NUTRITIONAL AND BIOLOGICAL VALUE OF VENISON CUTS AS A BASIS OF THEIR RATIONAL USE

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Abstract – This paper presents the indices of the nutritional and biological value of the different parts of reindeer carcasses and the principle of differential carcass cutting allowing the rational use of the obtained cuts.

Key Words – Cutting, Cuts, Nutritional value, Venison

- INTRODUCTION

Reindeer were domesticated as long as two thousand years ago and have been an essential part of the diet of many northern people for a long time. However, this kind of meat has been appreciated by the general public relatively recently.

Nowadays, reindeer breeding is developed in Russia, Sweden, Finland, Canada, the United Kingdom and other countries. Two thirds of the world reindeer livestock is concentrated in Russia (1197 thousand heads in 2000, 1583 thousand heads in 2011). Russian scientists have been studying the venison properties for many years. Its high nutritional and biological value, which is superior to those of the traditional kinds of meat raw material, has been proved. For example, the protein content in venison is 0.3% higher than in beef and 3.9% higher than in pork; with that, the calorie content is 2.1% lower than that of beef and 16.2% lower than that of pork. Besides, venison is superior to beef in the content of vitamins B_1, B_2 and PP; it is rich in many trace elements and can serve as their source in a human diet. The mentioned data characterize venison as an exceptionally nutritive, dietary and low-calorie kind of meat.

Effective and rational use of such a unique product is possible when studying the quality indices of different parts of a carcass and developing a differential chart of carcass cutting into cuts depending on their nutritional and biological value.

- MATERIALS AND METHODS

The carcasses of the first grade of finish from young reindeers up to 24 months old raised and fattened in Yakutia in the conditions of pasture keeping were used as a subject of research.

- RESULTS AND DISCUSSION

The development of the cutting chart was based on the results of the complex investigations of nutritional and biological value and functional properties of the individual parts of venison carcasses as well as the principle of the preservation of the anatomical integrity of muscles and groups of muscles with regard to the assortment of manufactured products and consumer demands. The quality parameters of the different parts of a carcass (cuts) were studied: morphological, chemical, fatty acid composition, vitamin content, as well as cooking property of collagen, in vitro protein digestibility and structural-mechanical properties.

The chemical composition data showed that the moisture content in cuts varied in the range of 72.9-77.5% and correlated with the fat content. The highest fat content was in m.biceps femoris (3.6%) and m. semitendinosus (3.2%) of hip and in m. supraspinatus of blade (3.1%); the lowest fat content was in the inside part of blade (0.8%) and in the side part of hip (1.15%). Total protein content varied from 19.3% in m. supraspinatus of blade to 22.2% in brisket (Table 1).

Analysis of fatty acid composition of lipid fractions separated from fat tissue of cuts revealed that it was quite close in the examined cuts (Table 2). Assessment of ω6/ ω3 ratio showed that the top piece of hip, back and fore rib and loin had the values of 4.2 and 3.98, which were close to the perfect generally accepted value.

Table 1 Chemical composition and nutritional value of a fleshy part of cuts (n=6)

Cut	Total protein, % M±m	Connective tissue protein, % to total protein, M±m	PQI
hip, including			
outside:			
m. biceps femoris	21.30±0.64	16.71	0.81
m. semitendinosus	21.20±0.41	13.44	0.74
inside	21.60±0.50	7.45	1.97
side	20.80±0.52	7.88	1.54
top	20.90±0.87	7.37	1.50
tail part	20.60±0.73	11.20	1.54
back and fore rib	21.40±0.45	5.19	2.96
loin	21.30±0.36	5.31	2.90
brisket	22.20±0.31	11.58	0.67
rib	20.40±0.56	17.33	0.74
flank	24.10±0.14	25.55	0.43
blade, including			
m. triceps brachii	21.30±0.31	11.03	0.96
m. infraspinatus and m. deltoideus	21.40±0.69	13.50	1.03
m. supraspinatus	19.30±0.50	14.97	0.99
inside part	21.00±0.23	10.67	0.61
hinder part of a blade	21.90±0.62	13.23	1.04
neck	20.40±0.22	11.08	0.97
fore and hind shank	22.80±0.38	15.93	0.86

Reindeer are herbivorous animals. They live in the natural conditions and have a limited food supply. The main source of feed is reindeer lichen pastures and green under the snow. Lichens (reindeer lichen) are rich in carbohydrates but poor in proteins and minerals. Also the components of reindeer feeding include moss, twigs, buds, bushes, plant leaves and sprouts, horse-tail, berries and mushrooms, which promote the generation of polyunsaturated fatty acids in animals.

Table 2 Fatty acid content in meat cuts (n=6)

Cut	Sum of amino acids , %			ω 6: ω 3
	saturated	monounsaturated	polyunsaturated	
hip, including				
outside:				
m. biceps femoris	45.50	10.34	10.45	2.37
m. semi-tendinosus	48.31	14.55	12.30	1.93
inside	46.10	10.54	12.48	1.27
side	43.10	13.47	13.99	2.46
top	46.18	13.51	14.95	4.20
tail part	43.66	13.33	13.06	1.21
back and fore rib	42.28	17.50	7.96	3.98
loin	42.14	17.43	10.30	3.93
brisket	43.30	11.12	20.60	2.17
rib	43.93	14.04	14.83	1.71
flank	46.24	15.24	11.54	1.80
blade, including				
m. triceps brachii	47.82	16.16	15.58	2.64
m. infra-spinatus and m. deltoideus	45.12	13.70	16.74	1.56
m. supra-spinatus	45.81	14.51	12.42	1.26
inside part	48.64	12.25	18.98	2.89
hinder part of a blade	44.75	13.12	12.97	1.98
neck	45.61	15.04	24.70	1.91

The studied cuts significantly differed in amino acid composition and the proportion of essential amino acids of muscle tissue proteins (Table 3). The highest content of essential amino acids was in back and fore rib and hip, the lowest was in flank and rib.

Table 3 Amino acid composition of venison (by cuts)

Cut	1. Amino acid content, g/100g of product	
	Total	including essential
hip, including		
outside:		
m. biceps femoris	20.66	6.78
m. semi-tendinosus	20.31	6.81

inside	21.01	6.46
side	20.28	6.55
top	20.40	6.73
tail part	19.68	6.44
back and fore rib	20.85	7.93
loin	20.75	7.92
brisket	21.32	7.15
rib	19.64	5.74
flank	23.01	5.62
blade, including		
m. triceps brachii	20.71	6.75
m. infraspinatus and m. deltoideus	20.67	6.24
m. supraspinatus	18.60	6.44
inside part	20.55	6.67
m. brachialis	21.20	6.49
neck	19.85	6.79

Cooking property of meat connective tissue collagen of the studied parts of a carcass was different and changed depending on the muscles location and their function during animal life (Table 4).

The data characterizing the intensity of the complex influence of the proteolytic enzymes of gastro-intestinal tract (digestibility in vitro) on meat proteins showed that it was in an inverse relationship with the quantity and quality of connective tissue proteins (Fig. 1).

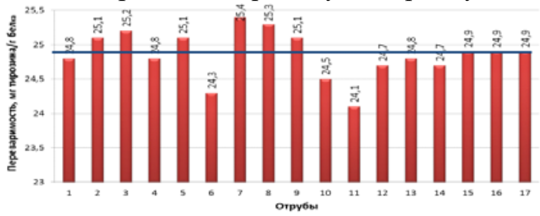

Figure 1 Meat proteins digestibility by gastro-intestinal tract enzymes (by cuts)
mean value

Hip: 1 - inside part; 2 - side part; 3- top part; 4 - m. biceps femoris; 5 – m. semitendinosus; 6 - tail part; 7 - back and fore rib; 8 - loin; 9 - brisket; 10 - rib; 11- flank; Blade: 12 - inside part; 13 - m. deltoideus; 14 - m. supraspinatus; 15 – m. triceps brachii; 16 – hinder part of a blade; 17- neck

Table 4. Characterization of the properties of meat connective tissue (by cuts)

Cut	Connective tissue protein, % M±m	Shear stress of raw meat, N/m² M±m	Collagen cooking property, % M±m
hip, including			
outside:			
m. biceps femoris	3.56±0.01	149.77 ±2.65	50.9±0.47
m. semi-tendinosus	2.85±0.01	135.65 ±2.79	51.6±0.58
inside part	1.61±0.01	118.53 ±2.51	58.6±0.58
side part	1.64±0.01	123.16 ±1.97	53.1±0.82
top part	1.54±0.01	131.47 ±2.34	61.7±1.17
tail part		140.5±1.66	59.6±1.18
back and fore rib	1.11±0.02	104.22 ±1.52	85.0±1.43

loin	1.13±0.01	103.75 ±1.65	84.5±1.37
brisket	2.57±0.01	142.18 ±1.94	64.1±1.29
rib	3.53±0.01	138.69 ±1.66	69.2±1.18
flank	6.16±0.01	151.09 ±2.15	29.9±0.35
blade, including			
m. triceps brachii	2.35±0.02	149.80±1.27	57.0±2.05
m. infra-spinatus and m. deltoideus	2.89±0.01	148.20±1.24	44.3±1.04
m. supra-spinatus	2.89±0.01	148.99±1.16	44.3±1.19
inside part	2.24±0.01	124.18±1.08	61.3±1.44
m.brachialis		147.9±1.66	58.6±1.18
neck	2.26±0.02	129.70±1.23	48.7±1.63

Taking into consideration the peculiarities of the anatomical organization of reindeer and the data of the complex investigations, a differential chart of reindeer carcasses cutting into boneless cuts (21) and bones (14) was developed (Fig.2).

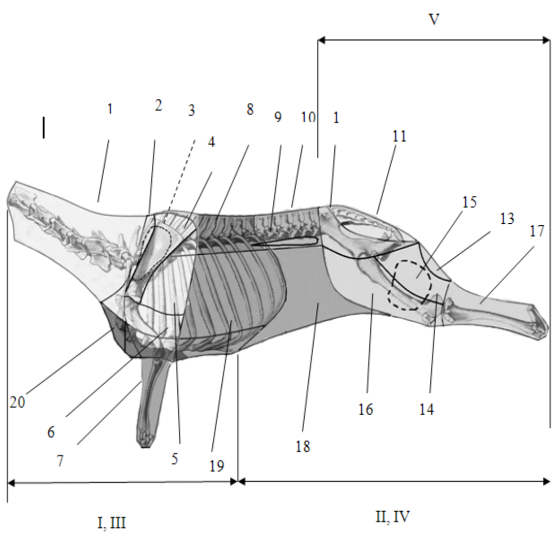

Figure 2. Venison cutting chart

Figure legend:

I (1-8, 19-20) – forequarter; II (9-18) – hindquarter; III (1-8, 19-20) - fore carcass half; IV (9-18) - hind carcass half; V (11-17) – hind part

1- neck, 2-7 blade: 2- m. supraspinatus, 3 - inside part, 4 - m. infraspinatus and m. deltoideus, 5 - m. triceps brachii, 6 - hinder part of a blade, 7 - fore shank, 8 - back and fore rib, 9 - tenderloin, 10 - loin, 11 - tail cut, 12-17 - hip: 12- top part, 13-14 - outside part: 13 - m. semi-tendinosus, 14 - m. biceps femoris, 15 – inside part, 16- side part, 17 - hind shank, 18 - flank, 19 - rib, 20 - brisket

- CONCLUSION

The creation of the differential chart of reindeer carcasses cutting into cuts will facilitate the development of this sector of animal husbandry and the rational use of venison.

The prospects appear promising for the reindeer breeding development in Russia because reindeer are undemanding animals and venison has an outstanding nutritional value, which according to the research is superior to the more traditional kinds of meat (beef, pork) in many quality indices.

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