

Veterinary and sanitary examination of domestic reindeer meat in the Arctic zone

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Abstract. Organoleptic, physico-chemical, microbiological reindeer were carried out for the comprehensive study of veterinary and sanitary valuation of domestic reindeer; chemical and toxicological studies of meat from MUP "Primorsky" p. Khara-Ulah of the Bulun district, SPK KRO Turvaurgin v. Kolymsky Nizhnezhny Kolymsky and Anabar districts of the Republic of Sakha (Yakutia). It has been established that the conditions of detention and the fodder base affect the meat production of reindeer, and the quality of meat is significantly improving. The integrated assessment of reindeer meat shows a higher nutritional value of reindeer meat, which is advantageous in terms of chemical composition, organoleptic and technological parameters.

1 Introduction

Northern domestic reindeer breeding is the only branch of agriculture in the Republic of Sakha (Yakutia), in which only the indigenous peoples of the North are practically employed. The uniqueness of reindeer breeding is that it remains not only a branch of the economy, but also a way of life for families of reindeer herders. Reindeer provide high-quality meat products, leather and fur raw materials. Venison is a biologically complete, high-quality nutritious product. In the regions of developed reindeer breeding, the population's need for meat is met by 75-90% or more at the expense of venison. The value of venison lies in its dietary qualities, which is achieved by the fact that they graze in the pristine tundra. Satisfying the needs of the population in high-quality food products is the most important social task of modern society. At the same time, the control of food products, raw materials of animal origin is a step of paramount importance aimed at protecting the interests of consumers. Veterinary and sanitary control is a guarantee of the good quality of meat. Veterinary and sanitary research is relevant today, as it allows you to guarantee the sanitary well-being of food raw materials and products produced from it.

2 Materials and methods

The purpose of the work is to determine the veterinary and sanitary examination of domestic reindeer meat in the Arctic zone of the Republic of Sakha (Yakutia).

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In accordance with the goal, the following tasks were solved:

to study commodity and organoleptic indicators of meat; conduct physical and chemical studies; conduct microbiological contamination; to study the chemical and toxicological indicators of meat; to determine and compare the quality indicators of meat of domestic deer in a comparative aspect from the Municipal Unitary Enterprise “Primorsky”, the village of Khara-Ulakh, Bulunsky district, the SPK KRO Turvaugin s. Kolymskoye, Nizhnekolymsky and Anabarsky districts of the Republic of Sakha (Yakutia). For comparative analysis, samples of venison meat were taken from three different regions of the Arctic zone of the Republic of Sakha (Yakutia), namely 5 samples of venison meat from the Nizhnekolymsky region, 5 samples of venison meat from the Bulunsky region, and 5 samples from venison meat from the Anabar region.

The methods of organoleptic research were carried out according to GOST 9959-91, 7269-2015 “Meat. Sampling methods and organoleptic methods for determining freshness” and according to the “Rules for the veterinary examination of slaughter animals and the veterinary and sanitary examination of meat and meat products” [1, 2]. The methods recommended by GOST 23392-78, GOST R 51478-99, GOST 23392-2016 and (Rules for the veterinary examination of slaughter animals and the veterinary and sanitary examination of meat and meat products, approved by the Ministry of Agriculture of the USSR on December 27, 1983). When bacteriological examination of the material was guided by GOSTs; GOST 10444.15-94 Food products. Methods for determining the number of mesophilic aerobic and facultative anaerobic microorganisms; GOST 31747-2012 Food products. Methods for detecting and determining the number of bacteria of the *Escherichia coli* group (coliform bacteria) [7]; GOST 32031-2012 Food products. Methods for detection of *Listeria monocytogenes* bacteria [3-5]; GOST 21237-75 Meat. Methods of bacteriological analysis [9]; Determination of the amount of QMAFAnM (the number of mesophilic aerobic and facultative anaerobic microorganisms) according to GOST 10444.15-94; Methods for examining samples for the detection and determination of the number of bacteria of the group of *Escherichia coli* (coliform bacteria) GOST 31747-2012 [7]; Methods for detection of bacteria *Listeria monocytogenes* GOST 32031-2012 [8]. Food products. Method for detection of bacteria of the genus *Salmonella* GOST 31659-2012. Food products [6].

The study on chemical-toxicological indicators was determined according to GOST 30178-96 Atomic absorption method for the determination of toxic elements; GOST 31707-2012 Determination of total arsenic and selenium by atomic absorption spectrometry with generation of hydrides with preliminary mineralization of the sample under pressure; GOST R 53183-2008 Determination of mercury by cold vapor atomic absorption spectrometry with preliminary mineralization of the sample under pressure [10-12].

3 Results and Discussion

Organoleptic examination was carried out in natural light and room temperature. The appearance and color of the meat was determined by external examination. The studied meat samples from the surface had a drying crust. The surface of a fresh cut is slightly moist or moist with a characteristic red or dark red color. Meat juice is red or dark red. There was slight contamination, hair on the surface, and some samples had minor blood clots. The consistency was determined by pressing on the surface of the meat with a finger, after which the rate of disappearance of the fossa was observed. The consistency of the meat is inelastic, the fossa does not straighten when pressed, which is typical for thawed meat.

According to the results of the assessment, the meat of domestic reindeer had the following characteristics: the appearance and color of the meat is red or dark red, some

meat samples have a bluish tint, which corresponds to the color of venison, this indicates a high iron content [13]. It has a delicate structure, is easily boiled soft, is well absorbed by the human body, and has a pleasant taste. Muscle fibers are thin, delicate, fine-grained on the cut; fatty layers between muscle fibers are rarely present; adipose tissue of white or pinkish color, with a matte tint, dense consistency; the broth is transparent or translucent with slight flakes, fragrant; the smell of meat is fresh, pleasant, specific without any foreign smells. The data obtained indicate the good quality (freshness) of the meat. The overall quality of the meat is good.

Organoleptic studies have shown that reindeer meat from the three regions presented meet the veterinary and sanitary requirements of frozen meat.

According to the results of physical and chemical studies of meat quality, the reaction with copper sulphate, peroxidase, reaction to pH was investigated. When studying the physicochemical parameters of reindeer meat, deviations from the data of healthy animals were not established.

According to table No. 1, 2, 3, it can be seen that the reaction with copper sulfate in reindeer meat is negative and the reaction to peroxidase also gave a negative result.

Table 1. The results of physical and chemical indicators of venison meat samples from the Nizhnekolymsky region.

p/n	Sample name	According to ND	Samples				
			No. 1	No. 2	No. 3	No. 4	No. 5
1.	PH	5.7-6.2	5.7±0.2	5.8±0.2	5.7±0.2	5.7±0.2	5.7±0.2
2.	Peroxidase reaction	Positive	Positive	Positive	Positive	Positive	Positive
3.	Reaction with sulfuric acid copper	Negative	Negative	Negative	Negative	Negative	Negative

Table 2. The results of physical and chemical indicators of samples of venison meat in the Bulunsky district.

p/n	Sample name	According to ND	Samples				
			No. 1	No. 2	No. 3	No. 4	No. 5
1.	PH	5.7-6.2	5.7±0.2	5.8±0.2	5.7±0.2	5.7±0.2	5.7±0.2
2.	Peroxidase reaction	Positive	Positive	Positive	Positive	Positive	Positive
3.	Reaction with sulfuric acid copper	Negative	Negative	Negative	Negative	Negative	Negative

Table 3. The results of physical and chemical indicators of samples of venison meat of the Anabar region.

p/n	Sample name	According to ND	Samples				
			No. 1	No. 2	No. 3	No. 4	No. 5
1.	PH	5.7-6.2	5.7±0.2	5.8±0.2	5.7±0.2	5.8±0.2	5.7±0.2
2.	Peroxidase reaction	Positive	Positive	Positive	Positive	Positive	Positive
3.	Reaction with sulfuric acid copper	Negative	Negative	Negative	Negative	Negative	Negative

According to physicochemical studies in selected samples of venison meat from three different regions of the Arctic zone of the Republic of Sakha (Yakutia), it was found that by determining the pH of the meat, the reaction with copper sulphate, the reaction to peroxidase are within the normative and technical indicators. It should be noted that the pH of venison meat in the Anabar region is slightly higher than in other samples taken, but is within the limits of normative and technical indicators.

Thus, the studied samples of venison according to all the physical and chemical studies carried out meet the requirements of GOST.

According to the results of microbiological indicators, the presence of microbes in meat determines its relatively rapid spoilage during storage and, most importantly, creates the risk of food toxic infections and toxicosis in people.

Table 4. Results of microbiological indicators of deer meat.

No.	Name	ND for methods	ND value	Venison meat		
				Anabar district	Bulunsky district	Nizhnekolymsky district
1.	QMAFAnM, CFU/g, no more	GOST 10444.15	1·10 ⁴	not detected	not detected	not detected
2.	BGKP (coli-forms)	GOST 31747	in 0.01g is not allowed	not detected	not detected	not detected
3.	pathogenic microorganisms including salmonella	GOST 31659	Not allowed in 25g	not detected	not detected	not detected
4.	Listeria monocytogenes	GOST 32031	Not allowed in 25g	not detected	not detected	not detected

Table No. 4 shows that according to the method for determining the number of mesophilic aerobic and facultative anaerobic microorganisms (QMAFAnM) in the studied meat samples, it is within the normal range.

Studies on the isolation of bacteria of the Escherichia coli group (ECG) were carried out in order to determine the sanitary conditions when cutting meat. When examining bacteria of the Escherichia coli group, meat samples were not found.

According to the results of microbiological studies on the isolation of Salmonella and Listeria, no samples of meat were found in the studied meat samples.

The main factor for chemical - toxicological studies was influenced by the ecological state of the Arctic zone of the Far North. Major projects are being implemented in the Arctic zone aimed at developing industrial production, including environmentally hazardous ones. These enterprises become the main sources of pollution, destroyers of natural ecosystems. In the Anabar region, industrial enterprises pollute not only the atmosphere, but also water resources [14]. In order to protect human health, effective control is needed to identify residual amounts of toxic components in animal products.

The atomic absorption method for determining toxic elements is the main method for determining the content of lead, cadmium, copper, zinc.

Table 5. The results of chemical and toxicological indicators of samples mg/kg of deer meat from the Nizhnekolymsky district.

No.	Name	ND for methods	ND value	Samples				
				No.1	No.2	No.3	No.4	No.5
1	Cadmium	GOST 30178-96	Not more than 0.05	Less than 0.02	Less than 0.02	Less than 0.02	Less than 0.02	Less than 0.02
2	Lead		Not more than 0.5	Less than 0.15±0.03	Less than 0.1±0.02	Less than 0.11±0.02	Less than 0.1±0.02	Less than 0.05±0.01
3	Mercury	GOST R 53183	Not more than 0.03	Less than 0.002	Less than 0.002	Less than 0.002	Less than 0.002	Less than 0.002
4	Arsenic	GOST 31707	Not more than 0.1	Less than 0.01±0.002	Less than 0.01±0.002	Less than 0.01±0.002	Less than 0.01±0.002	Less than 0.006±0.001

Table 6. The results of chemical and toxicological indicators of samples mg/kg of deer meat of the Bulunsky district.

No.	Name	ND for methods	ND value	Samples				
				No.1	No.2	No.3	No.4	No.5
1	Cadmium	GOST 30178-96	Not more than 0.05	Less than 0.02	Less than 0.02	Less than 0.02	Less than 0.02	Less than 0.02
2	Lead		Not more than 0.5	Less than 0.02±0.05	Less than 0.04±0.001	Less than 0.02±0.005	Less than 0.03±0.005	Less than 0.002±0.005
3	Mercury	GOST R 53183	Not more than 0.03	Less than 0.002	Less than 0.002	Less than 0.002	Less than 0.002	Less than 0.002
4	Arsenic	GOST 31707	Not more than 0.1	Less than 0.002	Less than 0.002±0.001	Less than 0.005±0.001	Less than 0.002±0.001	Less than 0.004±0.001

Table 7. The results of chemical and toxicological indicators of samples mg/kg of deer meat of the Anabar region.

No.	Name	ND for methods	ND value	Samples				
				No.1	No.2	No.3	No.4	No.5
1	Cadmium	M 04-64-2017	From 0.01 to 1.0 inclusive	0.002±0.0006	0.0024±0.0006	0.0025±0.0006	0.0024±0.0006	0.0024±0.0006
2	Lead		From 0.05 to 10 inclusive	<0.05	<0.05	<0.05	<0.05	<0.05
3	Mercury		From 0.0025 to 1.0 inclusive	0.00014±0.00005	0.00013±0.00005	0.00014±0.00005	0.00013±0.00005	0.00014±0.00005
4	Arsenic		From 0.05 to 10 inclusive	0.00103±0.0002	0.00104±0.0002	0.00102±0.0002	0.00103±0.0002	0.00103±0.0002

From this table No. 5 it can be seen that, according to chemical and toxicological indicators in the meat of venison of the Nizhnekolymsk region, the lead index is slightly higher than in other regions, but within the permissible concentrations [15].

Based on the results of the organoleptic evaluation of meat, the degree of freshness was determined. In terms of physicochemical, microbiological indicators they correspond to GOST, in terms of chemical and toxicological indicators in venison meat of the Nizhnekolymsky region, the lead indicator is slightly higher than in other regions, but within acceptable limits. Pathogenic microorganisms, including salmonella, listeria were not detected.

4 Conclusion

As a result of the laboratory studies of meat samples of domestic reindeer from the Nizhnekolymsky, Bulunsky, Anabarsky regions of the Arctic zone of the Republic of Sakha (Yakutia), the following conclusions can be drawn: the meat of domestic reindeer bred in the Arctic zone of the Republic of Sakha (Yakutia) meets the requirements for commodity and organoleptic indicators GOST; according to physical and chemical indicators of meat quality, they are classified as fresh and obtained from healthy animals and are high-quality food products that are in high demand among the population; it follows from the analyzes of microbiological studies that in all samples of venison CGB (coliforms), pathogenic microorganisms, incl. salmonella, *Listeria monocytogenes* bacteria are not isolated, QMAFAnM indicators are within the acceptable range; in terms of chemical and toxicological indicators, the excess of residual amounts of toxic components in the meat of domestic venison of the Nizhnekolymsk region, the lead indicator is slightly higher than other uluses, but did not exceed the maximum allowable level according to GOST; the examination of domestic venison meat indicates that the products sold are obtained from

healthy animals and belong to the category of benign food products, and are also subject to further sale in compliance with the storage and transportation regimes.

Venison is the richest source of complete protein. Regular consumption of deer meat is a salvation from the development of beriberi, strengthens the immune system. It increases the likelihood of not getting infected with parasitic invasions, since their diet includes moss lichen, which has antiparasitic properties. It is also a low-calorie, low-cholesterol product. A real storehouse of B vitamins and iron.

An organoleptic evaluation revealed that the studied meat of domestic reindeer meets the requirements of the “Veterinary and Sanitary Assessment of the Quality of Meat” [16]. The color of the meat is intense red or dark red, a bluish tint is allowed, which corresponds to the color of venison. The dark color of deer meat is primarily due to the higher content of myoglobin and hemoglobin, which contain a lot of iron. The consistency of the meat is quite dense due to some stiffness of the fibers. When cooking, the broth is transparent with small flakes and large drops of transparent light fat. In general, it should be noted that boiled reindeer meat deserves the highest ratings in terms of its organoleptic perception and can take its rightful place in food production. According to the evaluation of the broth samples, it can be seen that the tendency for the superiority of the indicators of the organoleptic evaluation of domestic deer meat compared to wild deer meat was also preserved when evaluating the broth samples, due to the increased fat content.

The chemical composition may depend on the season of the year, breed and age. The most optimal period is autumn. By spring, the content of many elements of the chemical composition of meat is reduced, which is associated with the deterioration of feeding conditions.

Comparative analysis of domestic reindeer meat from different regions of the Arctic zone of the Far North complies with veterinary and sanitary standards.

Thus, the conditions of keeping and the food base affect the meat productivity of deer, while the quality of meat is significantly improved. A comprehensive assessment of reindeer meat indicates a higher nutritional value of domestic reindeer meat, which compares favorably in chemical composition, organoleptic and technological indicators.

The recommended meat products for dietary and baby food with the use of deer meat in terms of chemical composition, biological qualities, and environmental requirements refer to a complete food product.

The unique qualities of venison make it an indispensable product in the diet of healthy consumers, as well as an exquisite delicacy, recognized and in high demand all over the world.

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