

Meat productivity and interior features of fat-tailed coarse wool lambs in the south-east of Kazakhstan

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Abstract: Increased lamb production in the South-Eastern region of Kazakhstan confirms the economic feasibility of processing young sheep from 7 to 12 months. Unfortunately, domestic literature offers little information on the selection and appropriate use of 4-month-old lambs for this purpose; this accounts for the relevance and both scientific and practical significance of research aimed at increasing the meat productivity of 4-month-old lambs (depending on breed) in the semi-desert zone of the South-Eastern region of Kazakhstan, based on technological developments. The object of the study was lambs of fat-tailed coarse wool breeds: Edilbay, Hissar and Kazakh fat-tailed breeds. The animals were 4 months old and kept from birth in one flock at the Yntykbay farm in Almaty region. Among the three studied breeds, Gissar stands out in terms of carcass weight, slaughter weight, and specific gravity of the meat and carcass. High-quality carcasses were obtained from all groups; the Hissar breed had the yield of 17.5 kg (carcass yield was 78.3%).

Keywords: Edilbay, Hissar and Kazakh fat-tailed breeds, Meat productivity, Slaughter weight, Slaughter yield, Morphological composition of lamb carcasses

1 Introduction

Fat-tailed coarse wool sheep are highly adaptable to extreme conditions in various breeding areas, differing favorably from other breeds and types of farm animals, since they use the feeding capabilities of natural pastures and are characterized by a higher adaptability to year-round grazing.

In coarse wool fat-tailed sheep breeding, selection tasks are focused on increasing the precocity and meat productivity of animals, increasing the volume of shearing, and also improving the quality of coarse wool.

To improve production and increase the economic efficiency of the industry, it is necessary to rationally use the existing sheep breed resources, taking into account the zonal characteristics of specific regions of the Republic of Kazakhstan. Studies reflect theoretical

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and practical issues of identifying patterns of development indicators in meat productivity, of analyzing the biological and productive characteristics of fat-tailed coarse wool sheep, and of determining the characteristics of fat-tailed animals in the corresponding natural-economic zones and regions of the CIS [1, 2-11].

However, the achieved results do not fully satisfy the ever-increasing market needs for sheep products. Numerous specific issues hinder further development of meat and fat sheep farming at present, namely, the lack of clear recommendations regarding the timing of slaughter for sheep of different productivity levels. Scientific justification for sheep breeding development is an urgent task. Industry development experience shows that increasing the efficiency and competitiveness of sheep breeding should be based on creating conditions for rational use of genetic resources [12].

The purpose of the study was to effectuate a comparative analysis of formation for meat productivity and for interior indicators of 4-month-old fat-tailed coarse wool lambs in the South-East of Kazakhstan.

2 Materials and methods

The experiment was carried out on the basis of the Yntykbay farm in Almaty region.

To conduct the research and production experiment, 3 groups of lambs aged 4 months were formed: Edilbay (Group 1), Hissar (Group 2) and Kazakh fat-tailed (Group 3) breeds.

To assess the meat qualities, the control slaughter of analogue lambs (3 heads from each group) was carried out according to the method by L.K. Ernst Federal Research Center for Animal Husbandry. The morphological and varietal composition of the carcasses was determined according to GOST 7598-81.

3 Results

In modern market conditions, domestic sheep breeding is focused on lamb production, which requires developing new approaches in selection and breeding. Meat productivity quantitative and qualitative indicators are quite dependent on feeding, keeping and rearing conditions, with heredity having a strong impact as well. This is confirmed by substantial differences between animals of the same species but various breeds in terms of early maturity, yield of edible parts of the carcass, payment for feed, etc.

The key indicators of sheep meat productivity change significantly depending on the direction of productivity, of breed, age, gender, and on the type of rearing and fattening [13].

The increasing demand for meat as a food product and the need to produce feed and resources at the lowest cost require creating new breeds of meat sheep with high growth energy, a high utilization rate and a good return on feed from meat and wool products.

To identify the meat and fat qualities of young fat-tailed sheep of different breeds, lambs were slaughtered at the age of 4 months. Notably, animals which most fully reflected the average performance in each group were selected (Table 1).

The table data shows that carcasses of standard weight were obtained in all groups. The control slaughter showed that young animals of Group 2 have relatively better slaughter characteristics, since lamb carcasses at this age are distinguished by their massiveness and roundness, with well-developed muscles.

Thus, Group 2 lambs in terms of carcass weight and slaughter weight exceeded their peers from Groups 1 and 3 by 5.1-5.2 and 15.4-17.2%, respectively.

Notably, one of key objective indicators of animal meat productivity is the ratio of meat and bones in the carcass, i.e. meat coefficient largely dictated by the breed characteristics, age, fatness and gender.

Table 1. Results of control slaughter of lambs of different genotypes at the age of 4 months (n=3).

Indicator	Group		
	1	2	3
Pre-slaughter live weight, kg	36.1	37.5	33.1
Carcass weight without tail, kg	16.6	17.5	14.8
Carcass yield without fat-tail, %	46.0	46.7	44.7
Fat tail, kg	1.6	1.7	1.1
Fat tail yield, %	4.43	4.53	3.32
Internal fat, kg	0.15	0.16	0.13
Internal fat yield, %	0.416	0.427	0.393
Slaughter weight, kg	18.35	19.36	16.03
Slaughter yield, %	50.8	51.6	48.4

In the present study, 4-month-old lambs of all groups had a fairly high proportion of meat in the carcass, namely 76.4-78.3%. At the same time, Group 2 was characterized by the highest indicators – 78.3% (Table 2).

Table 2. Morphological composition of the carcass of 4-month-old lambs of different genotypes (n=3).

Indicator	Group					
	carcass without fat tail			carcass with fat tail		
	1	2	3	1	2	3
Carcass weight, kg	16.6	17.5	14.8	18.2	18.9	16.3
Meat weight, kg	12.8	13.7	11.3	14.4	15.1	12.8
Meat weight, %	77.1	78.3	76.4	79.1	79.9	78.5
Weight of bones and tendons, kg	3.8	3.8	3.5	3.8	3.8	3.5
Weight of bones and tendons, %	22.9	21.7	23.6	20.9	20.1	21.5
Meat coefficient	3.37	3.60	3.23	3.79	3.97	3.66

Summarizing the research on the level of meat and fat productivity in experimental groups of young animals allows concluding that Hissar lambs have a noticeable advantage in localizing fat deposits in the fat tail. Thus, lambs of Group 2 showed an increase in the mass of fat tail fat – 0.1-0.6 kg higher than in Groups 1 and 3.

Along with quantitative indicators of meat productivity, the nutritional value of meat is to be determined by its chemical composition (Table 3).

Table 3. Chemical composition of lamb carcass meat (n=3).

Group	Content per 1 kg				Protein to fat ratio	Calories per 1 kg
	moisture	fat	protein	ash		
1	71.80	8.50	18.60	1.10	2.19	2065.0
2	71.60	9.70	17.60	1.10	1.81	2049.0
3	71.70	9.80	17.50	1.00	1.79	2021.0

The obtained data show that lamb meat in Groups 1 and 3 contained more moisture (0.20-0.10%, respectively) than in Group 2. The lowest fat content (8.50%) was found in Group 1; this is lower than in Groups 2 and 3 by 1.2% and 1.3%, respectively.

Protein and ash content in all groups revealed no significant differences. The protein to fat ratio of 1.79 to 2.19 is considered the most optimal for lean meat; this is considered normal for fat-tailed sheep in accordance with international requirements, since lean meat has reduced cholesterol content.

The meat from Groups 1 and 2 turned out to be more nutritious – 2065.0 and 2049.0 kcal compared to Group 3 (2021.0 kcal).

Thus, chemical analysis of the carcass meat showed that in all groups lamb meat is lean and has lower fat content, which meets the requirements of the world market.

When studying the meat qualities of lambs, the ratio of the weight of individual internal organs to the net body weight is of particular interest. The degree of functioning depends on the physiological processes associated with bodily development and, consequently, the productivity of the animal depends on internal organs development.

By nutritional value, offal is divided into two categories. Category 1 offal (heart, liver, kidneys, tongue, etc.) and a number of extractive substances that give a pleasant taste to food and contribute to its better digestibility are considered the most valuable. Category 2 (lungs, rumen, spleen, etc.) contain mainly incomplete proteins and therefore are difficult to digest.

In this regard, to characterize and compare certain interior indicators of lambs from various selection options, the quantitative and qualitative indicators of offal were analyzed (Table 4).

In general, in one group of lambs, the total weight of Category 1 offal ranges from 1.25-1.53 kg, or 3.78-4.08% of pre-slaughter body weight. For Category 2, the numbers are 3.18-3.65 kg, or 9.60-9.73%. In Group 2, offal mass and yield is slightly higher than in Groups 1 and 3.

Animal productivity is closely related to body organs. In this regard, animals of early maturing breeds at an early age and with a relatively low live weight achieve the same ratio of tissues, organs and body parts that are characteristic of adult animals of late maturing breeds with a higher live weight.

The weight of internal organs, expressed as a percentage of the weight of the carcass freed from the contents of the digestive tract, is usually higher in early-maturing animals. With age, the weight of the heart, liver, lungs and other organs absolutely increases; at the same time, their weight in relation to body weight decreases due to the fact that some organs and systems, namely the skeleton and muscles, grow faster.

Table 4. Weight and yield of offal to pre-slaughter body weight of lambs (n=3).

Indicator	Group			Average
	1	2	3	
Offal weight, kg				
Category: 1	1.45	1.53	1.25	1.42
2	3.50	3.65	3.18	3.44
Offal yield %				
Category: 1	4.02	4.08	3.78	3.96
2	9.69	9.73	9.60	9.67
Total, kg	4.95	5.18	4.43	4.85
Total, %	13.71	13.81	13.38	13.63

When identifying the interior characteristics of animals, it is necessary to study the development of internal organs, since these are closely related to the future productivity of animals. It allows identifying the connection between the morphological characteristics of the organism and the productive qualities of animals and, as a result, to evaluate their economically valuable characteristics based on interior indicators (Table 5).

A key interior sign is the blood of animals as an indicator of the life processes in the body. In terms of the weight of drained blood, lambs in Group 2 were noticeably superior to their peers in Groups 1 and 3 by 4.25-5.93%, which is due to more intense metabolism in Group 2 compared to Group 1. In Group 2, a larger amount of blood was transported by a larger heart than in Groups 1 and 3 – by 6.16-8.73%, respectively.

Table 5. Interior features of 4-month-old lambs (n=3).

Indicator	Group		
	1	2	3
Drained blood weight, g	1712.0	1788.0	1682.0
Heart, g	175.3	186.8	170.5
Lungs, g	468.2	480.3	459.5
Liver, g	553.5	565.0	549.1
Spleen, g	58.0	65.0	55.0
Kidneys, g	138.7	141.3	135.5
Stomach weight without contents, g	1.41	1.49	1.35
Intestinal length	large	8.5	8.7
	small	31.0	32.0

Lams in Group 2 were also characterized by better development of the lungs – the weight of this organ exceeded that in Groups 1 and 3 by 2.50-4.33%, respectively.

The liver functions are quite diverse and significant – bile formation and secretion, neutralization of toxic substances, regulation of blood glucose levels, blood formation, etc. Judging by the weight (549.1-565.0 g), the liver was normally developed in all groups; however, its weight in Group 2 exceeded that in Groups 1 and 3 by 2.04-2.81%.

The spleen, one of the main hematopoietic organs, was well-developed in all groups of lambs, yet in this case Group 2 was also superior to Groups 1 and 3 in terms of spleen weight by 10.77-15.38%.

Kidneys also play an important role in metabolic processes, removing decay products of organic substances. Kidney weight in Group 2 exceeded that in Groups 1 and 3 by 1.84-4.10%.

The functions of the digestive organs in animals are associated with ensuring their subsequent productivity, therefore, in addition to the absolute weight of the internal organs, stomach weight and the degree of intestine development (large and small intestines length) were analyzed. Lambs in Group 2 had an advantage in stomach weight – 1.49 g. The length of the large and small intestines differed in the compared groups of animals insignificantly, with some advantage in Group 2.

Thus, better internal organs development in Group 2 characterizes the lambs as animals with more intense metabolic processes than their peers in Group 1 and 3, which was subsequently reflected in the best indicators of their meat productivity, since they display a noticeable tendency towards higher yields of meat of the desired assortments.

4 Discussion

Lamb meat is a valuable component of human nutrition and a source of animal protein. The south-eastern region of Kazakhstan, with vast natural pastures, traditionally is a zone of developed sheep breeding. Economic efficiency and competitiveness of sheep breeding largely depend on introducing effective breeding techniques and technology, and the global trend of rising prices for lamb meat requires improving fat-tailed coarse wool sheep both in terms of increasing meat productivity and improving wool quality. Due to the devaluation of coarse wool, its further development in modern conditions is associated mainly with

lamb production. Therefore, the choice of breeds to solve this problem is of great scientific and practical interest.

Quantitative and qualitative indicators of meat productivity depend on a number of factors, most importantly age and gender of animals. The present study revealed undeniable effectiveness of selling sheep for meat during their birth year. Compared to adult animals, lambs raised for meat give higher gains and pay better for feed; besides, lamb meat has higher taste and nutritional qualities than other types of meat. When studying the meat productivity of fat-tailed coarse wool lambs, the authors followed the patterns established by N.P. Chirvinsky, G.F. Mukhin, F.M. Mukhamedgaliev and A.I. Erokhin. They indicate that development of farm animals, of their organs and tissues proceeds unevenly and is subject to certain biological patterns at different ages. Knowledge of the general biological laws of animal growth and development allows establishing the most rational terms for obtaining certain products in optimal quantities with the least amount of labor and minimal costs.

As known, fat-tailed coarse wool sheep breeding as a specialized industry is an important source of high-quality lamb production. In general, in the meat balance of Kazakhstan, lamb accounts for more than 30% of the total meat production. In this regard, a broader study of the meat productivity of fat-tailed coarse wool sheep in the South-Eastern region of Kazakhstan is required at various stages for scientific substantiation and use of the available genetic material in further selection and breeding work.

To study meat productivity of lambs belonging to various breeds, a control slaughter of 4-month-old lambs was carried out (3 heads from each breed, typical in terms of live weight of animals). The results obtained reveal that in terms of carcass weight and slaughter weight, Hissar lambs were superior to the Edilbay and Kazakh fat-tailed coarse wool breeds by 5.1-5.2 and 15.4-17.2%, respectively. The morphological composition of the carcass showed that Hissar lambs had a slightly higher proportion of meat than the Edilbay and Kazakh fat-tailed coarse wool breeds by 1.2 and 1.9%.

Thus, slaughtering 4-month-old lambs of the studied genotypes after weaning from their mothers in the conditions of South-East Kazakhstan allows obtaining full-weight carcasses from 14.8 kg to 17.5 kg without the tail, which corresponds to international standards.

5 Conclusion

1. When slaughtering lambs from all groups, high-quality carcasses were obtained; the weight (without the tail) for the Edilbay breed was 16.6 kg, for Hissar – 17.5 kg and for the Kazakh fat-tailed coarse wool breed – 14.8 kg at the slaughter yield of 50.8, 51.6 and 48.4%, respectively.

2. Lamb meat from all groups was characterized by high nutritional, biological and energy value. The yield of carcass meat was 76.4-78.3%; the yield of fat 8.50-9.80, the calorie content per 1 kg was 2021-2065 kcal.

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