

Meat Productivity of Red Steppe Breed Calves and Castrates With Moderate Breeding And Feeding

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Abstract

Meat productivity of calves and castrates of the red steppe breed under 18 months of age in 5 ages was studied: 1 day, 6 months, 9 months, 15 months, and 18 months, with the average daily live weight gain of 820 g and 775 g, grown and fattened on own feed. The calves were castrated at the age of 3 months.

By the age of 18 months, the calves gained live weight of 475.2 kg, castrates - 444.25 kg, the carcass weight was 237.9 kg and 224.0 kg. The slaughter yield of calves was 50.21% to 53.63%, and that of castrates - 48.83% to 55.25%. The carcasses were dissected with extraction of muscular, adipose and bone tissues, followed by weighing on scales. The relative weight of the muscle tissue increased in carcasses of calves from the age of 1 day till the age of 6 months from 64.02% to 71.27%, and then it decreased to 67.62% in the age of 18 months. In the carcasses of 6 months old castrates, it was 71.10%, and further decreased to 64.93%. The absolute muscular tissue weight growth rate in 18 months old calves, compared to that of one day old ones was 19.29 times, fat growth rate was 142.47 times, and bones' growth rate was 11.29 times; in castrates in the age from 6 to 18 months - 2.84 times, fat tissues - 15.33 times, and bone tissues - 2.50 times. We believe that the absolute live weight in calves and castrates by the age of 18 months has not reached the biological growth potential due to unnormalized feeding.

Keywords: calves, age, live weight, carcass weight, absolute and relative weight of muscle, fat and bone tissues.

INTRODUCTION

When the man first emerged on our planet, he faced his very first and eternal problem - food. Millennia have passed, social structures have changed, but the vital problem of food still remains unsolved on the global scale. In course of implementation of the Food Program for the period until 2020, it is planned to increase meat production in Russia by 9,707.3 thousand tons. In 2016, the overall meat production amounted to (thousand tons): poultry - 4,760, pork - 3,562, beef - 1,640, lamb 461.2 [1]

For milk and beef production, 50 breeds of cattle are bred in Russia, of which 86% are dairy cattle and combined productivity cattle. These breeds are mainly bred in the areas heavily inhabited by people [2].

It is known that cattle provide beef, regardless of how the animals are classified: meat, milk, or combined cattle. Consequently, the obtained beef is a product with various qualities that depend on how these multiple factors have influenced the growth of the three composite parts of the carcass - muscle, fat and bone tissues [3, 4, 5, 6].

The understanding of how the animals grow may lead to development of methods to control the growth processes, finding the ways to increase production of higher quality products. Beef is a product that people buy not only because it contains proteins and fats, but also due to its special taste qualities [4, 7].

For milk production, in South of Russia, the Caucasus, and Ukraine, the red milk steppe breed of cattle is also used with the livestock of 3.9 million heads. The obtained youngsters and crosses with meat breeds have high potential for meat productivity, which allows efficient feeding and growing in production of beef according to the industrial technology [4, 8, 9].

In the last decade, significant differences have been revealed in the quality indicators of meat, depending on breeding aimed at developing new animal genotypes with increased growth rates and the accumulation of greater amounts of muscle tissues, low stress-resistance, and lower cost of feed for weight gain. Meat productivity of young cattle and the quality of meat are influenced by castration of calves, which has been studied in detail [4, 10, 11, 12]. The authors note that uncastrated calves have more intensive

and prolonged growth of the muscle tissue, compared to castrated calves.

In this work, meat productivity of calves and castrates grown and fattened at cattle ranch "Zimovniki" in the Rostov region was studied. Up to 6 months of age, the calves were grown in winter in the standard premises according to the technology adopted in the sector. From 8 to 18 months of age, the animals were loosely kept in groups in arched premises, and the backyard was used for feeding. By the method of analogues, two groups were formed, one of which contained calves, and the other one - castrates. The calves were castrated at the age of 3 months.

The diet of calves contained the following: milk (180 kg), whole milk substitute (32.9 kg), concentrates, hay and green grass. Concentrated feed in the diet amounted to 32.5%; coarse feed - to 28%, juicy feed - to 12.3%. Youngsters were fed only with own production fodder.

For studying tissue growth, 3 heads in each age group were slaughtered: newborn calves - source material; 6 months old - beginning of gender dimorphism manifestation; 9 months old - according to GOST R 54315-2011 were classified as veal; 15 and 18 months old - slaughter animals [11].

The animals were slaughtered at the meat-processing factory, the head was detached from the carcass along the atlanto-occipital joint, the lower part of the thoracic limbs - between the bones of the wrist joint and the basidigital bone, of the pelvic limbs - between the bones of the ankle joint and the shank. Only two caudal vertebrae were left with the carcass [4].

Morphological studies of the carcasses were performed after 24-hour exposure in a refrigeration chamber at the temperature of 0 - 4 °C. Muscle, fat, and bone tissue and weight of cartilages and tendons were prepared individually, according to the methods described in [1, 6, 12]. The results of the slaughter parameters are shown in Table 1.

The data in the table below show that the live weight of calves from birth to the age of 6 months increased by 142.92 kg; in the age from 6 to 9 months - by 75.24 kg, of castrates - by 70.02 kg; from 9 to 18 months of age - by 230.85 kg, and that of castrates - by 213.39 kg.

Table 1. Slaughter indicators of youngsters of the red steppe breed

Weight indicators	Age, months				
	Newborn	6	9	15	18
Calves					
Live weight, kg	26.2 ±0.41	169.12 ±1.94	244.36 ±3.04	399.16 ±4.02	475.21 ±5.35
Average daily gains, g	-	794	836	860	845
Pre-slaughter live weight, kg	26.0 ±0.40	159.29 ±1.76	230.41 ±2.28	377.5 ±3.86	450.4 ±5.07
Hot carcass weight, kg	13.28 ±0.36	79.42 ±0.93	116.70 ±1.49	197.32 ±2.37	240.68 ±2.98
Hot carcass yield, % to the pre-slaughter live weight	51.06	49.86	50.65	52.83	53.20
Inner slaughter fat yield, % to the pre-slaughter live weight	-	0.36	0.46	1.15	1.43
Slaughter yield, %	51.06	50.21	50.78	53.20	53.63
Castrated calves					
Live weight, kg	-	160.84	230.86 ±2.74	373.96 ±3.92	444.25 ± 5.04
Average daily gain, g	-	748	778	795	781
Pre-slaughter live weight, kg	-	151.00	217.21 ±2.05	353.73 ±3.09	421.06 ±3.79
Hot carcass yield, %	-	49.90	50.85	53.28	53.75
Slaughter fat yield, %	-	0.39	0.48	1.18	1.50
Slaughter yield, %	-	48.83	51.33	54.46	55.25

Table 2. Morphological composition of carcasses

Weight indicators	Age, months				
	Newborn	6	9	15	18
Calves					
Absolute weight, g					
Weight of chilled carcass	13,024 ±319	78,370 ±917	114,908 ±1,014	194,564 ±1,984	237,912 ±2,176
Weight of muscle tissue	8,338 ±417	55,854 ±712	81,700 ±945	135,124±1,643	160,876 ±1,849
Weight of fat tissue	171 ±5	1,928 ±37	4,021 ±251	14,028 ±626	24 362 ±813
Weight of cartilages, ligaments	423 ±14	2,414 ±139	3,413 ±184	5,526 ±328	6,472 ±469
Weight of bones	4,092 ±242	18,174 ±384	25,774 ±456	39,886 ±567	46,202 ±615
Relative weight, % to the weight of the carcass					
Weight of muscles in the carcass	64.02	71.27	71.10	69.45	67.62
Weight of fat in the carcass	1.31	2.46	3.50	7.21	10.24
Weight of cartilages, ligaments	3.25	3.08	2.97	2.84	2.72
Weight of bones in the carcass	31.42	23.19	22.43	20.50	19.42
Castrated calves					
Absolute weight, g					
Weight of chilled carcass	-	72,150 ±813	108,780 ±915	186,202 ±2,355	224,034 ±2,830
Weight of muscles in the carcass	-	51,298 ±707	76,636 ±860	127,568 ±1,435	145,464 ±2,007
Weight of fat in the carcass	-	2,013 ±179	5,254 ±425	15,678 ±587	30,852 ±978
Weight of cartilages, ligaments in the carcass	-	2,179 ±146	3,122 ±178	5,120 ±376	6,026 ±481
Weight of bones in the carcass	-	16,660 ±325	23,768 ±390	37,836 ±512	41,692 ±584
Relative weight, % to the weight of the carcass					
Weight of muscles in the carcass	-	71.10	70.45	68.51	64.93
Weight of fat in the carcass	-	2.79	4.83	8.42	13.77
Weight of cartilages, ligaments in the carcass	-	3.02	2.87	2.75	2.69
Weight of bones in the carcass	-	23.09	21.85	20.32	18.61

The average daily live weight gain of calves from the day of birth to 6 months of age was 794 g, from 6 to 15 months of age it increased by 66 g, that of castrates - by 47 g, from 15 to 18 months of age, the weight gain decreased by 15 g, that of castrates - by 14 g. For the period from 6 to 18 months of age, the average daily weight gain of calves amounted to 838.6 g, that of castrates - by 776.5 g, which was less than in calves by 62.1 g, or 7.42%.

The live weight of 18 months old calves exceeded that of castrates by 30.96 kg, or by 6.52%. The pre-slaughter live weight decreased, compared to the live weight of calves by 5.97-5.22%.

Due to greater pre-slaughter live weight, calves were characterized by a significantly greater hot carcass weight and were heavier than castrates by 8.86 kg (4.49%, $P < 0.001$), in the age of 18-months - by 29.34 kg (6.51%, $P < 0.001$). As to the absolute weight of inner slaughter fat, 15 months old castrates contained 4.17 kg, calves - 1.9 kg, 18 months old - 5.32 kg and 6.47 kg, respectively.

By the slaughter yield, advantage of 15 months old castrates had been detected by 1.26%, of 18 months old ones - by 1.62%.

The quality of meat products is mainly determined by its morphological composition, and the higher the yield of the edible portion of the carcass is, the higher the quality is.

Carcass is a more objective indicator of quality than live weight. The weight of carcass of 18 months old calves increased, compared to the weight of newborn, by 18.27 times, compared to 6 months old calves - by 3.04 times, castrates - by 13.65 times. The results of the research are shown in Table 2.

As to the absolute weight of inner slaughter fat, 15 months old castrates contained 4.17 kg, calves - 1.9 kg, 18 months old - 5.32 kg and 6.47 kg, respectively.

In studying the morphological composition of carcasses, it has been found that carcasses of calves and castrates in all age periods contained more muscle tissue. Its average daily gain in calves in the age from one day to 6 months amounted to 263.98 g, from 6 to 9 months of age - to 287.51 g, of castrates - to 281.53 g, from 9 to 15 months of age - to 296.8 g and 282.96 g, and from 15 to 18 months of age - to 286.13 g and 198.84 g, respectively.

The absolute weight of muscle tissue in 6 months old calves, compared to one-day old, increased 6.70 times, that of 18 months old calves compared to 6 months old ones - 2.88 times, and castrates - 2.84 times.

The relative weight of muscle tissue in carcasses (to the weight of carcasses) of calves from birth to 6 months of age increased by 7.25%, then by the age of 18 months, it decreased by 3.65%. In 18 months old castrates, compared to 6-months old ones, it reduced by 6.17%.

In the aspect of food value, the second important tissue in the carcass is fat. Depending on its amount in the carcasses, they belong to various fatness categories.

In the carcasses of 6-month calves and castrates, there were small differences in fat content - 2.46% and 2.79%, by 18 months of age, in calves it increased to 10.24%, in castrates - to 13.77%.

The growth rate of fat weight in carcasses of 18 months old calves, compared to the weight of fat in 6 months old calves, was 12.63 times, in castrates - 15.3 times. With age, the rate of fat deposition in the carcasses of calves increased. Thus, from 6 to 18 months of age, the relative weight of fat tissue in carcasses of calves increased by 7.78%, that of castrates - by 10.98%.

More acceptable fat content in the carcasses of castrates was achieved only by the age of 18 months.

As to the growth and development of cartilages and ligaments, with the age of calves (6-month) their relative weight reduced from 3.08% to 2.72% (18-month), in castrates - from

3.02% to 2.69%.

The issue of the content of non-edible tissues (bones) in the carcasses of animals is of great interest. The average daily gain in bone weight in calves in the age from one-day to 6 months was 78.23 g, in calves in the age from 6 to 18 months - 76.79 g, in castrates - 68.58 g.

The growth rate of the absolute bone weight in calves at the age of 6 months, compared to one-day old, amounted to 4.44 times, in calves from 6 to 18 months of age - to 2.54 times, in castrates - to 2.50 times.

It is indicative that the relative weight of bones decreased in every age period of the animals. Its particularly intense reduction was observed in calves from the age of one day until the age of 6 months - by 6.23%, in the age from 6 to 18 months in calves - by 3.77%, in castrates - by 3.24%.

DISCUSSION

Meat productivity of calves in the zone of risky agriculture with insufficient amount of animal feed requires further study. In our experiment, animals were grown and fattened on the fodder that ensured the average daily live weight gain of 750-870 g. This method of growing and fattening animals was not economically beneficial, but the carcasses obtained from the animal contained relatively more muscle tissue (71.27-64.93%), and they were in greater demand with the population.

The research results have shown that the carcass yield in the age from 6 to 18 months increased by 6.75%.

To establish the morphological relationships in the carcasses, consequent slaughtering of animals in 5 ages was performed. The main method of accounting for the growth of young animals was determining the weight of tissues by weighing.

It has been found that various tissues' growth rate in terms of age results in changes in their shares in the carcass. Thus, with the age, the relative weight of muscle tissue in non-castrated calves increased only until the age of 6 months (71.27%), and in castrates - until the age of 6 months (71.10%), then it decreased. With each of the studied age period, fat content in the carcasses of animals increased, while the weight of bones, on the contrary, decreased. It should be noted that within the 18 months' period of growing and fattening castrated calves, carcasses with the desired shares of tissues were obtained, i.e. meeting the optimum requirements of good quality, while carcasses of calves in terms of fat content met only the minimum requirements. This indicates that in calves, intensive growth of muscle tissues takes longer than in castrates, and therefore, calves may be continued to be fattened until heavier state is achieved. However, castration of calves in the young age results in slowed growth of animals, and contributes to early fat deposition.

CONCLUSION

In conclusion, it should be noted that growing young cattle to higher live weight increases the amount of soft tissues in the carcass, and improves product quality, i.e. quantity determines quality.

In addition, it should be noted that there is no such breed that would perfectly satisfy requirements of all markets, just as there is no breed that would be best suited to the wide variety of environmental conditions, in which milk and beef are produced [4, 12].

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