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Original Article

Increasing the meat productivity of young sheep based on the use of the gene pool of the Dorper and Hissar breeds

Aumento da produtividade de carne de ovelhas jovens com base no uso do pool genético das raças Dorper e Hissar

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Abstract

In the pursuit of enhanced mutton production, improving the genetic reservoir of sheep with early maturation and high meat productivity is imperative. This study aims to assess the efficacy of integrating Dorper and Hissar rams into the breeding program of Kazakh fat-tailed coarse-haired ewes for generating young mutton. The research involved forming three groups, each comprising 40 ewes of the Kazakh fat-tailed coarse-haired breed, based on analog pairs. Ewes in Group I were inseminated with Dorper ram semen, those in Group II were inseminated with Hissar ram semen, and Group III served as a control with purebred Kazakh fat-tailed coarse-haired sheep breeding. Results revealed that crossbred rams in Group II achieved a significantly higher live weight of 45.2 kg at 120 days of age, surpassing the other groups by 9.7 kg and 10.6 kg. Crossbred gimmers in Group II reached a live weight of 42.0 kg by 4 months, outpacing the other groups by 12.2 kg. The crossbred lambs exhibited an expansive, deep, and sturdy physique, indicative of elevated meat productivity. Physique index analysis displayed that crossbred rams exhibited elongated limbs, bulkiness, and massiveness compared to purebred Kazakh fat-tailed coarse-haired lambs. In the 4.0-4.5-month age range, crossbred rams demonstrated a higher carcass muscle yield than their purebred counterparts, albeit the latter exhibited a 0.18% greater bone yield. Moreover, the meat of groups I and II sheep contained 19.6% and 20.1% protein content, respectively, surpassing the local Kazakh fat-tailed sheep population by 0.7% and 1.2% in absolute terms.

Keywords: sheep, Dorper breed, Hissar breed, Kazakh fat-tailed breed, crossbreeding, growth, conformation, meat productivity, meat quality.

Resumo

Na busca pelo aumento da produção de carne ovina, é imperativo melhorar o reservatório genético de ovinos com maturação precoce e alta produtividade de carne. Este estudo pretende avaliar a eficácia da integração de carneiros Dorper e Hissar no programa de criação de ovelhas cazaques de cauda gorda e pelo grosso para a geração de carneiros jovens. A pesquisa envolveu a formação de três grupos, cada um composto por 40 ovelhas da raça cazaque de cauda gorda e pelo grosso, com base em pares análogos. As ovelhas do Grupo I foram inseminadas com sêmen de carneiro Dorper, as do Grupo II foram inseminadas com sêmen de carneiro Hissar e o Grupo III serviu como controle com a criação de ovinos de raça cazaque de cauda gorda e pelo grosso de raça pura. Os resultados revelaram que os carneiros mestiços do Grupo II alcançaram peso vivo significativamente maior, 45,2 kg aos 120 dias, superando os demais grupos em 9,7 kg e 10,6 kg. Os gimmers mestiços do Grupo II atingiram peso vivo de 42,0 kg aos 4 meses, ultrapassando os demais grupos em 12,2 kg. Os cordeiros mestiços exibiram um físico expansivo, profundo e robusto, indicativo de elevada produtividade de carne. A análise do índice físico mostrou que os carneiros mestiços exibiam membros alongados, volume e solidez em comparação com cordeiros cazaques de raça pura, cauda gorda e pelo grosso. Na faixa etária de 4,0 a 4,5 meses, os carneiros mestiços demonstraram maior rendimento muscular de carcaça do que seus equivalentes de raça pura, embora estes últimos tenham apresentado rendimento ósseo 0,18% maior. Além disso, a carne dos ovinos dos grupos I e II continha 19,6% e 20,1% de teor de proteína, respectivamente, superando a população local de ovinos de cauda gorda do Cazaquistão em 0,7% e 1,2% em termos absolutos.

Palavras-chave: ovinos, raça Dorper, raça Hissar, raça cazaque de cauda gorda, cruzamentos, crescimento, conformação, produtividade de carne, qualidade de carne.

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1. Introduction

To enhance mutton production, it becomes imperative to enhance the genetic reservoir of sheep exhibiting early maturation and high meat productivity (Naqvi et al., 2017; Parés-Casanova, 2013; Wolf et al., 2014; Degtyarev et al., 2016). Owing to the waning demand and devaluation of wool, the effective trajectory of sheep breeding has shifted toward meat productivity, given the current global market demand for lamb and young mutton (Thiagaraja and Jayashanka, 2012; Tindano et al., 2017). Consequently, a growing body of research is directed toward identifying pathways to yield high-quality young lamb with minimal economic and labor costs. Using heterosis through industrial crossbreeding emerges as one method to bolster competitiveness within sheep breeding (Tsegay et al., 2013; Afanasyev et al., 2020; Malhado et al., 2009; Souza et al., 2013; Cardoso et al., 2013). The potential for successful crossbreeding to enhance breeds and invoke the heterosis effect hinges on the effectiveness of purebred breeding. Hence, purebred breeding serves as the foundation, with crossbreeding as the subsequent framework. However, it's important to acknowledge that crossbreeding entails the alteration of genetic systems inherent to a specific breed. Therefore, purposeful crossbreeding is a catalyst for progress and efficient animal husbandry endeavors (Wolf et al., 2014; Tindano et al., 2017).

The heterosis effect resulting from interbreeding distinct breeds can become apparent as early as the moment of fertilization. Hybrid offspring have been documented to exhibit elevated embryonic survival rates and greater fetal weight when compared to their purebred counterparts (Tsegay et al., 2013; Yakubu, 2010; Pogodaev et al., 2019). Many scholars contend that crossbreeding breeds of sheep with diverse productivity orientations leads to improved adaptive traits and productivity in offspring. Furthermore, such hybrids possess an extensive hereditary potential for economically valuable attributes and adaptive capacities (Pogodaev et al., 2020, 2021a, b; Cloete et al., 2000).

In light of this, investigations directed towards assessing the efficacy of leveraging the gene pool of Dorper and Hissar breeds to augment the meat qualities of sheep and achieve superior young lamb production are pertinent.

The objective of this study was to ascertain the efficacy of utilizing Dorper and Hissar rams in crossbreeding with Kazakh fat-tailed coarse-haired ewes, with the aim of generating high-quality young lambs.

The novelty of this research stems from the inaugural evaluation of the meat productivity of young sheep resulting from the crossbreeding of Kazakh fat-tailed coarse-haired ewes with Dorper and Hissar rams.

2. Materials and Methods

The scientific and practical investigation was conducted at the "Yerzhan" peasant farm in the Republic of Kazakhstan during the years 2020-2021.

To facilitate the scientific and industrial experiment, three groups, each consisting of 40 Kazakh fat-tailed coarse-haired ewes, were organized using analogous pairs. The crossbreeding process adhered to the framework outlined in Table 1.

Group I ewes were subjected to insemination with Dorper ram semen, while Group II ewes underwent insemination with Hissar ram semen. In the control Group III, purebred Kazakh fat-tailed coarse-haired sheep breeding was used.

The sheep were provided with well-balanced full-fledged rations, ensuring the adequate intake of all essential nutrients (Kalashnikov et al., 2003).

To determine the growth and development of lambs, the following parameters were taken into consideration: live weight, measurements, and body indexes. The trajectory of lamb live weight was traced through periodic weighings carried out at birth and subsequently on a monthly basis. These weighings facilitated the calculation of absolute, relative, and average daily gains in live weight spanning the time frame from birth to slaughter.

All research activities were executed in accordance with the established "Rules for conducting experiments involving experimental animals". The artificial insemination of the breeding stock adhered to specific guidelines, while the growth and development of the animals were scrutinized following conventional methodologies. The assessment of sheep productivity followed the procedures outlined in the Buylov et al. (1978).

The primary digital data extracted from the research were subjected to statistical analysis using variation statistics techniques (Plokhinsky, 1969).

Two stud rams were used for crossing: Dorper stud ram: No. 19, live weight - 85.5 kg, tightly knit animals with a massive, slightly elongated body. The muscles of the thighs and posterior part of the back are well developed.

Table 1. Experimental framework.

Group	Breed of		
	ewes	**rams**	**obtained young animals**
I – experimental	Kazakh fat-tailed coarse-haired (KFC)	Dorper (D)	½ KFC x ½ D
II – experimental	Kazakh fat-tailed coarse-haired (KFC)	Hissar (H)	½ KFC x ½ H
III – control	Kazakh fat-tailed coarse-haired (KFC)	Kazakh fat-tailed coarse-haired (KFC)	KFC

The coat is sparse, coarse, short, consisting of guard hairs and undercoat. White color, black head. The coat is uneven, the neck, chest and saddle are thick, there is almost no hair on the belly. The skin on the trunk, neck and legs is white. The skin on the head and upper neck is black. Legs are short and bare.

Stud ram of the Hissar breed No. 8745, born in 2019, black color, live weight - 94.1 kg. Rough constitution, with a deep and wide chest, straight legs, large fat tail, short hair, hook-nosed, polled.

It is known that the main direction of selection in meat and fat sheep breeding is meat productivity, and selection is carried out mainly to increase live weight.

3. Results and Discussion

One of the main factors of individual growth and development of the animal is the variability of body weight. Body weight reflects the functional and morphological development of the body and its value in a newborn lamb depends on many factors: the age and strength of the ewes' constitution, breed, etc. Live weight in growing animals plays an important role in cases where breeding is carried out to increase precocity (Table 2).

Hissar stud rams of the imported gene pool had a positive impact on the qualitative and quantitative indicators of the studied offspring. As can be seen from the data in Table 1, the average live weight of rams at birth in crossbreds of group I was 4.6; group II - 5.7 kg, group III - 5.1 kg, and in the gimmers, respectively, 4.3; 4.82 kg.

Upon reaching 30 days of age, the live weight of rams of group I was 9.0; they yielded to rams of group II by 5.5 kg and rams of control group III by 2.6 kg, while the gimmers of this selection also yielded to gimmers of other selections by 3.1 and 0.7 kg.

At the age of 60 days, there were no noticeable changes in the live weight of lambs. By the age of 90 days, the crossbred lambs of the group I noticeably gained weight, that is, the live weight of the lambs averaged 23.2 kg and outperformed the lambs of the control group III by 0.6 kg, yielding to the crossbred lambs of the group II by 3.7 kg. This is due to the biological characteristics of the Dorper breed, that is, offspring are born small and with age very quickly add body weight. A similar picture was observed for the gimmers.

At the age of 120 days, crossbred rams of group II had the highest result in live weight of 45.2 kg, which is 9.7 and 10.6 more than rams of other selections. Crossbred gimmers of group II by 4.0 months of age had a live weight of 42.0 kg and outstripped the gimmers of the other two selections by 12.2 kg.

When characterizing the growth and development of animals, it is necessary to give a comprehensive assessment, because the live weight clearly does not give an idea of the animal development. A more complete picture of its development can be obtained in a complex of basic measurements.

Linear measurements of the body, characterizing their physique, productive properties and constitutional features. Body measurements of lambs at birth were studied (Table 3).

According to height measurements, hybrid rams of group II are tall - 40.6 cm, hybrid gimmers - 37.8 cm.

In purebred rams, this figure was 37.7 cm, and gimmers - 35.3 cm. Chest girth in crossbred rams - 39.7 cm, gimmers - 37.7 cm, against purebred ones - 37.9 cm; 35.2; pastern girth, respectively, 5.8; 5.6; 5.6; 5.5cm.

The results of the research show that the crossbred rams of group I at birth had the following parameters: 36.9; 36.7; 36.4; 38.2; 11.6; 5.7 cm, gimmers 34.8; 34.6; 35.4; 36.2; 11.4; 5.5 cm, with age this figure increases and by 4.5 months of age it was in rams 56.8; 57.2; 56.0; 74.3; 23.8; 8.2 cm, in gimmers, respectively, 54.7; 55.0; 54.2; 70.2; 18.8; 7.8 cm.

Body measurements of crossbred lambs of group II at birth were 40.6; 41.7; 37.9; 39.7; 13.5; 5.8 cm, gimmers 37.8; 36.0; 35.4; 37.7; 12.7; 5.6 cm, respectively 67.8; 68.1; 64.3; 84.2; 27.3; 8.0 cm, by 4.5 months of age, these indicators were 67.8 for rams; 68.1; 64.3; 84.2; 27.3; 8.0 cm, for gimmers 67.0; 67.8; 64.0; 82.8; 26.7; 7.6 cm. Similar results were obtained from measurements of the height in the sacrum, the oblique torso length. These indicators increased by the age of 4.5 months by 20.5 and 19.6 cm. It should be noted that the hybrid lambs had a deep and wide chest. The chest depth was 23.8 cm, and the chest girth was 74.3 cm.

The metacarpus girth, which indicates the strength of the skeleton at birth, was 5.5 cm and increased by 2.7 cm towards the weaning.

The data obtained show that hybrid lambs have high growth energy, have a wide, deep and massive body, which indicates a high meat productivity of animals, with the intensification of the production of young mutton and lamb.

Table 2. Live weight dynamics of experimental lambs, kg (n=30).

Indicator	Group					
	I		II		III	
	rams	gimmers	rams	gimmers	rams	gimmers
At birth	4.6 ± 0.31	4.3 ± 0.27	5.7 ± 0.51	5.2 ± 0.46	5.1 ± 0.11	4.8 ± 0.53
30 days	9.0 ± 0.24	8.7 ± 0.24	14.5 ± 0.42	11.8 ± 0.17	11.6 ± 0.43	9.4 ± 0.13
60 days	15.2 ± 0.38	14.3 ± 0.11	19.2 ± 0.37	16.4 ± 0.43	16.8 ± 0.37	14.2 ± 0.25
90 days	23.2 ± 0.42	19.3 ± 0.37	26.9 ± 0.63	22.4 ± 0.18	22.6 ± 0.80	19.1 ± 0.19
120 days	35.5 ± 0.53	29.8 ± 0.42	45.2 ± 0.14	42.0 ± 0.81	34.6 ± 0.43	29.8 ± 0.57

Table 3. Dynamics of body measurements of experimental lambs, cm (n=30).

Body measurements	Group		
	I	II	III
Rams			
at birth			
Height at the withers	36.9 ± 0.23	40.6 ± 0.53	37.7 ± 0.57
Height at the sacrum	36.7 ± 0.34	41.7 ± 0.19	36.8 ± 0.27
Oblique torso length	36.4 ± 0.39	37.9 ± 0.42	35.4 ± 0.43
Chest girth	38.2 ± 0.42	39.7 ± 0.37	37.7 ± 0.38
Chest depth	11.6 ± 0.27	13.5 ± 0.31	12.8 ± 0.27
Pastern girth	5.7 ± 0.51	5.8 ± 0.49	5.6 ± 0.47
at the age of 30 days			
Height at the withers	42.6 ± 0.24	43.7 ± 0.33	42.5 ± 0.29
Height at the sacrum	43.8 ± 0.36	44.6 ± 0.28	43.7 ± 0.29
Oblique torso length	44.2 ± 0.41	45.2 ± 0.45	44.8 ± 0.29
Chest girth	51.8 ± 0.52	53.0 ± 0.14	52.4 ± 0.29
Chest depth	17.2 ± 0.26	18.4 ± 0.19	18.2 ± 0.29
Pastern girth	7.3 ± 0.17	7.5 ± 0.39	6.8 ± 0.14
at the age of 60 days			
Height at the withers	48.6 ± 0.31	49.8 ± 0.27	49.1 ± 0.29
Height at the sacrum	49.3 ± 0.42	50.3 ± 0.41	50.1 ± 0.29
Oblique torso length	50.2 ± 0.52	51.1 ± 0.33	50.7 ± 0.29
Chest girth	60.8 ± 0.23	60.9 ± 0.46	60.7 ± 0.29
Chest depth	20.8 ± 0.28	21.0 ± 0.38	20.7 ± 0.29
Pastern girth	7.6 ± 0.56	7.7 ± 0.48	7.2 ± 0.14
at the age of 90 days			
Height at the withers	49.0 ± 0.25	51.2 ± 0.44	50.3 ± 0.28
Height at the sacrum	49.3 ± 0.34	51.9 ± 0.61	51.1 ± 0.29
Oblique torso length	50.4 ± 0.48	51.5 ± 0.52	50.4 ± 0.29
Chest girth	50.5 ± 0.41	62.0 ± 0.29	51.2 ± 0.29
Chest depth	20.5 ± 0.62	22.2 ± 0.41	21.7 ± 0.28
Pastern girth	7.8 ± 0.81	7.8 ± 0.43	7.4 ± 0.14
at the age of 120 days			
Height at the withers	56.8 ± 0.27	67.8 ± 0.27	55.3 ± 0.61
Height at the sacrum	57.2 ± 0.31	68.1 ± 0.52	56.1 ± 0.59
Oblique torso length	56.0 ± 0.40	64.3 ± 0.47	55.7 ± 0.53
Chest girth	74.3 ± 0.52	84.2 ± 0.29	72.4 ± 0.48
Chest depth	23.8 ± 0.41	27.3 ± 0.61	22.6 ± 0.46
Pastern girth	8.2 ± 0.09	8.0 ± 0.22	7.9 ± 0.67
Gimmers			
at birth			
Height at the withers	34.8 ± 0.28	37.8 ± 0.41	35.3 ± 0.24
Height at the sacrum	34.6 ± 0.34	36.0 ± 0.34	34.6 ± 0.61
Oblique torso length	35.4 ± 0.43	35.4 ± 0.48	35.0 ± 0.22
Chest girth	36.2 ± 0.44	37.7 ± 0.29	35.2 ± 0.33
Chest depth	11.4 ± 0.52	12.7 ± 0.34	11.8 ± 0.41
Pastern girth	5.5 ± 0.53	5.6 ± 0.49	5.5 ± 0.46
at the age of 30 days			
Height at the withers	41.8 ± 0.41	42.3 ± 0.42	42.1 ± 0.29
Height at the sacrum	42.3 ± 0.26	43.7 ± 0.55	42.8 ± 0.29
Oblique torso length	43.8 ± 0.53	44.0 ± 0.19	44.2 ± 0.29
Chest girth	50.2 ± 0.21	51.7 ± 0.31	51.1 ± 0.29
Chest depth	16.5 ± 0.33	17.0 ± 0.14	17.2 ± 0.29
Pastern girth	7.2 ± 0.27	7.3 ± 0.19	6.6 ± 0.14
at the age of 60 days			
Height at the withers	47.2 ± 0.34	48.0 ± 0.41	47.8 ± 0.29
Height at the sacrum	48.0 ± 0.14	48.6 ± 0.52	48.1 ± 0.29
Oblique torso length	49.6 ± 0.51	50.6 ± 0.37	49.8 ± 0.29
Chest girth	48.9 ± 0.49	61.3 ± 0.57	51.2 ± 0.29
Chest depth	19.2 ± 0.29	20.4 ± 0.61	20.5 ± 0.29
Pastern girth	7.5 ± 0.33	7.6 ± 0.27	7.3 ± 0.14
at the age of 90 days			
Height at the withers	48.7 ± 0.29	49.6 ± 0.22	49.2 ± 0.29
Height at the sacrum	49.2 ± 0.21	50.8 ± 0.41	49.8 ± 0.28
Oblique torso length	49.6 ± 0.34	51.0 ± 0.50	49.8 ± 0.29
Chest girth	50.3 ± 0.46	61.3 ± 0.42	51.4 ± 0.28
Chest depth	19.8/ ± 0.18	21.2 ± 0.33	21.8 ± 0.29
Pastern girth	7.6 ± 039	7.6 ± 0.47	7.7 ± 0.14
at the age of 120 days			
Height at the withers	54.7 ± 0.33	67.0 ± 0.61	53.2 ± 0.43
Height at the sacrum	55.0 ± 0.45	67.8 ± 0.53	53.9 ± 0.46
Oblique torso length	54.2 ± 0.57	64.0 ± 0.47	52.7 ± 0.43
Chest girth	70.2 ± 0.36	82.8 ± 0.56	68.9 ± 0.49
Chest depth	18.8 ± 0.52	26.7 ± 0.42	19.4 ± 0.41
Pastern girth	7.8 ± 0.58	7.6 ± 0.33	7.6 ± 0.43

Based on the measurements obtained, 4 basic physiques were calculated, which most fully reflect the proportion of the body and the type of constitution (Table 4).

Indeed, a solitary measurement in absolute terms doesn't comprehensively encapsulate the nuances of an animal's physique, as it is assessed independently, devoid of contextual correlation with others. A more sophisticated indicator is represented by body indexes, which represent anatomically interconnected measurements expressed as percentages.

The computation of these indexes enables a more intricate portrayal of bodily proportions, facilitating an assessment of the animal's overall constitutional archetype. Evident from the information in Table 4 is the alteration of the lamb's body structure with advancing age. The animals exhibited a diminished height in their limbs, an elongated form, and a more expansive body.

Elevated chest depth measurements serve as an indicator of well-functioning respiratory and circulatory systems. By the age of 4.5 months, lambs exhibit a notable "blockiness index" indicating a compact body structure.

Table 4. Body indexes of lambs, % (n=30).

Indices	**Group**		
	I	**II**	**III**
	Rams		
	At birth		
long-legginess	63.2	67.7	66.0
stretchiness	89.7	93.4	93.8
blockiness	98.8	104.7	100.2
boneiness	13.6	14.3	14.8
	at the age of 30 days		
long-legginess	59.6	57.8	57.1
stretchiness	103.7	103.4	104.4
blockiness	117.1	117.2	116.6
boneiness	17.2	17.1	16.0
	at the age of 60 days		
long-legginess	57.2	57.8	57.6
stretchiness	103.2	102.6	103.2
blockiness	121.1	119.1	119.7
boneiness	15.4	15.5	14.6
	at the age of 90 days		
long-legginess	58.1	87.7	56.8
stretchiness	102.8	100.5	100.2
blockiness	100.0	120.3	101.5
boneiness	15.9	15.2	14.7
	at the age of 120 days		
long-legginess	58.0	59.7	59.1
stretchiness	98.5	94.8	100.7
blockiness	132.6	130.9	137.1
boneiness	14.4	11.7	14.2
	Gimmers at birth		
long-legginess	62.2	67.4	66.5
stretchiness	87.3	93.6	91.1
blockiness	96.8	99.7	100.5
boneiness	13.9	14.4	15.5
	at the age of 30 days		
long-legginess	60.5	57.5	56.7
stretchiness	104.7	105.4	104.6
blockiness	114.6	117.5	101.1
boneiness	17.2	17.1	15.6
	at the age of 60 days		
long-legginess	59.3	54.2	57.1
stretchiness	105.0	105.4	104.1
blockiness	98.5	121.1	102.8
boneiness	15.8	15.8	15.2
	at the age of 90 days		
long-legginess	59.3	57.2	55.6
stretchiness	101.8	102.8	101.4
blockiness	101.4	120.1	103.2
boneiness	15.6	15.3	15.6
	at the age of 120 days		
long-legginess	65.6	60.1	63.5
stretchiness	99.0	95.5	99.1
blockiness	129.5	129.3	130.1
boneiness	14.2	11.3	14.2

An in-depth analysis of these indexes reveals that crossbred rams demonstrate long-legginesss, blockiness, and massiveness when compared to their purebred Kazakh fat-tailed coarse-haired counterparts.

An essential biological characteristic lies within the constitution of these animals. The findings from the scrutiny of the constitutional attributes of the resultant offspring are summarized in Table 5.

The constitution of animals also affects their productivity. The constitution is divided into strong, rough and tender. A strong constitution is desirable, which indicates a high meat productivity of animals, with the intensification of the production of young mutton and lamb.

The study of the constitution of lambs showed that the strong type prevails in purebred (59.0%, 57.0%), and in crossbred lambs (60.0%; 58.0%; 61.0%, 59.5%), respectively, as rams (30 animals) and gimmers (30 animals).

According to the strength of the constitution, the greatest indicators of the desired strong constitution are in group II lambs. They are superior in rams to analogues from other rebounds by 1-2% and in gimmers by 1.5-2.5%.

This once again confirms that the animals of all groups generally have the desired strong type of constitution (Table 6).

One of the most important measures to increase the production of mutton while improving its quality is the organization of fattening and feeding of sheep. In addition, it is necessary to organize feeding, which allows getting high-quality lamb at minimal labor and cost. Good feeding results were achieved in the summer-autumn period of using natural pastures, sowing perennial grasses and annual feed crops.

Fattening young animals for 60 days with feeding with concentrates of 200 g per animal per day made it possible to increase its live weight by 6-8 kg with a significant increase in the quality of the carcass.

Animals were killed immediately after the spring-summer feeding.

The control slaughter of rams was carried out after fattening, 3 animals from each group (Table 7).

Control slaughter indicators indicate that the best slaughter rates are observed in crossbred rams: where the carcass yield was 48.8-49.5%, in purebred rams, respectively, 47.7%.

Table 5. Constitutional types of lambs.

Constitutional type	**Group**											
	I				**II**				**III**			
	n=30		**n=30**		**n=30**		**n=30**		**n=30**		**n=30**	
gender	♂	%	♀	%	♂	%	♀	%	♂	%	♀	%
strong	18	60.0	17	58.0	18	61.0	17	59.5	17	59.0	16	57.0
rough	9	30.0	11	38.0	8	28.5	11	36.0	9	32.0	11	36.0
tender	3	10.0	2	4.0	4	10.5	2	4.5	4	9.0	3	7.0

Table 6. Fatness of lambs, %.

Fatness	**Group**		
	I	**II**	**III**
	rams		
higher	35.7	36.4	32.6
average	61.4	61.2	62.8
below average	2.9	2.4	4.6
	gimmers		
higher	32.6	34.7	31.0
average	64.0	62.1	64.2
below average	3.4	3.2	4.8

Table 7. Slaughter indicators of sheep.

Indicators	**Group**		
	I	**II**	**III**
Live weight at the beginning of feeding. kg	36.3 ± 0.34	48. 2 ± 0.29	35.2 ± 0.17
Live weight at the end of feeding. kg	42.7 ± 0.31	56.2 ± 0.28	39.8 ± 0.41
Average daily gain. g	107	133	77
Slaughter weight. kg	20.6 ± 0.19	27.8 ± 0.37	18.7 ± 0.42
Slaughter yield. %	48.3	49.6	46.7
Carcass yield. %	48.8	49.5	47.7

When slaughtering crossbreeds, carcasses weighing 20.6-27.8 kg were obtained, purebred ones – 18.7 kg, that is, 1.9-9.1 kg more.

Meat sheep have high fattening and feeding qualities. Before the start of fattening, the sheep were weighed, and based on the indicators of live weight, they made up the feeding ration.

The average daily ration for each ram consisted of the following feeds: alfalfa green mass - 2.0 kg, natural grass hay - 1.5 kg, compound feed - 0.8 kg, cotton meal - 0.2 kg. On average, the diet contained 2 feed units and 240-275 g of digestible protein.

Animals received water and salt ad libitum.

The results of our research (Table 8) showed that the mass of rams during weaning was different. The live weight of crossbred rams (42.7; 56.2 kg) when fed was more than purebred (39.8 kg) animals of the control group by 2.9-16.4 kg.

Thus, in terms of meat productivity, crossbred rams are superior to their purebred peers.

When characterizing the meat qualities of animals, much attention is paid to the ratio of the mass of meat and bones.

According to numerous studies, animals at slaughter can give a carcass of the same weight, but when deboning these carcasses, different amounts of meat can be obtained. Animals of the meat direction in terms of the amount of meat in the carcass, under the same conditions, are superior to animals of other directions of productivity. The lamb carcass that contains the maximum amount of meat and the least amount of bones is the most desirable.

In our studies, at 4.0-4.5 months of age, the yield of meat in carcasses of crossbred rams was higher than that of purebred rams, and the yield of bones in purebred rams was 0.18% higher (Table 9).

In crossbred animals, a lower content of the specific gravity of bones was observed, which indicates an improvement in meat characteristics, respectively, the meat coefficient is higher than 3.01-3.25. The use of stud rams of the imported gene pool had a positive effect on the increase in the fleshy part of the carcass.

The chemical composition of meat is the indicator that determines the nutritional value of the product (Table 10).

It was found that the amount of protein in the meat of sheep of groups I and II was 19.6 and 20.1%, which is more by 0.7 and 1.2 abs. % than in the animals of the local population of Kazakh fat-tailed sheep.

Fat, to a greater extent than other indicators, is influenced by the age, breed and conditions of the animals. In this case, at 4.0-4.5 months of age, the amount of fat in crossbred lambs is 14.3-16.6%, and in purebred lambs 12.8%. In subsequent age periods, there is a further increase in calorie content.

Table 8. Data on the slaughter of rams after fattening.

Indicators	Group		
	I	II	III
Live weight at fattening. kg	42.7 ± 0.31	56.2 ± 0.28	39.8 ± 0.41
Live weight after fattening. before slaughter. kg	48.7 ± 0.22	64.6 ± 0.37	45.6 ± 0.41
Growth for 30 days. kg	6.0	8.4	5.8
Average daily gain. g	200	280	193
Slaughter weight. kg	24.2	33.2	22.5
Carcass yield. %	49.7	51.2	48.6

Table 9. Morphological composition of the carcass of crossbred and purebred rams at the age of 4.0-4.5 months.

Group	Carcass weight. kg	Meat		Bones		Meat coefficient
		kg	%	kg	%	
I	25.9	19.8	76.5	6.1	23.5	3.25
II	28.1	21.1	75.2	7.0	24.8	3.01
III	23.3	16.7	71.0	6.6	29.0	2.53

Table 10. Chemical composition of the meat part of the carcass.

Group	Meat components				Calorie content. kcal
	protein	fat	moisture	ash	
I	19.6	16.6	62.80	1.00	1900.6
II	20.1	14.3	64.58	1.02	1867.6
III	18.9	12.8	67.32	0.98	1736.2

The economic efficiency of the result of various crossing options carried out in order to improve productive qualities shows that the highest income and high profitability was obtained from group II - 64.4%, and from animals of group I - 61.3%, somewhat less from group III - 57.0%.

4. Conclusion

Under the same conditions of keeping and feeding, crossbred young animals obtained from crossing ewes of the Kazakh fat-tailed coarse-haired breed (KFC) with rams of the Dorper (D) and Hissar (H) breeds are highly reliable than purebred peers of the Kazakh fat-tailed coarse-haired breed (KFC) in all periods of cultivation in terms of live weight, average daily, absolute and relative growth.

At the age of 120 days, crossbred rams (½ KFC x ½ D) and (½ KFC x ½ H) outnumbered purebred (KFC) in live weight by 9.7 and 10.6 kg, and crossbred gimmers by 12.2 kg.

The study of conformation indicators indicates that crossbred animals have higher indices of extension, chest and massiveness, and purebred animals of the Kazakh fat-tailed coarse-haired breed (KFC) have higher indices of long legs and overgrowth.

Crossbred sheep have high slaughter and meat qualities. After fattening and feeding, they significantly surpassed purebred peers in terms of pre-slaughter live weight, chilled carcass weight, slaughter weight, and meat weight in the carcass.

The meat products of young animals were of high quality. The amount of protein in sheep meat (½ KFC x ½ D) and (½ KFC x ½ H) was 19.6 and 20.1%, which is more by 0.7 and 1.2 abs. % than in animals of the local population of Kazakh fat-tailed sheep.

The use of rams of the Dorper and Hissar breeds for crossing with ewes of the Kazakh coarse-haired fat-tailed breed is economically beneficial. The level of profitability increased by 4.3 7.4 abs. % in favor of crossbred young animals.

To increase the production of high quality mutton and increase the competitiveness of the sheep breeding industry in the conditions of the Republic of Kazakhstan, it is recommended to use Dorper and Hissar rams for industrial crossing with ewes of the Kazakh fat-tailed coarse-haired breed.

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