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Research article

Development of technology for food concentrates of culinary sauces of increased nutritional and biological value

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Abstract: The goal of the work is to develop the technology for food concentrates of culinary sauces with the use of soy-pepper and soy-mushroom food additives. The object of research was dry mixtures of food concentrates of sauces with the addition of protein-vitamin concentrates (PVC), created on the basis of soya beans of variety Persona, selected by the All-Russian SRI of Soybean. The basis of PVC was the soya beans PVC is granules or flakes, which are dried to moisture content of 10–12% and grinded to a powdery condition. It was established that the inclusion of 15% PVC with pepper in the recipe of dry mixture «Sour-sweet sauce» and with a decrease in the amount of wheat flour and tomato powder, there is an increase in protein content by 33.7%, vitamin E by 52.3%, vitamin C by 55.2%, minerals by 11.8%. Replacing in the recipe of the food concentrate «Mushroom sauce» of mushrooms for PVC with mushrooms provides an increase in protein content by 14.3%, vitamin E by 20.0%, minerals by 5.2%. By organoleptic characteristics, they have a pronounced flavor and aroma, attractive appearance and color.

Keywords: soya beans; food concentrate; dry mixture; sauce; technology; nutritional value; protein; organoleptic characteristics

1. Introduction

A daily food ration should provide a person with all the necessary nutrients and energy. As a result of research conducted by nutritionists, it has been found that there is a significant deficiency of protein, polyunsaturated fatty acids, vitamins and some micro- and macro-elements in human nutrition, while carbohydrates and fats, on the contrary, are in excess. In this regard, scientists are faced with the

task of creating food additives, the chemical composition of which can increase the nutritional value of traditional dishes and food products, allowing balancing and enriching the human food ration and reducing the deficiency of many important nutritional elements [1]. In order to enrich products with protein, minerals, vitamins and fiber, as well as giving them different natural range of colors as a product containing biologically active substances, the plant raw materials (beans, vegetables, etc.) are widely used [2–5].

Sweet pepper is widely used in cooking. It is rich in minerals, vitamins C, A, group B. Mushrooms (ceps, orange-cap boletus, etc.) are a valuable product, allow to improve the taste properties of food and diversify nutrition. They contain 8–21% lipids, as well as a significant amount of extractive and aromatic substances that determine the taste properties. A relatively large amount of protein and chitin-like structure of fiber (fungin) bring mushrooms closer to meat products [6].

The Amur region comes first in soybean production in Russia. The protein contained in the beans of this agricultural crop is rich in amino acids, including essential. Therefore, soybean is a promising raw material for obtaining high-protein food additives and products. Numerous studies have established that the systematic usage of soy products greatly reduces the risk of the most common and dangerous diseases, such as atherosclerosis, coronary heart disease, hypertension, diabetes, etc. Soya beans contain large quantities of polyunsaturated fatty acids (PUFA), phospholipids, isoflavones, tocopherols, pectin, and other valuable substances that have a therapeutic effect on the human body [7–11].

Food concentrates are multi-component dry mixtures that are convenient for speedy cook at home. They are stored for a long time without special conditions, since they are deprived of most of the water. Currently, the range of food concentrates is quite wide. At present, dry mixtures of sauces have obtained a wide circulation due to the simplicity of their usage and the possibility of application when preparing a large assortment of culinary dishes. Improving the production technology of food concentrates, with the inclusion of soy additives in the composition, will expand the product range of this group [12–14].

The goal of research: development of technology for food concentrates of culinary sauces with the increased nutritional and biological value using soy-pepper and soy-mushroom food additives.

In this connection, it was necessary to solve the following tasks:

- develop recipes and technology of food concentrates «Sour-sweet sauce with PVC» and «Mushroom sauce with PVC» using the food additives based on soya beans, mushrooms and sweet pepper;
- substantiate the dosage of the combined food additives introduced into the dry mixtures of sauces;
- conduct a comparative assessment of the nutritional and biological value of analogues and developed food concentrates;
- evaluate organoleptic characteristics of analogues and developed food concentrates.

2. Materials and methods

The object of research was dry mixtures of food concentrates of sauces with the addition of PVC, created on the basis of soya beans. To increase the taste and organoleptic properties of PVC, dried mushrooms (Technical specifications (TS) 9164-014-23158063-10, OOO «Si-Product») and fresh sweet pepper (GOST 34325-2017) were introduced into their composition. The basis of PVC was the soya beans of variety Persona, selected by the FSBSI ARSRI of Soybean (patent no. 6857 of March 19, 2013).

The chemical composition of food concentrates «Sour-sweet sauce with PVC» and «Mushroom sauce with PVC» was determined by the following methods: fat, protein, carbohydrates, amino acids, minerals (potassium, phosphorus, calcium, magnesium) and fiber were determined with the use of «FOSSNIR System 5000» infrared scanner by the near-infrared spectroscopy method; moisture—by the method of drying to constant mass; total ash content—by the method based on obtaining a residue of mineral substances, which is formed as a result of complete combustion of the organic part of the product sample and the following gravimetric determination of the mass fraction for ash; vitamin C was determined by the titrimetric method, which is based on extracting vitamin C with a solution of hydrochloric acid followed by the titration with a potentiometric solution of sodium 2,6-dichlorophenolindophenolate until obtaining the light pink color; vitamin E—by the high-performance liquid chromatography method. The organoleptic indicators were studied by evaluating the appearance, color, smell, taste, consistency.

The following equipment was used to prepare PVC: SoyabellaSB-130 extractor (Tribest, China), press manual PI 10 for pressing the liquid fraction (CELMS, Italy), Veterok-5ESOF-0.5/220 dehydrator (Spektr-Pribor, Russia), electronic scales SF-400 (eTya, China), laboratory mill LZM-1 (Ukraine, «OLIS»).

The processing of experimental data was carried out with the use of Statistica 6.0.

The balance of amino acid composition of protein of analogues and model samples of food concentrates was assessed in comparison to the standard of FAO/WHO scale with the use of formalized indicators. A qualitative assessment of the being compared proteins is that the higher the values of balance coefficient of the amino acid composition (BCAC) or less than the value of the imbalance coefficient of the amino acid composition (ICAC) and the values of deflection coefficient of the amino acid composition (DCAC) from the reference ones, the better the essential amino acids are balanced and the more rational they are can be used by the body (ideally BCAC = 1; ICAC = 0, DCAC = 0) [15].

The results of sensory evaluation of ready meals, prepared from analogues and developed food concentrates, are described by the quantitative descriptor-profile analysis method. For this, the most significant organoleptic properties of the developed products and their analogues (descriptors) were determined, and in order to obtain a numerical parameter for intensity perception of sensory attribute, the graphic profilograms were constructed using an intensity scale of descriptors. The construction of organoleptic profiles was performed on clusters (descriptors): appearance; consistency; characteristics of taste, aroma and flavor [16].

3. Results and its discussion

As a result of the conducted research, the technologies for preparation of PVC have been developed, which are valuable nutrient additives, rich in protein, fat, and minerals. PVC contain significant amounts of vitamins E, C and can be used to enrich food products (Tables 1, 2 and 3), that is consistent with the literature data [17–19].

3.1. Technology of cooking PVC with pepper

Soya beans are inspected, removing damaged and faulty specimens, washed and soaked in water at a temperature of 18–20 ℃ for swelling. Red sweet fresh pepper are washed, cleaned and divided

into pieces with the size of the faces 10 × 10 mm. The swollen soya beans are separated from the water and mixed with the cut pepper. Water is added to the mixture in a ratio of 1:6 and extracted it to obtain a soy-pepper suspension. The suspension is filtered, separating the liquid and solid fractions. For the formation of a coagulation structure, a combined coagulant consisting of a composition of ascorbic and succinic acids, taken in a 2:1 ratio, is introduced into the liquid fraction. At the end of the process of structure formation, the formed clot is separated from the formed serum by pressing. The clot is molded in the form of flakes, bringing them to a moisture content of 10% by convective drying [20].

3.2. Technology of cooking PVC with mushrooms

After inspection and washing, soya beans are soaked in water at 18–20 ℃. In order to obtain a soy-mushroom PVC, a mixture of dried ceps and orange-cap boletus are used. Dried orange-cap boletus and ceps in a ratio of 1:2 are soaked in water for swelling, washed in running water to remove extraneous impurities and purify from mucilaginous materials. Mushrooms are grinded up into pieces with a face size of not more than 10 mm and mixed with the swollen beans in a ratio of 1:1. Water is added to the mixture in a ratio of 1:6 and extracted to obtain a soy-mushroom suspension. The suspension is filtered, separating into the liquid and solid fractions. Ascorbic acid solution is added to the liquid fraction to coagulate protein substances. The formed clot is separated from the serum by pressing, molded granules with a diameter of 5–6 mm and dried by convective drying to a moisture content of not more than 12%.

Table 1. Organoleptic characteristics of PVC.

Indicators	Characteristic	
	PVC with mushrooms	PVC with pepper
Appearance	Dry granules with a rough surface, the same size throughout the mass, without foreign inclusions	Dry granules with a rough surface, the same size throughout the mass, without foreign inclusions
Consistency	Particles are porous, fragile, moderately breakable	Particles are porous, fragile, moderately breakable
Color	From brown to dark-brown with shades	Light red (color of pepper), homogeneous by the whole mass with shades, uniform throughout the mass
Smell	Moderately pronounced, pleasant, with the aroma of mushrooms without foreign smell	Moderately pronounced, pleasant, with the aroma of pepper without foreign smell
Taste	Moderately pronounced, pleasant, with mushroom taste without foreign flavor	Moderately pronounced, pleasant, with pepper taste without foreign flavor

As a result of the above-mentioned operations, soy-pepper and soy-mushroom *solid fractions* are obtained. They are rich in protein (13.3–15.2%) and fiber (22.3–25.8%) with a water content of 9.0–9.3%, and they can also be used as enriching food additives in the production of traditional foodstuffs [19,21,22].

Dried PVC, obtained in this way, was used as additives in the manufacture of food concentrates of culinary sauces [20].

«Sour-sweet sauce» and «Mushroom sauce» is taken as a basis. PVC was introduced into the composition of dry mixtures in powder form. This is due to the fact that the culinary sauces are powdered mixtures with evenly distributed recipe components. Granulated PVC do not allow to achieve the required structural and mechanical characteristics, they are not destroyed during rehydration and cooking, retain their shape, and thus have a bad influence on the viscosity and fluidity of the colloidal system of the finished sauce [20,23].

Table 2. Nutritional value of PVC (the number of replicates in the experiment is 4).

Name of product	Mass fraction (%)						Energy value, kilocalories
	water	protein	fat	carbohydrates	dietary fibers	minerals	
Soy-pepper PVC	10.0 ± 0.1	3.1 ± 0.1	7.4 ± 0.1	33.3 ± 0.5	7.2 ± 0.1	12.0 ± 0.2	320.0
Soy-mushroom PVC	12.0 ± 0.1	43.7 ± 0.4	17.2 ± 0.2	13.6 ± 0.2	5.8 ± 0.1	7.7 ± 0.1	384.0

Table 3. Mass fraction of minerals and vitamins in PVC (the number of replicates in the experiment is 4).

Name of product	Mass fraction (mg/100 g)					
	K	P	Ca	Mg	vitamin E	vitamin C
Soy-pepper PVC	2701 ± 26	1244 ± 12	608 ± 8	583 ± 6	9.6 ± 0.1	150 ± 2
Soy-mushroom PVC	1977 ± 20	312 ± 5	558 ± 6	507 ± 5	10.6 ± 0.1	148 ± 2

3.3. Technology of cooking sauces with PVC

Dried PVC are inspected (remove extraneous impurities and nonstandard particles), grinded up to a particle size of 0.05–0.10 mm through the mill and sieved. Dried onion and garlic are dried a little to a moisture content of not more than 6%, then inspected, grinded up by the mill, sieved through a wire-cloth sieve No. 0.5–0.8. Wheat flour is dried a little at a temperature of 100–110 ℃ to a golden color and humidity of 8.0–9.5% and sieved through a wire-cloth sieve No. 1.2–1.6. Granulated sugar and edible salt are sieved through the wire-cloth sieve No. 2.0–2.5. Salt with moisture more than 1% is dried a little. Ground black pepper and tomato powder are inspected and sieved. Bay leaf and allspice are inspected, grinded up by the mill and sieved with the wire-cloth sieve No. 0.5–0.8. The components are dosed out according to the recipe and loaded into the mixer in the following sequence: flour, grinded PVC, tomato powder, grinded onion and garlic, granulated sugar, edible salt, pepper, bay leaf. Mixing is carried out for 5–7 minutes, up to obtaining a uniform, evenly colored mass [23].

The resulting products are a powdered mixture of light-red («Sour-sweet sauce with PVC») or brown-gray («Mushroom sauce with PVC») color with grinded particles of vegetables, PVC and spicery, the components are evenly distributed throughout the product mass (Figure 1). The shelf life of the finished product is 6 months at a temperature of not more than 20 ℃ and a relative air humidity of not more than 75%.

1 *2*

Figure 1. Appearance of dry mixtures of culinary sauces: *1*) sour-sweet sauce with PVC; *2*) mushroom sauce with PVC.

The following variants for the preparation of sauces with PVC have been studied:

Sour-sweet sauce with PVC Soy-pepper PVC was introduced in the model recipe of food concentrate of sour-sweet sauce in the amount of 15, 20 and 25%, of the total mass of dry mixture of the sauce, thus replacing 5% of wheat flour and 10, 15 and 20% of tomato powder of the product mass [Gulyaev *et al*., 1984]. In the course of the experiment with the change of the main factors within the limits of variation levels, a mathematical model for the organoleptic evaluation of the sauce in the form of a multiple regression equation was obtained. The main criterion of the quality of the finished product was a comprehensive assessment (Y in points), the formation of which was influenced by the most significant factors, such as a mass fraction of PVC in powder form (X_1, %), consistency (X_2, in points) and taste (X_3, in points):

$$Y = 46.6667 – 0.1467X_1 + 3.7333X_2 – 0.6445X_3 \rightarrow 100 \text{ points} \quad (1)$$

Based on the obtained mathematical model (1), it was established that the mass fraction of PVC in powder form (X_1) amounts to 15% of the total mass of the dry mixture, at the same time a comprehensive assessment (Y_1) amounts to 99.8 points, of which 20 points is a consistency (X_2), 30 points—taste (X_3);

Mushroom sauce with PVC Soy-mushroom PVC was introduced in the recipe of mushroom sauce in the amount of 15, 20 and 25% instead of dried ceps, increasing or decreasing the amount of wheat flour [Gulyaev *et al*., 1984]. The mathematical model for this sauce is as follows:

$$Y = 84.4035 + 0.0933X_1 – 2.0966X_2 + 1.8244X_3 \rightarrow 100 \text{ points} \quad (2)$$

In this case, the mass fraction of PVC in the powdered form (X_1) is 20% of the total mass of the dry mixture. Comprehensive assessment (Y_2) amounted to 99.7 points, of which 19.7 points is consistency (X_2), 30 points is taste (X_3).

The results of the organoleptic evaluation reveal the difference in taste and in consistency of the finished sauces prepared with different amounts of PVC in the recipe of dry mixtures. This makes it possible not only to assess the quality level of products on a five-point scale, but also to obtain mathematical models that allow determining the optimal values of factors-mass fractions of soy-pepper and soy-mushroom PVC.

The optimal mass fraction of soy-pepper PVC in the sour-sweet sauce is 15%, at replacing 5% of wheat flour and 10% of tomato powder of the total mass of the dry mixture. This leads to an

improvement in the taste of the finished dish due to some reduction in the sour taste of tomatoes, the obtaining of an additional piquant pepper flavor and the formation of a more liquid consistency due to a decrease in the amount of wheat flour.

The reducing wheat flour in the recipe by more than 5% of the total mass of the product led to the formation of an excessively liquid and fluid consistency not inherent in sauces. The introduction of more soy-pepper PVC worsened the color and consistency of the product, led to the loss of taste and aroma of sour-sweet sauce, in accordance with its name.

The optimal mass fraction of soy-mushroom PVC in the mushroom sauce is 20%, with a complete replacement of the dried ceps in the recipe of food concentrate. The introduction of soy-mushroom PVC in a smaller amount influenced the mushroom flavor strength, and a larger amount of PVC worsened the color and consistency of the sauce.

The obtained indicators formed the basis for creating recipes for food concentrates of culinary sauces with the use of PVC (Tables 4, 5).

Table 4. The recipe of food concentrates «Sour-sweet sauce» and «Sour-sweet sauce with PVC», %.

Name of the component	Sour-sweet sauce (analogue)	Sour-sweet sauce with PVC (development)
Wheat flour extra class	19.0	14.0
Tomato powder	48.0	38.0
Granulated sugar	15.0	15.0
Edible salt	11.7	11.7
Dried onion	3.0	3.0
Dried garlic	2.0	2.0
Mustard (powder)	0.6	0.6
Allspice	0.2	0.2
Bay leaf	0.3	0.3
Ground black pepper	0.2	0.2
Soy-pepper PVC	–	15.0
Total	100	100

Table 5. The recipe of food concentrates «Mushroom sauce» and «Mushroom sauce with PVC», %.

Name of the component	Mushroom sauce (analogue)	Mushroom sauce with PVC (development)
Wheat flour extra class	56.8	54.8
Dried ceps	20.0	–
Dried bulb onion	12.0	12.0
Salt	8.0	10.0
Granulated sugar	3.0	3.0
Ground black pepper	0.2	0.2
Soy-mushroom PVC	–	20.0
Total	100.0	100.0

The sequence of technological operations for obtaining dry mixtures of sauces is shown in Figure 2. The results of the analysis of the chemical composition of the studied sauces are shown in Table 6.

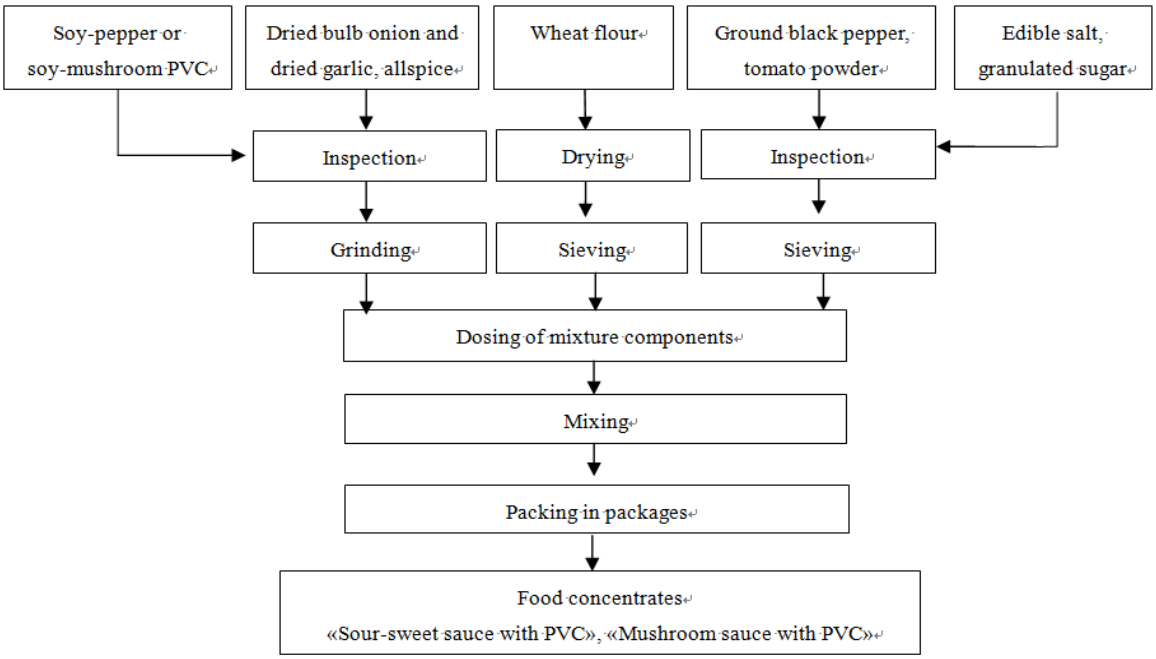

Figure 2. Technological scheme for obtaining food concentrates: «Sour-sweet sauce with PVC», «Mushroom sauce with PVC».

Table 6. The chemical composition of food concentrates of sauces (per 100 g of dry product).

Indicators	Sour-sweet sauce		Mushroom sauce	
	Without PVC	With PVC	without PVC	With PVC
Water, g	9.0	9.0	9.0	9.0
Protein, g	8.9	11.9	14.7	16.8
Fat, g	1.0	1.5	4.8	5.2
Carbohydrates, g	62.9	59.2	52.0	49.4
Dietary fibers, g	8.9	8.0	7.9	7.4
Vitamin E, mg	4.4	6.7	2.0	2.4
Vitamin C, mg	29	45	32	32
Minerals (g), including:	9.3	10.4	11.6	12.2
Potassium, mg	1008	1183	984	589
Phosphorus, mg	186	323	218	159
Calcium, mg	135	201	83	181
Magnesium, mg	96	157	41	122
Energy value, kilocalories	313.0	311.5	310.0	311.6

The introduction of 15% soy-pepper PVC into the sauce recipe provides an increase in protein content by 33.7%, vitamin E by 52.2%, minerals by 11.8%. At the same time, there is a decrease in carbohydrate content by 5.9%. Replacing dried ceps in the recipe of food concentrate «Mushroom sauce» by soy-mushroom PVC provides an increase in protein content by 14.3%, vegetable fat by 8.3%, vitamin E by 20.0%, minerals by 5.2%, including calcium by 98 mg and magnesium by 81 mg,

while reducing the carbohydrate content by 5.0% per 100 g of the product relative to the analogue. The caloric content of products practically does not change.

A comparative assessment of the protein quality according to amino acid composition, presented in Tables 7 and 8, characterizes the being studied model systems as biologically valuable. These indicators change slightly in dry mixtures «Mushroom sauce with PVC», however, the deflection coefficient of the values of amino acid composition improves in comparison to the reference ones (from 4.14 to 1.86), that indicates an improvement in the qualitative composition of protein relative to the analogue. At the same time, almost all indicators of the balance of amino acid composition in the food concentrate «Sour-sweet sauce with PVC» get better relative to the analogue [15,24].

Table 7. Comparative characteristics of the balance of the amino acid composition of food concentrate «Mushroom sauce» and «Mushroom sauce with PVC».

Indicator	Standard according to FAO/WHO scale		Mushroom sauce (analogue)			Mushroom sauce with PVC (development)		
	amino acid, g/100 g	score, unit fractions	amino acid, g/100 g	score, unit fractions	UCEA, unit fractions	amino acid, g/100 g	score, unit fractions	UCEA, unit fractions
Valine	5.0	1.0	4.56	0.91	1.00	4.96	0.99	0.83
Isoleucine	4.0	1.0	3.95	0.99	0.92	4.65	1.16	0.71
Leucine	7.0	1.0	7.26	1.04	0.88	7.43	1.06	0.77
Lysine	5.5	1.0	5.25	0.95	0.95	4.52	0.82	1.00
Threonine	4.0	1.0	4.11	1.03	0.89	3.72	0.93	0.88
Methionine + cystine	3.5	1.0	3.75	1.07	0.85	3.54	1.01	0.81
Phenylalanine + tyrosine	6.0	1.0	9.58	1.60	0.57	8.59	1.43	0.57
Tryptophan	1.0	1.0	4.55	4.55	0.20	2.45	2.45	0.33
Sum of amino acids	36.0	–	43.01	–	–	39.86	–	–
Indicators of balance of amino acid composition								
C_{min}, unit fractions	1.0		0.91			0.82		
BCAC, unit fractions	1.0		0.76			0.74		
ICAC, unit fractions	0		0.24			0.26		
CRI, g/100 g of protein	→min		11.26			12.61		
EAA index	→1.0		1.28			1.16		
DCAC	0		4.14			1.86		

Note: UCEA—utilization coefficient of the essential amino acid; C_{min}—amino-acid score; BCAC—balance coefficient of the amino acid composition; ICAC—imbalance coefficient of the amino acid composition; CRI—«comparable redundancy» indicator; EAA index—essential amino acid index; DCAC—deflection coefficient of the amino acid composition from the reference ones.

Table 8. Comparative characteristics of the balance of amino acid composition of food concentrate «Sour-sweet sauce» and «Sour-sweet sauce with PVC».

Indicator	Standard according to FAO/WHO scale		Sour-sweet sauce (analogue)			Sour-sweet sauce with PVC (development)		
	amino acid, g/100 g	score, unit fractions	amino acid, g/100 g	score, unit fractions	UCEA, unit fractions	amino acid, g/100 g	score, unit fractions	UCEA, unit fractions
Valine	5.0	1.0	3.24	0.65	0.35	3.79	0.76	0.59
Isoleucine	4.0	1.0	1.72	0.43	0.53	2.51	0.63	0.72
Leucine	7.0	1.0	4.69	0.67	0.34	5.22	0.75	0.60
Lysine	5.5	1.0	1.24	0.23	1.02	2.45	0.45	1.01
Threonine	4.0	1.0	2.90	0.73	0.32	3.15	0.79	0.57
Methionine + cystine	3.5	1.0	2.08	0.59	0.39	2.23	0.64	0.71
Phenylalanine + tyrosine	6.0	1.0	5.53	0.92	0.25	4.99	0.83	0.54
Tryptophan	1.0	1.0	0.96	0.96	0.24	1.01	1.01	0.45
Sum of amino acids	36.0	–	22.36	–	–	25.35	–	–
Indicators of balance of amino acid composition								
C_{min}, unit fractions	1.0		0.23			0.45		
BCAC, unit fractions	1.0		0.37			0.64		
ICAC, unit fractions	0		0.63			0.36		
CRI, g/100 g of protein	→min		61.22			20.33		
EAA index	→1.0		0.61			0.72		
DCAC	0		2.83			2.16		

The analysis of the quality of the obtained food products by organoleptic indicators in accordance with the five-point assessment scale was conducted at the degustation meeting [25]. To prepare control samples of culinary sauces, 25 g of the obtained dry mixture was taken, than 200 mL of room temperature water was poured in it, mixed thoroughly, brought to a boil and cooked for 7–10 minutes. The results of sensory evaluation of ready meals, prepared from analogues and developed food concentrates, are described using the quantitative descriptor-profile analysis method (Figure 3, 4) [16].

The profiles of organoleptic evaluation of culinary mushroom sauce and mushroom sauce with soy-mushroom PVC differed from each other by some parameters. The presence of grinded particles of soy-mushroom PVC of gray color and brown shade were observed in the developed sauce and as a result, the sauce has become darker and more saturated in color in contrast to the analogue. At the same time, the intensity of mushroom taste in the developed product did not decrease. Both samples had a pleasant taste and smell of mushrooms, with the aroma of spices. The bean taste was almost not perceived in the given development.

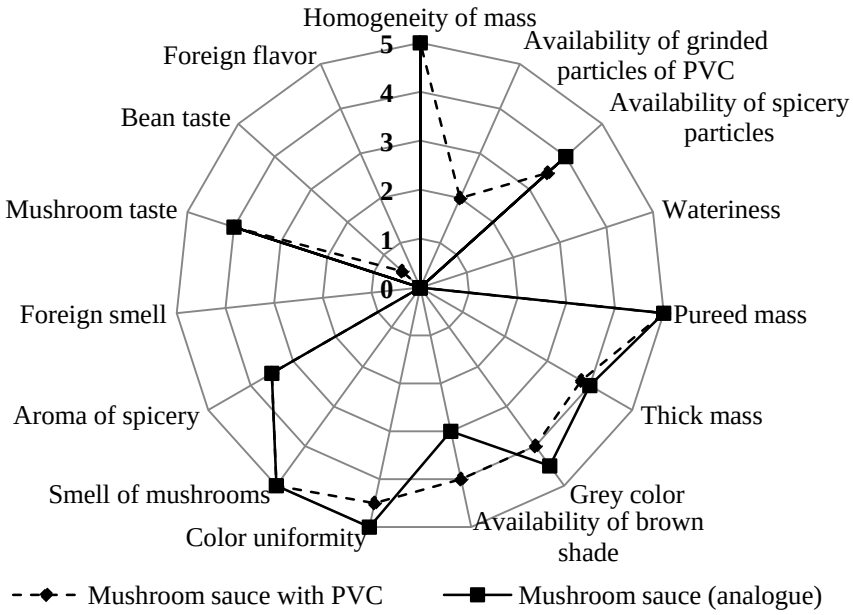

Figure 3. Sensory profile of mushroom culinary sauce with soy-mushroom PVC.

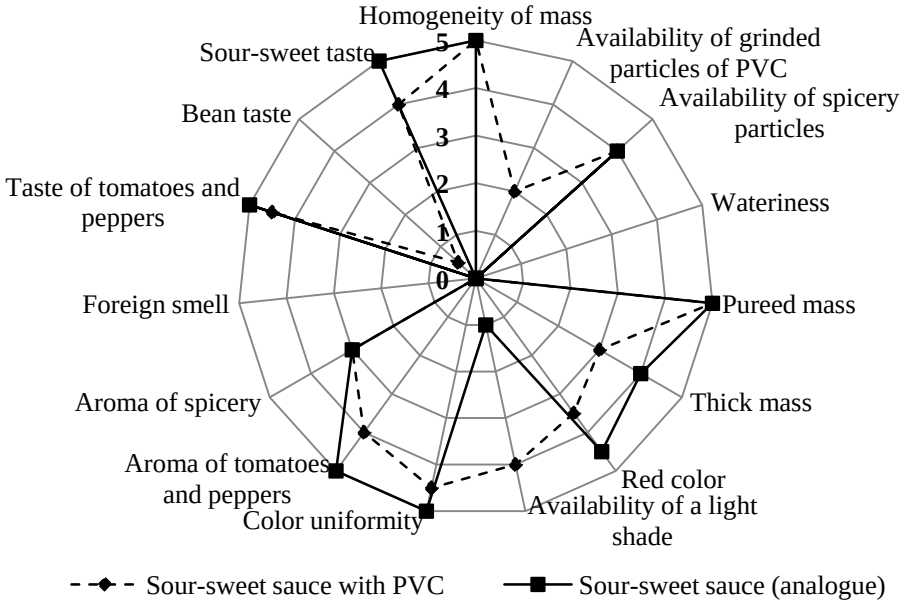

Figure 4. Sensory profile of sour-sweet culinary sauce with soy-pepper PVC.

Profiles of organoleptic evaluation of culinary sour-sweet sauce and sour-sweet sauce with soy-pepper PVC had distinctive features. Because of the presence of grinded particles of PVC of a light-red color in the developed product, the sauce had a lighter and less saturated color compared to the analogue. Due to the reduced content of the tomato powder in the recipe of the developed sauce, the intensity of the tomato taste has slightly decreased in it. This made it possible to obtain a product

with a more moderate and pleasant taste and aroma of tomato, pepper and spices. There was practically no bean taste in the sauce with soy-pepper PVC.

These indicators did not reduce the overall perception of the appearance and taste advantages of the developed products. The resulting sauces, like their analogues, had a high assessment of the organoleptic characteristics corresponding to the name of the culinary food product.

4. Conclusions

The technology for new types of food concentrates using PVC based on soya beans has been developed. As a result, the technologies for preparing food concentrates «Sour-sweet sauce» and «Mushroom sauce» were changed by introducing PVC into their recipes. Eventually, due to the partial or complete replacement of standard components, their nutritional and biological value is increased, relative to analogue. In particular, the protein content increases by 14.3–33.7%. The carbohydrate content decreases by 5.0–5.9%. The organoleptic and taste qualities of sauces are improved, that guarantees high quality of the developed food products and expands the range of manufactured food concentrates of culinary sauces.

The Russian Federation patent no. 2678073 «The method for preparing concentrate of the sauce with increased nutritional and biological value» was received for the food concentrate «Sour-sweet sauce with PVC».

For industrial production of the obtained products, the technical documentations were developed and approved (STO FSBSI ARSRI of Soybean 9199-006-00668442-2017 «Food concentrates. Mushroom sauce with protein-vitamin concentrate» and STO FSBSI ARSRI of Soybean 9199-005-00668442-2017 «Food concentrates. Sour-sweet sauce with protein-vitamin concentrate»).

Conflict of interest

The authors declare no conflict of interest.

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