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CERVUS ELAPHUS: CULTIVATION IN THE KALININGRAD REGION, PROCESSING AND EVALUATION OF THE QUALITY AND SAFETY OF VENISON PRODUCTS

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ABSTRACT

Recently, there has appeared a tendency to use non-traditional animal raw materials to expand the range of sausages. The purpose of the research is to determine the organoleptic and physico-chemical properties, as well as quality indicators of new sausages with a mass fraction of deer muscle tissue in the recipe (> 60%). An organoleptic evaluation was carried out, then the study of physicochemical parameters, the mass fraction of protein, fat, salt, sodium nitrite, total phosphorus, and residual activity of acid phosphatase was performed. Next there were studied such microbiological indicators as QMAFAnM, BGKP (coliforms), sulfite-reducing clostridia, *Staphylococcus aureus*, and pathogenic microorganisms: *Salmonella, Escherichia coli, Listeria monocytogenes*. Safety indicators have been established: the content of toxic elements (mercury, arsenic, cadmium, lead) and quality indicators: the content of nitrosamines, pesticides. The quality control of packaging and labeling was carried out visually in accordance with the requirements of the standard. The temperature is measured inside the product with a glass liquid thermometer. The net weight of consumer packaging was determined gravimetrically by static weighing. It has been proved that all three types of the studied sausages «Zavtrak okhotnika», «Drezdenskiye» and «Oldenburgskiye» corresponded to the normative documentation in terms of organoleptic, physico-chemical properties, quality and safety indicators, nutritional value.

Keywords: venison, *Cervus elaphus*, sausages, organoleptic, physico-chemical properties, quality and safety indicators

INTRODUCTION

In recent decades, two opposite trends have emerged in the world. First, there is a constant increase in the world's population (according to data 2020, it was up to 7.8 billion, 89% of which are potential meat consumers) (**Gu et al**., **2021; Kemper, 2020**). Secondly, the resource of raw meat is reduced **(Kirkin *et al.*, 2019**). Meanwhile, meat products are one of the most popular in the diet of a modern person, thanks to essential amino acids (**Silva *et al.*, 2019**). Therefore, the issue of minimal and rational use of meat raw materials in products is becoming increasingly relevant (**Samelis and Kakouri, 2018**). Modern meat production is characterized by the introduction of protein-containing vegetable fillers (**Al-Adawi *et al.*, 2016**), which improve the quality and taste of products (**Phan *et al.*, 2019**). In particular, such additives are used in the production of sausages and meat compositions (**Lisitsyn *et al.*, 2018**). Vegetable fillers contain various proteins, carbohydrates, a complex of mineral compounds, fibers. The technology of using vegetable fillers integrated into sausage production improves product quality.
Some specific characteristics of sausage products should be taken into account (**Alamri *et al.*, 2021**). Thus, sausages are popular all over the world due to the combination of several properties. Firstly, they have a high nutritional and caloric value (406.96 kcal (or 1703 kJ) per 100 g, the average value for boiled-smoked sausages) (**Serikkyzy *et al.*, 2022**). This amount is ¼ of the daily norm of proteins and up to half of the fat diet, based on the daily norm of 2000 kcal for 1 day. Secondly, a long shelf life is another important property of sausage products, which determines the possibility of their transportation over long distances without loss of quality (**Wang *et al.*, 2018**). However, the quality of sausage products largely depends on the origin, breed of cattle and the quality of the animals' diet (**Malekian *et al.*, 2014**). Equally important is the quality of the technical equipment of the enterprise. It should be noted that the quality of products depends on the compliance of meat raw materials with generally accepted standards. In particular, sausages made from imported frozen meat may be of poor quality, which affects the nutritional, organoleptic, structural, and mechanical properties of the product (**Verma and Banerjee, 2010**).
Therefore, despite the number of modern technologies listed above, it is necessary to develop new ones, to increase the efficiency of the production of sausages. New recipes should use both high-quality meat raw materials and food additives in the correct dosage. The use of new additives will reduce the cost of the product, expand the range of offered sausages, improve their quality, and also make the final product more beneficial to health by improving hygiene. Of course, the regular use of healthy products will have a positive effect on physiology (**Serikkyzy *et al.*, 2022**).
Noble deer (*Cervus elaphus*) is an artiodactyl mammal from the deer family. Red deer are large animals (100–300 kg). This animal was first described by the famous naturalist Carl Linnaeus in 1758. The red deer lives in most of Europe, the Caucasus, Asia Minor, Iran, parts of Western and Central Asia, Africa Australia, New Zealand, USA, Canada, Peru, Uruguay, Chile and Argentina. The coloration of deer is subject to very strong geographical variability, and this applies to both summer and winter fur. Figure 1 shows photos of deer reared in the Kaliningrad region, Russia, from the personal collection of the authors.

Figure 1 - Photo of *Cervus elaphus* grown in the Kaliningrad region, Russia

Russia is one of the world leaders in meat production. However, the Russian meat industry is underdeveloped, despite the active use of modern technologies (**Lisitsyn *et al.*, 2018**). Therefore, Russia can become a model territory for

conducting modern research on the development and implementation of new technologies for the production of boiled sausages (**Lisitsyn *et al.*, 2018**).
The aim of the research was to determine the organoleptic, physico-chemical properties and quality indicators of new sausages with a mass fraction of deer muscle tissue in the recipe over 60%.

MATERIAL AND METHODS

Scheme of butchering a deer carcass

The scheme for cutting a deer carcass is shown in Figure 2 (**Serikkaisai *et al.*, 2014**).

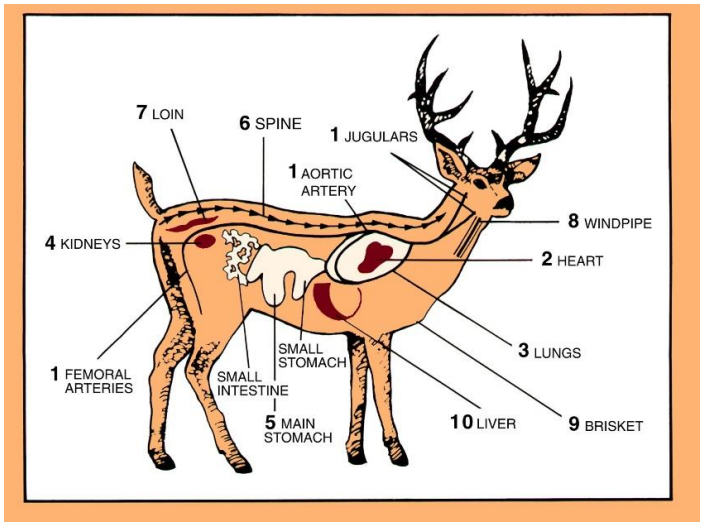

Figure 2 - Scheme of cutting a deer carcass

Reindeer meat was cut into 28 cuts. The yield and morphological composition of the cuts are presented in table 1 **[13]**.

Table 1 Yield and morphological composition of venison cuts

Cut name	Cut yield M±m	Boneless meat M±m	Bone M±m
Thigh cut on the bone with shank	36,21±1,10	29,27±2,01	6,94±0,52
Hind shank	6,09±0,17	3,16±0,50	2,93±0,76
Tail cut	2,91±0,15	1,32±0,11	1,59±0,09
Back cut	8,72±0,39	5,04±0,46	3,68±0,63
Lumbar cut	6,58±0,36	4,12±0,18	2,46±0,03
Sternocostal cut	13,37±0,78	10,41±1,13	2,96±0,77
Pashina	2,31±0,16	2,31±0,16	-
Front cut with shank	21,98±0,92	17,66±0,27	4,32±0,58
Shoulder cut	18,66±0,16	16,03±0,24	2,63±0,46
Fore shank	3,32±0,15	1,63±0,54	1,69±0,19
Neck cut	9,16±0,43	6,73±1,35	2,43±0,63
Tenderloin	1,67±0,75	1,67±0,21	-
TOTAL	100,00	77,21	22,79

Assortment of sausage products

The range of sausages studied in this research:
-sausages «Zavtrak okhotnika»;
-sausages «Drezdenskiye»;
-sausages «Oldenburgskiye».

Figure 3 shows the appearance of venison sausages.

a b

Figure 3 - Appearance of venison sausages: a) Zavtrak okhotnika sausages, b) Oldenburgskiye sausages

An example of an entry in the documentation: Sausages boiled from roe deer meat. Category A chilled meat product. Stanadart 25831015-002-2022.
Sausage products must comply with the requirements of the standard and be produced according to the recipes specified in the technological instructions in compliance with the Rules for the Veterinary Inspection of Slaughter Animals and the Veterinary and Sanitary Expertise of Meat and Meat Products, the Sanitary Rules for Meat Industry Enterprises, approved in the prescribed manner.
2.2 Sampling for analyzes
ampling for organoleptic evaluation, physicochemical and microbiological, radiation control was carried out according to the methodology given in (**Serikkaisai *et al.*, 2014**).
The preparation and mineralization of samples to determine the content of toxic elements and the preparation of samples for microbiological testing were carried out according to (**Sofi *et al.*, 2017**).

Definition of quality and safety indicators

Organoleptic assessment is carried out according to traditional methods, according to (**Ham et al., 2016**; **Sánchez-Zapata, et al., 2013**).
Microbiological studies were carried out according to (**Ores *et al.*, 2018**).
The content of toxic elements was determined by the method described in (**Ham et al., 2016**).
Studies on the content of nitrosamines according to the Guidelines MUK 4.4.1.011-93 "Determination of volatile N nitrosamines in food raw materials and food products", pesticides - according to the Guidelines MU 2142-80 "Guidelines for the determination of organochlorine pesticides in water, food, feed and tobacco products by thin layer chromatography" and according to the Guidelines MU 3049-84 "Guidelines for the determination of residual amounts of antibiotics in animal products", and radionuclides - according to (**Ham et al., 2016**).
The quality control of packaging and labeling of venison sausages was carried out visually, the temperature was measured inside the product with a glass liquid thermometer (not mercury), the net weight of consumer packaging was determined by the gravimetric method (static weighing) with a weighing limit corresponding to the measured mass, according to (**Donskova *et al.*, 2018**).
It is allowed to use other measuring instruments with metrological characteristics not lower than those specified in the standard recommended for food products. When using other measuring instruments, control is carried out in accordance with the instructions for their use.
Statistical data were processed using Microsoft Excel 2013 (Microsoft Inc., USA). Mean values were calculated for each of the groups in % and other units. A significant difference was calculated using a two-sample t-test; differences were significant at $p \leq 0.05$.

RESULTS AND DISCUSSION

Subheadings should be used

According to the research results of the Institute of Ecology and Evolution named after A.N. Severtsov Russian Academy of Sciences, our deer are carriers of the reference gene pool. Red deer are the indigenous inhabitants of our region. Once they were completely exterminated by hunters. The deer population was again formed on these lands by the Princess of Oldenburg, who brought these animals to her estate from Germany. There are no such inhabitants in Europe anymore.

Table 2 Plants that the red deer feed on in the Kaliningrad region

Preferences	Plant name	Winter	Summer
Preferred	Legumes – Fabaceae	+	+
	Willow – Salicaceae	+	+
	Goat willow – *Salix caprea* L.	+	+
	Willow bluish – *Salix coesia*	+	+
Main	Cereals – Poaceae	+	+
	Euphorbia – Euphorbiaceae	+	+
Forced	Fallen needles of larch and cedar	+	-
Additional	Birch round-leaved – *Betula rotundifolia* spfch	+	+
	Cotoneaster chokeberry – *Cotoneaster melanocarpus* Fish	+	+
	Honeysuckle bristly – *Lonicera hispida*	+	+
	Kuril tea – *Pentaphylloides fruticosa* (*Dasiphora fruticosa*)	+	-
	Meadowsweet average – *Spirae media*	+	-
	Meadowsweet oak-leaved – *Spirae chamaedrifolia*	+	-

Red deer (*Cervus elaphus*) is a mammal of the artiodactyl deer family. A fairly large animal (weighing up to 300 kg) with a slender physique. Adult males have branched horns with five or more appendages on each horn. The females are hornless. The ears are large and oval. The tail is short. In newborn animals, the

body color is spotted; in adult representatives, spotting is absent or weakly expressed. On the back of the thighs, near the tail, there is a light-colored field, a "tail mirror", which helps these animals not to lose sight of each other in a dense forest.

In red deer, the mirror extends above the tail and has a rusty tint. The horns of adult males are large, with numerous processes. The eyes glow red or orange at night. The noble deer combines many subspecies: Caucasian deer, European deer, maral, Bukhara deer, wapiti, red deer. Red deer subspecies vary in size. For example, large deer and wapiti weigh more than 300 kg and reach a body length of more than 2.5 m with a height at the withers of 130 - 160 cm, and a small Bukhara deer weighs less than one hundred kilograms and has a body length of 75 - 90 cm. Subspecies and shape may differ horns. So, the European deer has a large number of processes, and the deer do not have a crown, but the horn itself is very massive and gives 6-7 processes.

Red deer feed mainly on grass, leaves and shoots of trees, mushrooms, lichens and reeds. However, they do not disdain bitter wormwood, and even such poisonous plants as belladonna and aconite. In need of salt, deer willingly go to salt licks. The plants that the red deer feed on in the Kaliningrad region are presented in Table 2.

If in captivity deer can live up to thirty years, then in natural conditions their age, as a rule, lasts 12-14 years. Females live much longer than males.

A mixed herd of deer is most often led by an old female, around which her children of different ages gather. Usually the size of such herds does not exceed 4 - 6 animals. In the spring, the herds break up. In autumn, the male gathers a harem.

In September, the deer begin the rutting season. At this time, the largest inhabitants of the Deer Park arrange fights and roar. The trumpet roar is heard throughout the district. Thus, the males intimidate the opponent and attract the female. Once upon a time, September, the time of the roar of the deer, was called Ryuen. During this period, deer are quite aggressive and it is impossible to approach them closer than 50 meters.

After the rutting period, calves and adolescents join the group of adult females. This type of herd already has 10 or even 30 heads.

Fawns are born from May to June. At this time, females hide their offspring from the eyes in the dense foliage of trees and tall grass. They are very cautious and shy.

Organoleptic and physico-chemical indicators of the quality of sausages are presented in table 3.

Table 3 Organoleptic and physico-chemical indicators of the quality of sausages

Name indicator	Name and characteristics of venison sausages		
	Sausages «Zavtrak okhotnika»	Sausages «Drezdenskiye»	Sausages «Oldenburgskiye»
Taste and smell	Peculiar to this type of product, with the aroma of spices, the taste is moderately salty, without foreign taste and smell		
Consistency	Elastic, tender, juicy		
Appearance	Bars with a clean, dry surface		
Sectional view	Uniform, from light pink to light brown, evenly mixed; for sausages "Drezdenskiye", "Oldenburgskiye" - white or light gray color on the cut with inclusions on the cut and under the shell of pieces of bacon and spices		
Form	Twisted or tied bars of cylindrical shape with flat or oval ends, from 9 to 20 cm long, in a shell with a diameter of 18 mm to 32 mm; length no more than 8 cm in a shell with a diameter of 14 mm to 18 mm		
Mass fraction of sodium chloride (table salt), %	2,0 ± 0,1	1,9 ± 0,1	1,9 ± 0,1
Mass fraction of sodium nitrite, %	0,005 ± 0,001	0,005 ± 0,001	0,005 ±0,001
Residual activity of acid phosphatase, %, no more	0,005 ± 0,001	0,006 ± 0,001	0,006 ± 0,001

Based on the tabular data (Table 3), it was found that such organoleptic parameters as appearance, texture, sectional view, taste and smell are approximately the same for all three types of sausages «Zavtrak okhotnika», «Drezdenskiye» and «Oldenburgskiye».

According to the salt content, «Zavtrak okhotnika» was in the lead (2.0 ± 0.1%), followed by «Drezdenskiye» (1.9 ± 0.1%) and «Oldenburgskiye» (1.9 ± 0.1%).

The mass fraction of sodium nitrite color developer was 0,005 ± 0,001% for all three types of sausages, residual acid phosphatase activity - 0,005 ± 0,001% - 0,006 ± 0,001%.

When performing research, it is allowed:

- an increase in the mass fraction of table salt in the finished product by 0.2% during the warm period of the year (May-September);
- the presence of fine porosity in the section;
- yellowish color of bacon under the shell from smoking;
- the presence of inclusions of connective tissue on the cut.

The content of toxic elements, antibiotics, pesticides, nitrosamines, benz(a)pyrene and radionuclides in sausages are presented in table 4.

Table 4 Indicators of quality and safety of sausages

Substance name (element)		Permissible level of content, mg/kg		
		«Zavtrak okhotnika»	«Drezdenskiye»	«Oldenburgskiye»
Toxic elements:	lead	0.3 ± 0.009	0.2 ± 0.06	0.3 ± 0.009
	arsenic	0.08 ± 0.002	0.08 ±0.002	0.09 ±0.002
	cadmium	0.03 ± 0.001	0.03 ± 0.001	0.02 ± 0.001
	mercury	0.01 ±0.001	0.01 ± 0.001	0.01 ± 0.001
Antibiotics: (not determined for raw materials from wild animals)	Levomycetin		No	
	tetracycline group		No	
	grisin		No	
	bacitracin		No	
Benz(a)pyrene		0.001 ± 0.0	0.001 ± 0.0	0.001 ± 0.0
Pesticides:	hexachlorocyclohexane (α,β, γ are isomers)	0.09 ± 0.003	0.08 ± 0.002	0.08 ± 0.002
	DDT and its metabolites	0.08 ± 0.002	0.09 ± 0.003	0.09 ± 0.003
Nitrosamines	total NDMA and NDEA	0.001 ± 0.0	0.003 ± 0.0	0.003 ± 0.0
Radionuclides, Bq/kg	Cesium -137	130 ± 3.9	109 ± 3.3	137 ± 4.1

Tabular data (Table 4) indicate that «Zavtrak okhotnika» contained the least amount of pesticides (DDT and its metabolites) - 0.08 ± 0.002 mg/kg and nitrosamines (total NDMA and NDEA) - 0.001 ± 0.0 mg/kg. The smallest amount of toxic elements (lead 0.2 ± 0.006 mg/kg and arsenic 0.08 ± 0.002 mg/kg), pesticides (hexachlorocyclohexane (α, β, γ - isomers) 0.08 ± 0.002 mg/kg) and radionuclides (cesium-137 - 109 ± 3.3 Bq/kg) was contained in the «Drezdenskiye» sausage. The sausage «Oldenburgskiye» contained a minimum amount of cadmium 0.02 ± 0.001 mg/kg and hexachlorocyclohexane (α, β, γ - isomers) 0.08 ± 0.002 mg/kg. However, in general, it must be said that all three types of venison sausages corresponded to the regulatory documentation in terms of organoleptic, physico-chemical properties, quality and safety indicators.

Microbiological indicators of sausages are presented in table 5.

Table 5 Microbiological indicators of sausages

Name of indicator		Indicator value		
		«Zavtrak okhotnika»	«Drezdenskiye»	«Oldenburgskiye»
Product weight, g, in which not allowed	CGB (coliforms)	1.0 ± 0.03		
	Sulfite-reducing clostridia	0.1 ± 0.01		
	S. aureus	1.0 ± 0.03		
	Pathogenic microorganisms:			
	Salmonella	25 ± 0.75		
	Listeria monocytogenes	25 ± 0.75		
	E. coli	1.0 ± 0.03		

The data in Table 5 allow concluding that all three types of venison sausages «Zavtrak okhotnika», «Drezdenskiye» and «Oldenburgskiye» corresponded to the regulatory documentation for microbiological indicators: CGB (coliforms), sulfite-reducing clostridia, *S. aureus*, pathogenic microorganisms: *Salmonella, Listeria monocytogenes, E. coli*.

The nutritional and energy value of sausages per 100 g of the product is presented in table 6.

Table 6 Nutritional and energy value of sausages per 100 g of product

Name of product	Protein, g not less than	Fat, g not more than	Calories, kcal/100 g or kJ/100 g
«Zavtrak okhotnika»	9 ± 0.36	22 ± 0.65	234/983
«Drezdenskiye»	10 ± 0.45	35 ± 0.90	355/1491
«Oldenburgskiye»	10 ± 0.45	35 ± 0.90	355/1491

Табличные данные (табл. 6) позволяет утверждать, что по количеству белка лидировали сосиски из оленины «Drezdenskiye» и «Oldenburgskiye», с содержанием белка 10 ± 0.45 г, за ними следовали сосиски «Zavtrak okhotnika», с содержанием белка 9 ± 0.36 г. При этом количество жира увеличивалось в таком же порядке: для сосисок «Drezdenskiye» и «Oldenburgskiye» - 35 ± 0.90 г, для сосисок «Zavtrak okhotnika» - 22 ± 0.65 г. Калорийность сосисок из оленины («Oldenburgskiye», «Drezdenskiye», «Zavtrak okhotnika») составила 355, 355 и 234 ккал/100 г, соответственно.

It was found that the activity of water during cooking and smoking sausages decreased by 1.2 times compared to raw sausages ($p \leq 0.05$). A similar trend was noted with respect to water-holding capacity.

Therefore, cooking and smoking contributes to faster drying of sausages. At the same time, an increase in the hardness of the product was observed, which indicated its better quality. This is due to the function of retaining moisture and fat, which is performed by cooking sausages (**Serikkyzy *et al.*, 2022**).

The production of sausages should fulfill the main task of the food industry, namely, meeting the needs of the population. Over the years, it becomes increasingly difficult to meet the criteria for increasing production (due to population growth) while maintaining quality (**Serikkaisai *et al.*, 2014**). Markets, especially in developing countries, are filled with non-certified and low-quality products (**Sofi *et al.*, 2017**). Sausages of such production do not pass any sanitary-microbiological or organoleptic testing. Therefore, the meat industry is constantly in need of new developments and technologies (**Ham et al., 2016**). The main problem is meat substitute additives that can maintain or even improve the taste and physical and mechanical qualities of the product (**Sánchez-Zapata, et al., 2013**). As a rule, new technologies for the production of sausage products are reduced to the creation of products from venison using cooking and smoking (**Ores *et al.*, 2018**). Thus, a complex effect is achieved - the product contains a number of useful substances that can neutralize the carcinogenic risk of smoking, some of the substances can even have a therapeutic effect. At the same time, with a decrease in fat content, greater emulsification is achieved, which improves the quality of the product (**Donskova *et al.*, 2018**).

Recently, along with the rise in meat prices, there has been a natural decline in the production of sausages. In venison sausages, there is neither beef nor pork. However, the study did not take into account such aspects, and the standard ratios of ingredients were followed in the recipe. Thus, further studies can be carried out taking into account the market value of pork and beef meat and its partial replacement with venison (**Miyashita *et al.*, 2023**).

Yozo *et al.* (2023) developed "Venison Sausage" using sika deer meat to address the disadvantages associated with the unique smell and tough texture of deer meat in order to turn sika deer into a useful resource. " Venison sausage" was made by adding 20% minced pork, 20% crushed ice, 2.4% salt, 2% sugar, 0.15% color developer, 0.1% ascorbic acid, 0.2% polyphosphate, 0.4% baking soda, 0.6% coarse black pepper, 0.2% spices and 0.1% sage to minced sika deer thigh meat. The ingredients were mixed by hand and then poured into sheep intestine casings. After drying at 60°C for 30 minutes, the sausage was smoked at 60°C for 30 minutes and then cooked at 70°C for 1 minute. The developed "Venison Sausage" showed a significantly improved texture and quality of taste. In addition, the high protein content, low fat content and high iron content, which are the distinguishing characteristics of deer meat, along with the characteristic red color of the meat, provide an excellent balance between the organoleptic and nutritional characteristics of the sausage.

The study (**Tsaregorodtseva *et al.*, 2015**) noted that venison occupies an insignificant share in the total volume of the Russian market. However, this type of raw meat has its own consumer, both regionally and in terms of expanding the range of meat products produced mainly in large cities (**Gorbacheva *et al.*, 2021**).

The objects of the study were frozen venison; unsalted pork fat; melted chicken fat; fried venison sausages. During the experiment, the possibility of using whey in the process of forming a filling system for the production of sausages was substantiated. It has been shown that the addition of whey at the stage of seasoning minced meat and the interaction of whey proteins with the structural elements of meat contributes both to the loosening of muscle fibers and the activation of enzymatic processes. This ensured the intensification of the maturation of the meat system for an average of 8 hours **(Kolobov *et al.*, 2018**). The analysis of the obtained results confirmed that the use of venison and melted chicken fat in sausages contributes to an increase in their nutritional value, including energy and biological value. The product obtained according to option 1 was characterized by a higher energy value, which amounted to 244.6 kcal (1015.3 kJ). The lowest (239.4 kcal / 995.7 kJ) was found in samples of option 3 with a content of venison 75.0% and rendered chicken fat 10.0%. The introduction of a natural additive - CO_2 - extract of oregano with its antioxidant properties is an additional advantage of the proposed technical solution. This makes it possible to reduce the degree of fat oxidation and, as a result, increase the shelf life of venison sausage (**Tsaregorodtseva *et al.*, 2015**).

Composite venison sausages with balanced nutrition and unique taste were processed in (**Inerbaeva, 2018**) using venison and pork meat as the main raw materials, which differ in price, nutrients, taste and technological characteristics, with the addition of food additives such as fruits and vegetables, dietary fiber and isomaltooligosaccharides. With the help of one-factor experiments, the influence of soy protein, potato starch, isomaltooligosaccharides, dietary fibers, fruits and vegetables, the mixing ratio of venison and pork meat on the textural properties of composite venison sausages was carried out. The composition of some of the above ingredients has been optimized using an orthogonal scheme based on texture properties and organoleptic evaluation. Soy protein and potato starch had a large effect on the textural properties of composite venison sausages, which were little affected by isomaltooligosaccharide. The optimal amounts of added soy protein and potato starch were 6% and 5%, respectively. The best dietary fiber for compound venison sausages was apple peel, and the best vegetable was shiitake mushroom. Based on the results of constructing orthogonal arrays, factorial and range analysis, the following formula for composite venison sausages (calculated by weight) was carried out: the mixing ratio of venison and pork meat is 4:6, shiitake mushrooms 15%, apple peel 5% and isomaltooligosaccharide 4% (**Airapetyan *et al.*, 2020**).

The study (**Zachesova and Kolobov, 2017**) assesses the quality of raw reindeer meat and products of its processing - boiled-smoked sausages. The characteristic of venison is given, which is not only rich in protein, but also contains water-soluble vitamins. The microbiological safety of venison grown in the conditions of the Far North was studied. The raw materials have passed the veterinary and sanitary examination in the state veterinary service and received an official veterinary document characterizing the safety of the product. The stages of production and the technological process of boiled-smoked sausage of three types are described, namely: sausages, hunting and Norilsk. All safety checks were carried out in accordance with SanPiN 2.3.2.1078-01, Technical Regulations of the Customs Union 021/2011 “On Food Safety” and Technical Regulations of the Customs Union 034/2013 “On Safety of Meat and Meat Products”. The technological scheme for the production of boiled-smoked venison sausages is presented. For the processing of non-traditional meat raw materials, standard technological methods were used: cutting, salting, maturation, molding and heat treatment. The energy value of 100 g of raw smoked sausages was: sausages - 453 kcal, hunting - 453 kcal, Norilsk - 280 kcal. At the end of processing, the safety of raw smoked sausages was checked for microbiological indicators. All samples

showed compliance with standard regulatory requirements (**Zachesova and Kolobov, 2017**).

CONCLUSION

Thus, as a result of the studies, the organoleptic, physico-chemical properties and quality indicators of new sausages «Zavtrak okhotnika», «Drezdenskiye» and «Oldenburgskiye» category A with a mass fraction of deer muscle tissue in the recipe over 60% were determined.

It should be said that all three types of venison sausage «Zavtrak okhotnika», «Drezdenskiye» and «Oldenburgskiye» corresponded to regulatory documentation in terms of organoleptic, physico-chemical properties, all quality and safety indicators (including microbiological ones).

The quality control of packaging and labeling was carried out visually in accordance with the requirements of the standard. The temperature was measured inside the product with a glass liquid thermometer mounted in a metal frame or with a semiconductor thermometer. The net weight of consumer packaging was determined gravimetrically by static weighing, with a weighing limit corresponding to the measured weight. All the studied indicators did not go beyond the normative ones.

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