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RESEARCH OF THE SOY OKARA IMPACT ON THE QUALITY INDICATORS OF MEAT CHOPPED SEMI-FINISHED PRODUCTS

[1]*M.A. ABSALIMOVA*, [1]L.K. BAIBOLOVA, [1]A.M. TAEVA, [2]I.A. GLOTOVA*

[1](«Almaty Technological University», Kazakhstan, 050012, Almaty, st. Tole Bi, 100)
[2](Voronezh State Agrarian University named after Emperor Peter I, Russian Federation, Voronezh)
Corresponding author e-mail: ustus93@mail.ru*

The article presents studies of the influence of the recipe composition, in particular, the mass fraction of herbal additives on the organoleptic, functional and technological properties of food systems of a combined composition using raw materials of animal (beef, lamb, poultry) and vegetable (soy okara, carrots) origin. The results of the study of soybean-minced okara for food safety indicators are also presented. The functional and technological indicators of meat chopped semi-finished products were also determined: moisture-binding capacity = 89.1%, water-holding capacity = 77.4%, fat-holding capacity = 83.2%. The output of meat chopped semi-finished products with PCC is 91%. The obtained values for the quality characteristics indicate the prospects of using this type of soybean-minced okara: directly for food, as well as for the production of minced meat semi-finished products, such as cutlets, minced meat, steaks; to design and optimize recipes for semi-finished products.

Key words: protein-carbohydrate compositions, output of finished products, soybean-minced meat, okara, meat chopped semi-finished products.

СОЯ ОҚАРАСЫНЫҢ ШАБЫЛҒАН ЕТ ЖАРТЫЛАЙ ФАБРИКАТТАРДЫҢ САПА КӨРСЕТКІШТЕРІНЕ ӘСЕРІН ЗЕРТТЕУ.

[1]М.А. АБСАЛИМОВА, [1]Л.К. БАЙБОЛОВА, [1]А.М. ТАЕВА, [2]И.А. ГЛОТОВА*

[1](«Алматы технологиялық университеті», Қазақстан, 050012, Алматы қ., Толе Би көш, 100)
[2](«Император Петр I атындағы Воронеж мемлекеттік аграрлық университеті», Воронеж қ, Ресей Федерациясы)
Автор-корреспонденттің электрондық поштасы: ustus93@ mail.ru*

Мақалада рецепт құрамының, атап айтқанда, жануар (сиыр, қой, құс еті) және өсімдік (соя окара, сәбіз) шикізатын пайдаланатын құрамаланған құрамдағы тағамдық жүйелердің органолептикалық, функционалдық және технологиялық қасиеттеріне шөптік қоспалардың массалық үлесіне әсері туралы зерттеулер берілген. Сондай-ақ азық-түлік қауіпсіздігі көрсеткіштері үшін тартылған соя окараны зерттеу нәтижелері берілген. Шабылған жартылай фабрикаттардың физика-химиялық көрсеткіштері де анықталды: ҚҚС = 89,1%, ҚҚС = 77,4%, ЖҰС = 83,2%. АКК қосылған шабылған жартылай фабрикаттардың шығуы 91% құрайды. Сапа сипаттамалары үшін алынған мәндер тартылған соя окарасының осы түрін пайдалану перспективаларын көрсетеді: тікелей тағамға, сондай-ақ котлеттер, тартылған ет, стейктер сияқты тартылған ет жартылай фабрикаттарын өндіру үшін; жартылай фабрикаттардың рецептураларын жобалау және оңтайландыру кезінде.

Негізгі сөздер: ақуыз-көмірсулы құрамдар, дайын өнімді шығару, тартылған соя окара, тартылған ет жартылай фабрикаттары.

ИССЛЕДОВАНИЕ ВЛИЯНИЯ СОЕВОГО ФАРША ОКАРЫ НА КАЧЕСТВЕННЫЕ ПОКАЗАТЕЛИ МЯСНЫХ РУБЛЕНЫХ ПОЛУФАБРИКАТОВ

[1]М.А. АБСАЛИМОВА, [1]Л.К. БАЙБОЛОВА, [1]А.М. ТАЕВА, [2]И.А. ГЛОТОВА*

[1](«Алматинский технологический университет», Казахстан, 050012, г. Алматы, ул. Толе Би, 100)
[2](ФГБОУ ВО «Воронежский государственный аграрный университет имени императора Петра I», Российская Федерация, г. Воронеж)
Электронная почта автора корреспондента: ustus93@mail.ru*

В статье приведены исследования влияния рецептурного состава, в частности, массовой доли растительных добавок на органолептические, функционально-технологические свойства пищевых систем комбинированного состава с использованием сырья животного (говядина, баранина, мясо птицы) и растительного (соевая окара, морковь) происхождения. Также приведены результаты исследования соевого фарша окары на показатели пищевой безопасности. Определены такие функционально-технологические показатели мясных рубленых полуфабрикатов, как: ВСС = 89,1%, ВУС = 77,4%, ЖУС = 83,2%. Выход мясных рубленых полуфабрикатов с БУК 91 %. Полученные значения для качественных характеристик свидетельствуют о перспективах использования данного вида соевого фарша окары: непосредственно в пищу, а также для производства мясных рубленых полуфабрикатов, таких как котлеты, мясной фарш, бифштексы; при проектировании и оптимизации рецептур полуфабрикатов.

Ключевые слова: белково-углеводные композиции, выход готовых изделий, соевый фарш, окара, мясные рубленые полуфабрикаты.

Introduction

Products represent the predominant share of protein technology ingredients on the Kazakhstan market (primarily soy concentrates, isolates and textured forms) from foreign manufacturing firms. As for domestic large-tonnage protein ingredients, soybean meal dominates among them. At the same time, our country has large potential resources of vegetable protein-carbohydrate raw materials, which are limitedly used in the technology of meat products due to the lack of scientifically grounded recommendations for their use.

Biopolymers in the basis of fillers or meat raw material substitutes can be of protein (for example, soy or other types of plant protein isolates) or polysaccharide nature (various types of fibre preparations), but the best economic and technological effect is achieved by combining proteins and polysaccharides in protein-carbohydrate compositions. An additional effect is achieved by a complementary combination of protein preparations from plant and animal sources (e.g., a combination of soy protein and collagen animal protein preparations). As a rule, the initial components of protein-carbohydrate compositions of PCC are presented in the form of powders with equilibrium moisture [1, 2, 3].

The functional orientation of food systems is given by physiologically active ingredients, which primarily include protein-carbohydrate compositions, an acute deficiency of which is observed in food diets. It should be noted that raw materials of animal origin practically do not contain this functional ingredient and are the most suitable object for enrichment. In this regard, the search for new raw materials for the production of PCC is an important task.

In the production of minced meat products, the task of expanding the sources of protein preparations through alternative legume crops - lentils, chickpeas, lupines - is relevant. The potential of pseudo grain crops such as amaranth, buckwheat, and quinoa as sources of complex enrichment of meat products is not disclosed [4].

Materials and Research Methods

Objects and methods of research. The objects of research were experimental (№ 1 and № 2) and control (№ 3 and № 4) meat chopped semi-finished products (figure 1).

In the production of meat chopped semi-finished products, the following raw materials and materials were used:

- Chilled minced beef semi-finished product made from chilled raw materials (Flow charts 013/2930079);
- Minced lamb semi-finished chilled meat (TC 9214-001-99138198-07);
- Semi-finished minced chicken, made from chilled raw broiler chickens (Flow charts 012/2927598);

- Okara soya minced meat (SO 81952917-001-2013);
- Fresh carrots according to GOST 1721-85 "Fresh table carrots, procured and delivered. Technical conditions";
- Onions according to GOST 1723-2015 "Fresh onions for industrial processing. Technical conditions";
- Chicken eggs GOST 31654-2012 "Food chicken eggs. Technical conditions";
- Soy sauce according to SO 56887222-023-2015;
- Whey protein concentrate WPC-80 according to SO All-Russian Research Institute of Butter and Cheese Making 045-2019;
- Drinking water according to Sanitary rules and regulations 2.1.4.1074-01;
- Table salt according to GOST 51574-2000;
- a mixture of spices "Mix of peppers" (ground) according to TC 9199-001-52303135-2006.

The determination of heavy metals in okara soybean meal was carried out by atomic absorption research method. All measurements were carried out in accordance with the "MGA915/1000 Spectrometer Operation Manual". Data collection and processing with the subsequent formation of the report in a convenient form was carried out using the software included in the delivery set of the device.

Presumptive Bacillus cereus bacteria were counted using the horizontal method. The test for detection of Bacillus cereus was carried out according to the recommendations given in Annex A of the Interstate Standard - Foodstuffs. Methods for detection and determination of the number of E. coli bacteria (coliform bacteria) (GOST 31747-2012). When testing for detection and counting the number of yeasts and moulds was carried out inoculation and incubation in accordance with the interstate standard - Microbiology of food products and animal feed. Methods for detection and counting of yeasts and moulds. GOST 10444.12-2013.

In determining the moisture-binding capacity (WBC) by pressing a weight of minced meat (0.3 g) is weighed on a toric scales on a polyethylene cup with a diameter of 15-20 mm (the diameter of the circle must be equal to the diameter of the scale cup), then it is transferred to ashless filter 11 placed on a glass or plexiglass plate so that the sample was under the circle. The sample is covered with the same plate as the lower one, placed on it a weight of 1 kg and incubated for 10 min. The filter with the sample is then removed from the weight and the bottom plate, and a pencil is then used to outline the contour of the spot around the pressed meat. The outer contour is drawn as the filter paper dries in the air. The areas of the spots formed by the compacted meat and the adsorbed moisture are measured with a planimeter. The size of the wet spot (external) is calculated from the difference between the total area of the spot and the area of the spot formed by the meat. It has been experimentally established that 1 cm² of the wet spot area of the filter corresponds to 8.4 mg of water. The mass fraction of bound moisture by the pressing method is calculated according to the formulas:

$x_1 = (А - 8{,}4Б)\ 100/m_0$, (1)

$x_2 = (А - 8{,}4Б)\ 100/А$, (2) where

x_1 - the mass fraction of bound moisture, % to the mass of meat;

x_2 – the same, % of total moisture;

A is the total mass of moisture in the sample, mg;

B is the wet spot area, mg;

m_0 is the weight of the sample of meat, mg.

When determining the water-retaining capacity (WRC), a sample of carefully ground meat weighing 4–6 g was evenly applied with a glass rod to the inner surface of the wide part of the milk butyrometer.

The butyrometer was tightly closed with a cork and placed in a water bath at the boiling temperature with its narrow part down for 15 min, after which the mass of released moisture was determined by the number of divisions on the butyrometer scale.

Water-retaining capacity of meat (WRC, %):

$$WRC = B – MGC \qquad (3)$$

moisture generating capacity (MGC, %):

$$MGC = a \cdot n \cdot m\text{-}1 \cdot 100 \qquad (4)$$

where

B - the total mass fraction of moisture in the sample, %;

a - the division value of the butyrometer; a = 0.01 cm3;

n - the number of divisions;

m - the sample mass, g.

When determining the fat retention capacity (FRC), first calculate the MGC, find the mass of meat remaining in the fat retention chamber to an accuracy of ± 0.0001 g. The meat is placed in a blotter and dried to a constant weight at 423 K for 1.5 h. After drying, a (2,0000 ± 0,0002 g) sample is taken and placed in a porcelain mortar, to which is added 2.5 g (1.6 cm^3) of fine calcined sand and 6 g (4.3 cm^3) of α-monobromomnaftalin. The contents of the mortar are thoroughly ground for 4 minutes and filtered through a folded paper filter. 3-4 drops of the test solution are applied evenly with a glass rod to the bottom prism of the refractometer. The prisms are closed and screwed together. The light beam is directed by means of a mirror onto the prism of the refractometer, setting the telescope so that the intersecting filaments (aliade) are clearly visible. The aliade is moved until the boundary between the illuminated and dark parts coincides with the point of intersection of the filaments and the refractive index is read off. At the same time, the refractive index of the monobromomnaphthalene is determined. The determination is repeated several times, using average data for the calculation. Fat retention capacity of meat (FRC, %):

Fat-retaining capacity (FRC%):

$$FRC = g1 \cdot g2 \ -1 \cdot 100, \tag{5}$$

where

g_1 – mass fraction of fat in sample after heat treatment, %;

g_2 – the same before heat treatment, %.

Mass fraction of fat in sample (g, %):

$g = [104 \cdot \alpha \cdot (n_1 - n_2) \cdot m_1]/m_2$, where

α - a coefficient characterizing such a fat content in a solvent that changes the refractive index by 0.0001%;

n_1 - the refractive index of the pure solvent;

n_2 - the refractive index of the test solution;

m_1 – mass 4.3 cm^3 α – monobromonaphthalene, g;

m_2 – weighing weight, g

The coefficient α was established experimentally by comparing the results of determining the mass fraction of fat by the Soxhlet method and refractometric.

$\alpha = c_1 / (104 \cdot \Delta n)$, (8) $c_1 = (c\ 100)/m_0$, (6)

where

c_1 – mass fraction of fat in the filtrate, %;

Δn – difference between the refractive indices of pure solvent and test filtrate;

c – fat content in the sample, determined in the Soxhlet apparatus, g;

m_0 – weight of the sample of the solvent, g.

Results and their discussion

Table 1 presents the results of the determination of heavy metals in minced soy okara using an atomic absorption spectrometer.

Table 1 - The results of the determination of heavy metals in minced soy okara

Name of indicator	units	Test result	Error (uncertainty)	Standard	SD per test method
Cadmium	mg\kg	0,0042	0,0014	No more 0,2	M 04-64-2017 Food products and food raw materials. Feed, compound feed and raw materials for their production. Method for measuring the mass fraction of cadmium, arsenic, tin, mercury, lead, chromium by atomic absorption spectrometry using an atomic absorption spectrometer with electrothermal atomization MGA-1000
Arsenic	mg\kg	0,026	0,010	No more 0,1	
Mercury	mg\kg	0,0040	0,0016	No more 0,03	
Lead	g\kg	0,120	0,019	No more 0,2	

As a result, the study showed compliance with the requirements of TR TS 021/2011 of the Technical Regulations of the Customs Union "On Food Safety", SO 81952917-001-2013, which is the basis for the possibility of using minced soy okara to obtain protein-carbohydrate compositions to replace part of the meat raw materials in meat chopped semi-finished products.

Table 2 presents the results of a study of microbiological indicators of minced soy okara.

Table 2 - The results of the study of microbiological indicators of minced soy okara

Name of indicator	units	Test result	Standard	SD per test method
B.cereus	g	Not found in 0.1 g	In 0.1 not allowed	GOST 10444.8-2013 - Microbiology of food and animal feed. Horizontal method for enumeration of presumptive bacteria Bacillus cereus. Colony count method at 30°C.
Bacteria of the Escherichia coli group	g	Not found in 0.1 g	In 0.1 not allowed	GOST 31747-2012-Food products. Methods for detecting and determining the number of bacteria of the Escherichia coli group (caliform bacteria)
Yeast	cfu/g	Not highlighted	No more than 50	GOST 10444.12-2013 - Microbiology of food and animal feed. Methods for detection and enumeration of yeasts and molds
The number of mesophilic aerobic and facultative anaerobic microorganisms	cfu/g	$3{,}0 \cdot 10^3$	No more than $5{,}0 \cdot 10^4$	GOST 26670-91 - Food products. Methods for cultivating microorganisms; GOST 10444.15-94-Food products. Methods for determining the number of mesophilic aerobic and facultative anaerobic microorganisms
Mold	cfu/g	cfu/g	No more than 10	GOST 10444.12-2013 - Microbiology of food and animal feed. Methods for detection and enumeration of yeasts and molds

As a result of the study, microbiological indicators comply with the requirements of TR CU 021/2011 of the Technical Regulations of the Customs Union "On Food Safety", SO 81952917-001-2013, which is the basis for the possibility of using minced soy okara to obtain protein-carbohydrate compositions to replace part of the raw meat in meat chopped semi-finished products.

Variants of recipes for meat chopped semi-finished products are presented in table 3.

The appearance of semi-finished products after heat treatment (roasting) is shown in Figure 1.

Organoleptic indicators of prescription compositions of meat chopped semi-finished products after heat treatment (roasting) are presented in table 4, functional and technological indicators of prescription compositions - in table 5.

Table 3 - Recipe options for meat chopped semi-finished products

name of raw materials	Recipe № 1 (experiment)	Recipe № 2 (experiment)	Recipe № 3 (control)	Recipe № 4 (control)
	Weight, kg per 100 kg of minced meat			
Ground beef	15,9	16,8	23,9	25,25
Minced lamb	14,5	15,3	21,8	23
minced chicken	17,3	18,2	26	27,44
Okara	23,9	25,2	-	-
Onion	9,88	10,36	9,78	10,17
Chicken egg	4,78	5,05	4,78	5,05
Soy sauce	2,8	3,03	2,8	3,03
whey protein concentrate 80	0,94	0,98	0,94	0,98
Water	4,8	5,08	4,8	5,08
Carrot	5,2	-	5,2	-

Figure 1 - Experimental (№ 1 and 2) and control (№ 3 and 4) samples of meat chopped semi-finished products

Table 4 - Organoleptic characteristics of the studied products

Indicator name	Recipe № 1 (experiment)	Recipe № 2 (experiment)	Recipe № 3 (control)	Recipe № 4 (control)
Appearance	Formed round-oval shape, surface without broken edges			
Color	Light beige	Light brown	Brown	Brown
Smell and taste	characteristic of the product after heat treatment, without foreign tastes and odors			
Consistency	Juicy, tender, corresponding to the texture of fried cutlets	Juicy, corresponding to the consistency of fried cutlets	Less juicy than in experimental recipes, corresponds to the consistency of fried cutlets	

Table 5 - Functional and technological indicators of meat chopped semi-finished products

Indicator	Sample Results			
	Recipe №1	Recipe №2	Recipe №3	Recipe №4
pH	6,70±0,29	6,72±0,27	6,65±0,26	6,68±0,25
MBC,%	88,3±0,38	89,1±0,36	80,1±0,39	78,2±0,37
WRC, %	76,3±0,24	77,4±0,26	69,3±0,23	67,9±0,22
FRC, %	82,0±0,39	83,2±0,38	70,4±0,28	68,0±0,26
Losses during heat treatment, %	10,0±0,08	9,0±0,07	19,0±0,1	21,8±0,3
Yield after heat treatment, %	90,0±3,7	91,0±3,8	81,0±3,5	79,2±3,2

As a result of the research, it can be seen that formulation № 2 is the most optimal for further experimentation, since it has higher quality indicators compared to other samples. In addition, this recipe can be used as a base for multicomponent enrichment with macro - and microelements and vitamins, which are contained in chickpea flour or buckwheat flour.

***Conclusions*.** Developed meat chopped semi-finished products can be used in public catering, as it was found that the new type of raw materials, soybean okara is safe. According to the results of the research, we can conclude that the experimental sample № 2 differs from the control samples, namely, there is an increase in pH by 0,07%, moisture-binding capacity by 9%, water-retaining capacity by 8,1%, fat-retaining capacity by 12,8%. At the same time, the yield after heat treatment is 91%, which is higher by 5-6% compared to the control samples number 3 and 4.

REFERENCES

1. Iltyakov, A.V. Assessment of functional properties and development of a complex of soy proteins and dietary fibers to stabilize the quality of meat products [Text] / A.V. Iltyakov // Commodity researcher of food products. – 2010. – №12. – P. 31-36.

2. Antipova, L.V. Protein-polysaccharide combinations in the development of high-quality meat products [Text] / L.V. Antipova, N.M. Ilyina, N.A. Drozdova // Bulletin of the Voronezh State University of Engineering Technologies.– 2012. – №1. – P. 78-82.

3. Glotova, I.A. Development of new methods for introducing biopolymer complexes into the composition of food systems based on meat raw materials [Text] / I.A. Glotova, A.O. Ryazantseva // FES: Finance. Economy. – 2018. – №3. – P. 54-61.

4. Lyudmila Antipova, Olga Dvoryaninova / Fundamentals of biotechnology for processing agricultural products. – 2014. – P. 34-36.

5. Edelev, D.A. Nutrigenomics as an important factor in designing a human diet / D.A. Edelev, M.Yu. Sidorenko, M.A. Perminova // Food industry. -2011. – № 4. – P. 18-23.

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ИСПОЛЬЗОВАНИЕ ОТХОДОВ СВЕКЛОСАХАРНОГО ПРОИЗВОДСТВА В КОРМОВЫХ ДОБАВКАХ

[1]Ж.С. АЛИМКУЛОВ, [1]Г.Е. ЖУМАЛИЕВА, [1]А.А. АМАНТАЕВА, [1]К.Н. ФАЗЫЛОВА, [1]К.Т. ШАУЛИЕВА*

[1](ТОО «Казахский научно-исследовательский институт перерабатывающей и пищевой промышленности», Қазахстан, Алматы 050060 ул. Ю. Гагарина, 238Г)
Электронная почта автор- корреспондента: a.amantaeva@rpf.kz*

В данной статье представлен рецепт кормовой добавки для дойных коров. По расчетному рецепту в комбикормовом цехе были выроботаны опытные партии кормовых добавок. Определены питательная и энергетическая ценности полученных кормовых добавок. По полученным результатам при использовании свекловичного жома 15%, мелассы 15% взамен отрубей пшеничных повышается переваримый протеин на 45-50%, а также получены хорошие результаты по другим показателям качества. Экспериментально подтверждено, что использование в рационах крупного рогатого скота отходов свеклосахарного производства, способствует снижению затрат кормов, себестоимости производства с единицы продукции.

Ключевые слова: **комбикорм, кормовая добавка, рецепт, крупный рогатый скот, свекловичный жом, меласса.**