanins, mg/dm^3	143,7

Also in blackberry extract was identified by a group of biologically active substances – vitamins (C and PP) and phenol carbonic acids (chlorogenic, caffeic, gallic, protocatechuic) (Fig 2). The greatest amount of nicotine contained (33,6 mg/dm^3) and caffeic acid (31,3 mg/dm^3). First discovered resveratrol (0,1 mg/dm^3), which is a phenolic compound with antioxidant and cardio effect.

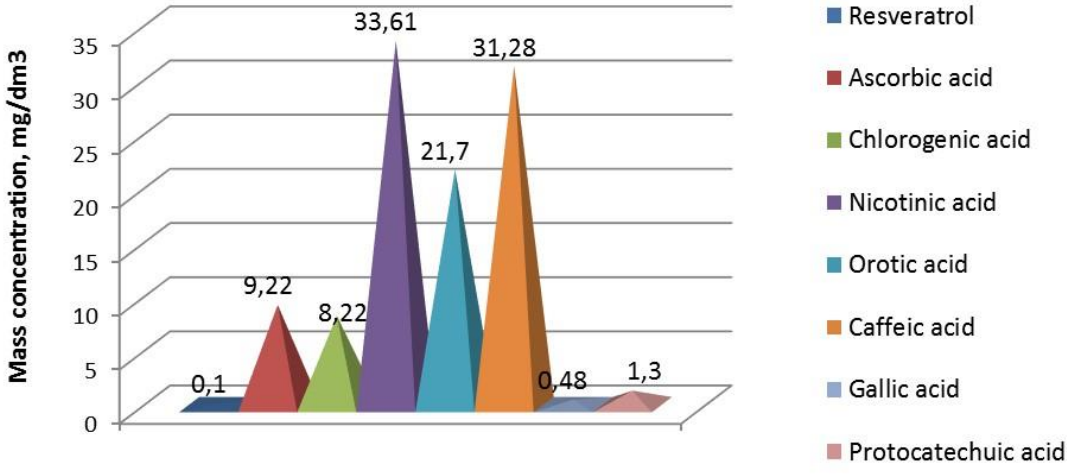

Figure 2: The content of vitamins and phenol carbonic acids in the extract of blackberry, mg/dm^3

These findings allow the use of extracts of feijoa and blackberry as additional sources of bioactive substances and because of their low sugar content, acidity and intense color, apply it for blending with the grape juice in order to optimize its physical and chemical composition and the harmonization of taste qualities.

When determining the optimum ratio of basic beverage ingredients in the composition as the main criteria were selected sensory characteristics of finished products. Range added in beverages extracts ranged from 10 to 30%.

As a result of tasting the highest scores were awarded to: for a drink from feijoa– option consists of 80% juice and 20% extract; for a drink with blackberry - option, which includes 85% juice and 15% extract. At a higher content of extract beverage taste became inharmonious and uncharacteristic products processing grapes, with less significant differences from grape juice were observed.

It was found that the addition of feijoa and blackberry extracts grape juice allowed to enrich its flavor and taste of the sophisticated tones with juniper, quince, tar and berry shades, enhance its color, and thus improve the quality of the finished beverage. Compared to grape juice tasting score beverages increased to 2,8-3 points.

As a result of investigation of physical and chemical composition of the obtained beverage it has been found that the introduction into beverages and feijoa blackberry extracts led to a decrease in their content of sugar, increasing the concentration of titratable acid and total phenolics. Furthermore, addition of blackberry extract it possible to increase the mass concentration of anthocyanins in the beverage from 44,4 to 66,6 mg/dm^3, provided that the finished product a bright and elegant color (Table 3).

Table 3: The physical and chemical composition of grape juice and beverages of a functional purpose on the basis

Name of indicator	The grape juice	Beverage with added feijoa	Beverage with added blackberry
Mass concentration of sugars, g/100 cm^3	24,4	20,0	19,6
Mass concentration of titratable acids in terms of tartaric, g/dm^3	3,7	4,5	6,0
pH	3,7	3,4	3,4
The total amount of phenolic substances, mg/dm^3	571,4	1285,7	549,3
Anthocyanins, mg/dm^3	44,4	22,2	66,6
Acidimetric indicator	66	44,1	32,7

Mass concentration of vitamins and phenol carbonic acids in the test beverage with the addition of feijoa extract was 195,44 mg/dm^3 (Fig 3).

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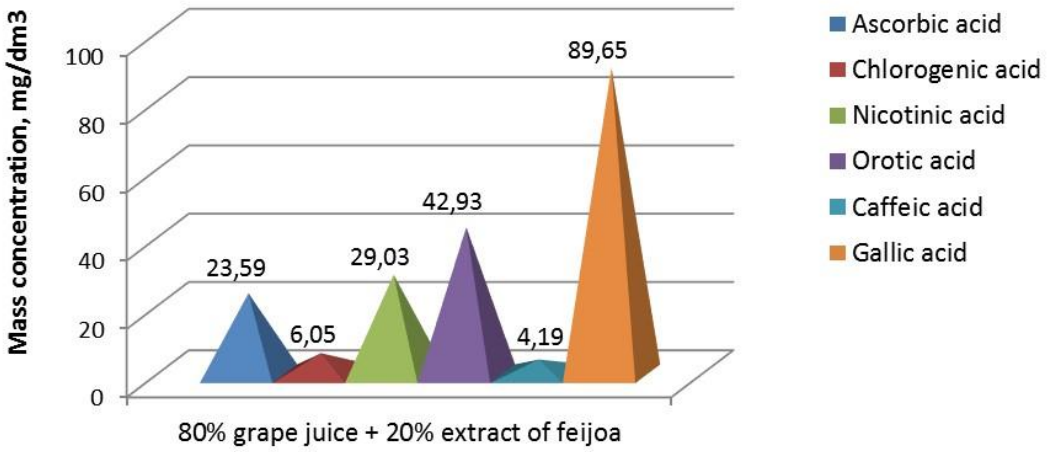

Figure 3: The content of vitamins and phenol carbonic acid in the drink of a functional purpose on the basis of grape juice and feijoa, mg/dm³

Introduction to the framework juice blackberry extract helped increase in 1,5-2 times the mass concentration of gallic, caffeic and orotic acids having P-vitamin activity in the beverage functionality.

Mineral the value of functional beverages due to their content of macro- and microelements (Table 4).

When making feijoa extract in the drink was identified iodine mass concentration which was 0,11 mg/dm³. In the investigated beverage with the introduction of blackberry extract is set for optimal assimilation of its ratio of calcium with magnesium is about 1:0,7.

Table 4: The content of macronutrients in beverages of a functional purpose on the basis of grape juice and feijoa, mg/dm³

Cation, mg/dm³	Beverage with added feijoa	Beverage with added blackberry
Potassium	1618,0	1325,0
Natrium	45,0	30,6
Magnesium	123,0	92,6
Calcium	137,0	121,3
Sum	1922,2	1569,5

Thus, the investigated beverages of a functional purpose by introducing into their structure feijoa and blackberry extract is rich in biologically active substances: vitamins, phenol carbonic acids, as well as macro- and microelements, necessary for normal functioning of the human organism. Contents of anthocyanins increased by 45% with the introduction of blackberry extract, which enhances and enriches the color of the finished beverage.

In assessing functional properties of the beverage it has been found that they include increased mass concentration of phenolcarboxylic acids and vitamins as compared with direct extraction of grape juice. At the same time the satisfaction of daily requirement for vitamins in the use of batch volume (300 ml) developed for a drink with feijoa ranged from 15 to 43,5%, in the macro-and micronutrients – up 63,3% from the norm. For beverages with blackberry this figure was from 5,5 to 16% (Table 5).

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Table 5: Comparative evaluation of the functional properties of the developed beverages

Name of physiologically functional ingredient	Daily requirement, mg	Providing daily needs,% of normal		
		grape juice (control)	drink based on grape juice and feijoa	drink based on grape juice and blackberry
Vitamin C	70	2	15	7
Vitamin PP	20	0,3	43,5	5,5
Potassium	2500	20	19,5	16
Magnesium	400	10,5	18,5	15
Iodine	0,15	-	22	-
Silicium	5	-	63,3	-

Indicators of toxicological and microbiological safety of drinks based on grape juice and plant extracts are normal and consistent with the requirements of the Technical Regulations of the Customs Union on juice products from fruits and vegetables.

RESULTS

The studies developed technological scheme of production of beverages of a functional purpose on the basis of grape juice (Fig 4).

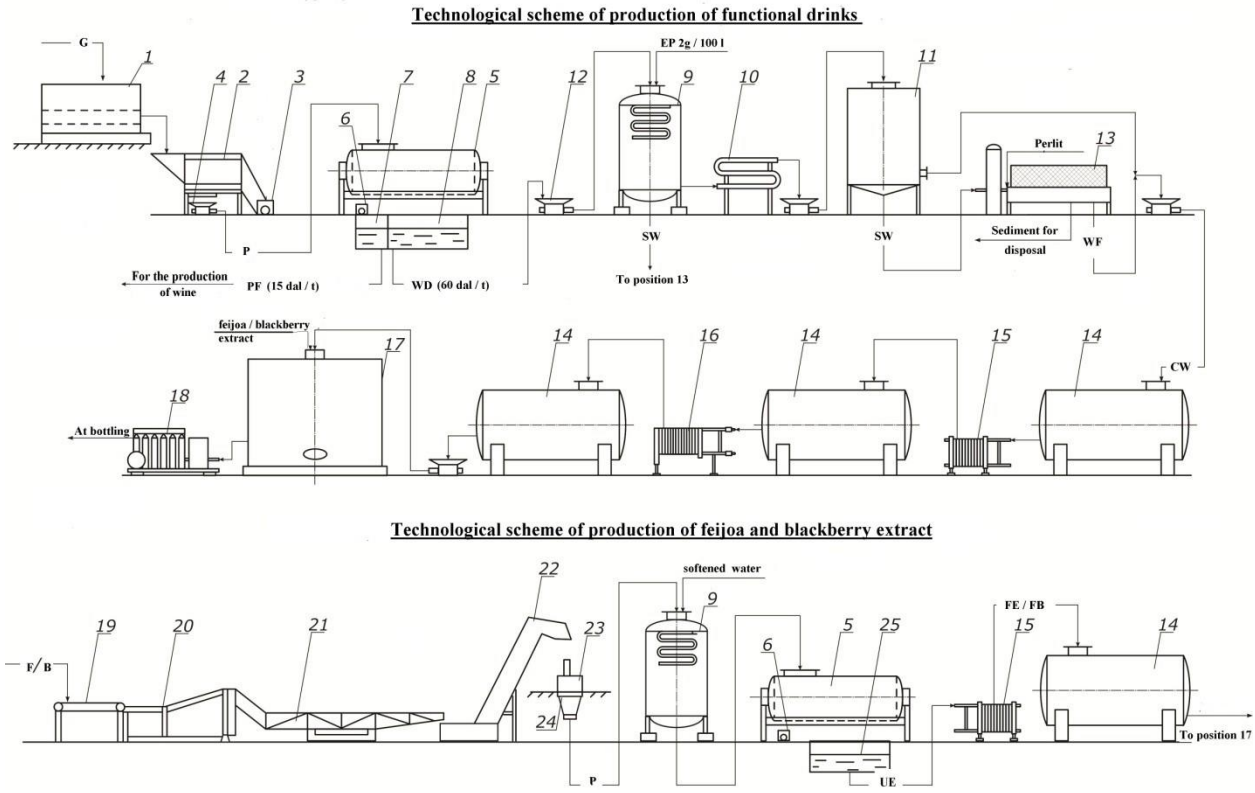

Figure 4: Technological scheme of production of functional drinks based on grape juice:

1 – feed hopper; 2 – crusher; 3 – conveyor; 4 – pump for pulp; 5 – pneumatic press; 6 – conveyor for pomace; 7 – sump for pressing fractions (PF) ; 8 – sump for wort-drift (WD); 9 – tank with agitator; 10 – cooler;11 – sump; 12 – pump; 13 – vacuum-perlite filter; 14 – tank; 15 – pasteurizer; 16 – ultra-cooler; 17 – blender; 18 – tangential membrane filter; 19 – roller conveyor; 20 – washer; 21 – sorting and inspection conveyor; 22 – elevator; 23 – crusher; 24 – conical tank; 25 – tank for extract; G – grapes; P – pulp; WD – wort-drift; PF – pressing fraction of wort; SW – sediment from wort, WF – wort filtrate; CW – clarified wort; F – feijoa fruit; UE – unpasteurized extract; B – blackberries; FE – feijoa extract; BE– blackberry extract

In the proposed technological scheme used modern high-performance equipment to receive high quality products and reduce the production costs.

The developed technology has been tested in the factory of «Wines and Beverages of Abkhazia» in Sukhumi (Abkhazia Republic).

Developed and approved technical documentation for the production of new grades of functional drinks «Energy. Feijoa» and «Energy. Blackberries». The results of research work implemented in the educational process of the department of production and processing of food products from of plant raw material of Stavropol State Agrarian University in Stavropol (Russia).

CONCLUSIONS

Thus, as a result of the research is scientifically proved and developed the technology functional purpose drinks with a high content of biologically active substances from the grape juice direct extraction using natural local herbs. The possibility of using the fruits of feijoa and blackberries as sources of biologically active components. Developed new formulations of beverages of a functional purpose and an assessment of their quality and safety. Established functional properties designed drinks, due to the high content of essential and nonessential amino acids, vitamins C and PP, phenol carbonic acids and organic acids, macro-and micronutrients.

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