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FUNCTIONALLY ENRICHED MEAT PRODUCT WITH INCAPSULATED VITAMIN SUPPLEMENT

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The article presents the study results of the functionally enriched meat product from lamb and ostrich meat with a biologically active additive. The fat-soluble vitamin complex "aevit" encapsulated with the food oligosaccharide β-cyclodextrin (E459) has been used as a functional ingredient. The use of poultry meat in the recipe allowed to obtain a product with high consumer properties. Based on the conducted experiments, a comparative characteristic of the physicochemical, energy, amino acid and organoleptic parameters of the obtained semi-smoked sausage products is given.

Key words: cyclodextrin complexes, functional products, meat product, poultry meat, vitamin complex.

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ҚАПТАЛҒАН ДӘРУМЕНДІ ҚОСПАМЕН БАЙЫТЫЛҒАН ФУНКЦИОНАЛДЫ ЕТТІК ТАҒАМ

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Мақалада диеталық қоспасы бар қой еті мен түйеқұс етінен функционалды түрде байытылған ет өнімін зерттеу нәтижелері келтірілген. Функционалды ингредиент ретінде майда еритін "аевит" витаминінің тағамдық олигосахарид β-циклодекстринмен (Е459) қапталған кешені пайдаланылды. Рецептурада құс етін пайдалану жоғары тұтынушылық қасиеттері бар өнімді алуға мүмкіндік берді. Жүргізілген эксперименттер негізінде алынған жартылай ысталған шұжықтардың физика-химиялық, энергетикалық, амин қышқылдарының және органолептикалық көрсеткіштерінің салыстырмалы сипаттамасы қарастырылған.

Негізгі сөздер: циклодекстриндік кешендер, функционалды өнімдер, еттік өнім, құс еті, дәрумені кешен.

ФУНКЦИОНАЛЬНО ОБОГАЩЕННЫЙ МЯСНОЙ ПРОДУКТ С ИНКАПСУЛИРОВАННОЙ ВИТАМИННОЙ ДОБАВКОЙ

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В статье представлены результаты исследования функционально обогащенного мясного продукта из мяса баранины и страуса с биологически активной добавкой. В качестве функционального ингредиента использован жирорастворимый витаминный комплекс «аевит», инкапсулированный пищевым олигосахаридом β-циклодекстрином (Е459). Использование в рецептуре мяса птицы позволило получить продукт с высокими потребительскими свойствами. На основе проведенных экспериментов дана сравнительная характеристика физико-химических, энергетических, аминокислотных и органолептических показателей полученных полукопченых колбасных изделий.

Ключевые слова: циклодекстриновые комплексы, функциональные продукты, мясной продукт, мясо птицы, витаминный комплекс.

Introduction

Justification of the choice of the article, goal and objectives

Nowadays the meat products high cost leads to the searching for technological methods and the creation of new products with high nutritional value through the use of poultry meat. The use of African ostrich meat is of great interest among meat producers [1, p.5-6; 2, p.121-124]. The share of this component in the overall structure of meat balance in the world is growing annually. The use of this meat in sausage products allows to obtain less expensive products, therefore more competitive ones [3, p.175-178; 4, p.72-79]. The study results of the nutritional value of ostrich meat indicate a high protein content (21.7%) and a low fat content (1.2%) in comparison with other types of meat (for example, beef meat contains 18.7 and 16.0%, respectively). The amino acid composition of ostrich meat is rich with all indispensable essential amino acids. The amount of linoleic acid in ostrich meat is approaching the standard (10.45/100 g), and the content of arachidonic acid (2.34/100 g), extremely important for humans, ostrich meat exceeds the standard several times [3, p.72-79]. In connection with the above, ostrich meat is promising and advisable to use for development (on its basis or with its use) both traditional meat products and therapeutic and prophylactic products, especially for people predisposed to cardiovascular diseases, suffering from iron deficiency anemia and obesity.

At the Department of "Technologies of Food and Processing Industries" of the Kazakh Agrotechnical University named after S.Seifullin, research is being conducted on the development of a formulation and technology for obtaining of encapsulated food additives for meat products with antioxidant and therapeutic and prophylactic properties [5, p.76-78; 6, ID 6148939]. This is a new innovative direction in the meat industry, which has extremely important practical significance and social efficiency [7, p.10940-10975]. Currently, the market of functional food products (FFP), such as nanostructured with oligosaccharides of vitamins, antioxidants and other ingredients continues to develop rapidly. Thus, in next countries, as South Korea and Japan, FFP accounts for almost 50% of all food products produced, and in Europe, the USA and Russia - about 25-30% [8, p.1694-1720; 9, p. 21-39].

Cyclodextrins (CD) are cyclic oligosaccharides that have an internal hydrophobic cavity and a hydrophilic outer shell. They are products of the biochemical transformation of starch. The CD family includes three main products: α-, β- and γ-CD, their macro rings consist of six, seven and eight glucopyranose residues, respectively. Hydrophobic molecules are embedded in the inner cavity of the CD, forming supramolecular nanostructured inclusion complexes of the "guest-host" type [8, p.1694-1720]. This ensures significant changes in the physicochemical properties of the molecules of the substance bound to cyclodextrins: the stability of the

"guest" substance molecule sensitive to oxygen or light increases, the solubility of substances rises [9, p.30-33; 10, p.95-111], the possibility of converting liquids into powdery form is realized, unpleasant odors and taste are masked [7, p.10940-10975; 11, p.301-305]. β-Cyclodextrin is a food additive (E459), stabilizer and emulsifier, which provides food a viscosity, maintains a homogeneous dispersion of immiscible substances and components [8, p.1694-1720].

This paper presents the research results on the development of a functionally enriched meat product from lamb and ostrich meat, enriched with encapsulated vitamin supplement "aevit" (AE). AE is a vitamin complex preparation with immunostimulating and antioxidant properties. Vitamin E promotes tissue regeneration, has a positive effect on vision, supports the reproductive function of the body, improves blood circulation and restores vascular permeability. Vitamin E is relatively stable when heated, but is easily destroyed by exposure of air oxygen and ultraviolet rays [12, p.5-12; 13, p.26-37]. In this regard, we used an encapsulated form of an oil solution of vitamin AE with β-cyclodextrin. In the oligosaccharide shell, vitamin AE will be better preserved from the effects of oxidants, has water solubility and improved biological digestibility due to uniform distribution in meat products.

The aim of the work is to develop a functionally enriched meat product from lamb and ostrich meat, enriched with encapsulated vitamin supplement "aevit". The tasks of the work are to study the recipe and create technologies for obtaining semi-finished meat products for the distribution of meat compositions from lamb (60%) and ostrich meat (30%) with the addition of an encapsulated vitamin supplement. for the total production of semi-smoked sausages.

Materials and Research Methods

A semi-smoked lamb sausages (60%) and ostrich meat (30%) have been taken as the objects of meat products. The prototype for the development of recipes was the lamb sausage, developed in accordance with SE RK 243-2013 from lamb (50%) and bacon (50%). The technology of obtaining sausage products with encapsulated vitamin complex β-CD-AE was tested in production conditions on the basis of the Kazakh Agrotechnical University named after S. Seifullin (Nur-Sultan). The following reagents were used in the experiments: β-cyclodextrin (99.5%, purchased from Fluka), vitamin complex "aevit" (retinol palmitate, 100000ME, α-tocopherol acetate, 100 IU) (hereinafter vitamin AE, 200 mg, Medbiopharm, Russia), transparent viscous oil of light yellow color. The water-soluble β-CD-AE inclusion complexes (2:1) have been obtained by microwave processing. The results of physico-chemical and thermal analysis of a sample of β-CD-AE inclusion complexes (using a scanning electron microscope (SEM), ^{1}H NMR, ^{13}C (JNM-ECA Jeol 400, DMSO-d_6 spectroscopy and a differential scanning calorimeter DTA/DSC (Setaram)) were described earlier in [12, p.5-13].

Organoleptic assessment of semi-smoked sausages was carried out in accordance with SS 9959-91 "Meat products. General conditions of organoleptic evaluation". The moisture content was determined in accordance with SS 9793-74 by drying the suspension to a constant mass (at 105 ± 30°C). Physico-chemical and microbiological characteristics of meat sausage products were determined by generally accepted methods in the testing laboratory of Nuritest LLP (Almaty, KZ accreditation certificate) and the Scientific Center for Radioecological Research of Shakarim State University (Semey) according to the relevant state standards.

Main part

Results and their discussion

It is important for the food industry to develop a new type of product that not only preserves all the useful properties of meat, but also improves organoleptic, physico-chemical quality indicators and technological properties [14, p.30-35; 15, p.61-66; 16, p.60-64]. When developing recipes and technologies of the studied meat semi-finished products using lamb (60%) and ostrich meat (30%), the general scheme of production of semi-smoked sausage products was taken as a basis. The fresh ostrich meat used in the experiments had a dark red color on the surface and was characterized by a dense consistency.

Before the main technological operations, chilled and fresh lamb and ostrich meat was deboned, the meat was separated from the bones and from the veins, connective tissue and fat (veining) and cut into pieces weighing up to 200 g. Then the veined meat was sent to maturation, i.e. to salt (up to 3% table salt and sodium nitrite according to the recipe). Salted meat is aged from 24 to 48 hours at a temperature of 2-4°C. Salted lamb meat was ground in a meat grinder with a grate diameter of 2 mm, ostrich meat - with a diameter of 4 mm.

The stuffing operation was carried out in a stirrer according to the recipe: spices and vitamin complexes were added, all ingredients were mixed until a homogenous mass of minced meat was

formed. Stuffing the finished minced meat into a natural shell was done with a syringe, then hatching, then knitting with twine. After binding, the loaves are subjected to precipitation for 4 hours at a temperature not higher than 4°C. Next, the loaves were hung on special frames with an interval at least 10 cm and fried at a temperature of 90°C. After the end of frying, the finished sausage products acquire a reddish color and a dry shell, while the temperature inside the loaves should not be higher than 50°C.

Sausage products were cooked with hot steam, the temperature inside the universal thermal chamber was 80±85°C, and the humidity was 95%. The cooking process ended when the temperature inside the loaves reached 72°C. The sausage was cooled under a cold shower to a temperature of 16°C inside the loaf. These conditions provide a smooth surface of the loaf. Then the cooled sausage was placed in the smoking chambers for smoke treatment at a temperature of 24°-30°C for 4-6 hours. Aspen chips were used for smoking. After smoking, the loaves were dried at a temperature of 4°–8°C in a room with good air circulation. Finished sausage products were carefully checked for organoleptic indicators, as well as for compliance with technical conditions and standards.

After the end of the technological process, a comparative organoleptic assessment has been carried out, as well as physico-chemical, microbiological and other parameters have been studied. It was revealed the dynamics of the pH values of the meat product during cold storage is characteristic of raw materials with normal autolytic processes. Semi-smoked sausage can be stored for up to 30 days at a temperature of 4°C and relative humidity of 75% in the suspended state.

Results of organoleptic evaluation of samples of semi-smoked sausages with the content of the inclusion vitamin complex beta-CD:AE are shown in Table 1. From the data provided follows that experimental samples No.1-3 have higher consumer indicators compared to the control (lamb sausage) ones. For example, the organoleptic parameters of experimental samples (aroma, consistency, taste and juiciness) are slightly higher than those of the control sample.

Tables

Table 1 - Organoleptic evaluation of the quality of prototypes

Indicators	Control ST RK 243-2013	Prototype samples		
		1	2	3
Appearance	8,4	8,5	8,5	8,4
Colour	8,5	8,6	8,4	8,5
Smell, aroma	8,0	8,1	8,2	8,0
Consistency	8,3	8,0	8,2	8,1
Taste	8,0	8,1	8,2	8,2
Juiciness	8,2	8,3	8,4	8,3
Overall rating	8,23	8,26	8,31	8,25

Based on these data, a preliminary conclusion was made that the combination of 60% lamb and 30% ostrich meat is the most appropriate. The specified ratio of the main meat components gives the product a moderately taste inherent in semi-smoked sausage. Table 2 shows the physico-chemical parameters, nutritional and energy value of a meat product with a vitamin complex. According to microbiological indicators, samples of lamb sausage products and ostrich meat corresponded to SanPiN 2.3.2.1078-01 (Table 2). The main changes in the indicators are observed in the amino acid composition of the prototype. The final product has a pronounced lean taste, is characterized by attractive organoleptic characteristics: juicy and delicate consistency, light brown color and a delicate meat smell. The developed meat product from lamb and ostrich meat with encapsulated vitamin complex β-CD:AE can be used as a useful and safe product and is recommended for wide use.

Table 2 - Physico-chemical and microbiological characteristics of meat sausages with encapsulated vitamin complex β-CD:AE (2:1)

Name of indicators, units of measurement	Control ST RK 243-2013	Prototype samples	Designation of the regulatory document for test methods
Microbiological:			
Pathogenic, including salmonella	Not detected	Not detected	SS 31659-2012
L. monocytogenes	Not detected	Not detected	SS 32031-2012
Staphylococcus aureus	Not detected	Not detected	SS 9958-81
E. coli group bacteria (coliforms)	Not detected	Not detected	SS 9958-81
Physico-chemical:			
Peroxide number (1/2)/kg	3,71±0,37	3,29±0,33	SS P 51487-99
Nutritional value, g/100g:			
Mass fraction of protein	23,75±0,02	24,29±0,02	SS 25011-81
Mass fraction of fat	11,28±0,01	12,56±0,01	SS 23042-86
Carbohydrates	0,96±0,05	1,66±0,08	I.M.Skurikhin, issue 1, 1987
Moisture	61,14±0,3	59,43±0,3	SS 9793-74
Ash	2,33±845	2,60±0,03	SS 15113.8-77
Energy value, kcal/kJ/100g	202/845	215/900	I.M.Skurikhin, issue 1, 1987
Vitamins, mg/100g:			
Vitamin A	-	0,253±0,025	SS P 54635-2011
Vitamin E	-	12,98±1,30	SS EN 12821-2012
Amino acid composition, mg/100g:			
Aspartic acid	1126,0±112,6	2143,0±214,3	MM 1363-2000
Glutamic acid	1964,0±196,4	3546,0±354,6	MM 1363-2000
Serin	458,0±45,8	934,0±93,4	MM 1363-2000
Histidine	233,0±23,3	547,0±54,7	MM 1363-2000
Glycine	702,0±70,2	1624,0±165,4	MM 1363-2000
Threonine	514,0±51,4	1151,0±115,1	MM 1363-2000
Arginine	745,0±74,5	1721,0±172,1	MM 1363-2000
Alanin	706,0±70,6	1445,0±144,5	MM 1363-2000
Tyrosine	380,0±38,0	782,0±78,2	MM 1363-2000
Cysteine	77,0±7,7	273,0±27,3	MM 1363-2000
Valin	544,0±54,4	1144,±4,1	MM 1363-2000

Table 3 - Comparative characteristics of products by some indicators

Product Name	Product Features				
	fat, %	protein, %	moisture content, %	ash, %	caloric content, kcal/kJ /100
Control ST RK 243-2013	11,28±0,01	24,29±0,01	61,14±0,01	2,33±0,01	202/845
Prototype sample	25,95±0,03	21,64±0,01	49,18±0,01	2,25±0,01	324/1355

Conclusions

As a result of the conducted research, a functionally enriched meat product was developed from lamb and ostrich meat. The fat-soluble vitamin complex "aevit" encapsulated with the food oligosaccharide β-cyclodextrin (E459) was used as a vitamin ingredient. The developed meat product can be used as a healthy and safe meat product. The research results can be used in the development of a technological scheme for the production of semi-smoked sausage products from lamb and poultry meat with encapsulated fat-soluble vitamin

components. Due to the possibility of effective enrichment of meat semi-finished products with fat-soluble vitamins, the developed scientific approach is of interest for use in the production of functional nutrition products.

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