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DNA MARKERS CHARACTERISTICS
OF RAM HOGS OF MEAT-LARD BREEDS
(GROWTH, DEVELOPMENT AND MEAT PRODUCTIVITY)

Abstract. The article presents the results of studying the growth, development and meat productivity of meat-lard ram hogs, as well as the presence of gene polymorphism in meat-lard sheep.

As a result of studies aimed at investigating the role of marker assessment of sheep, there were obtained data on the frequency of occurrence of genotypes in the two studied genes associated with the growth rate and meat quality of sheep. It was found that in the studied sample of sheep, the GH2 and 1(IGF1) genes were polymorphic. The presence of associations of various genetic variations with one or another level of the studied traits was revealed.

During the experiment, the growth and development of young meat-lard ram hogs from birth to 12 months of age were monitored by weighing and linear analysis, taking into account the dynamics of changes in live weight and exterior indicators. It was established that young animals of both breeds had the highest growth energy in the first month and at the time of weaning. The smallest weight gain was between 4 and 7 months of age, i.e. during the feeding season.

At the age of 12 months, the Edilbay sheep had a live weight of 61.1 kg, which is 5.7 kg or 9.7% higher than that of young Kazakh fat-tailed ones. Gimmers of Edilbay breed had a similar advantage. So, at the same age, the difference in favor of gimmers of Edilbay breed was 4.8 kg or 10.1%.

The results of the control slaughter of one-year-old rams showed the presence of certain interbreed differences in the main indicators. In terms of pre-slaughter weight, young Edilbay sheep exceeded their peers - the Kazakh fat-tailed breed by 9.9%, and by carcass weight without a fat tail by 11.7%. The slaughter yield was: in the Edilbay breed - 49.9, in the Kazakh fat-tailed breed - 48.6%, which is 2.7% lower. The unequal content of protein and fat in the meat led to different calorific values: higher - 215.6 kcal in Edilbay sheep, and 207.2 kcal in young sheep of the Kazakh fat-tailed breed, which is 3.9% lower.

Morphobiochemical analysis showed that, in general, blood parameters in young animals of both breeds were within the physiological standards.

Keywords: meat and lard sheep breeding, selection, meat productivity, morphobiochemical composition of blood, gene polymorphism, DNA markers.

Relevance. The creation of highly productive breeds and types of sheep with improved productive and consumer traits is currently impossible without the use of modern achievements in the field of animal genetics. In many countries, new approaches based on the use of genetic markers of productivity traits have begun to be widely used in creating breeds and types of animals. Marking of traits at the genotype level, in addition to traditional classical breeding methods, can significantly increase the efficiency of breeding and selection and achieve the desired result within several generations.

Despite extensive foreign data on the benefits of using genetic markers in breeding, there is only poor information on the results of their practical application as additional criteria for evaluating animals bred in

Kazakhstan. In this regard, it became necessary to conduct studies aimed at investigating the role of marker assessment of sheep using DNA markers. The use of this method in addition to the traditional methods of assessing and selection of animals by phenotype will increase the efficiency of selection and breeding work with sheep of various breeds.

Increasing meat production and improving its quality remains an urgent task for livestock bred in Kazakhstan. In the successful solution of this problem, a special role belongs to sheep breeding. In the future, the share of mutton in the formation of the country's meat balance should be significantly increased due to its resources. Modern sheep breeding both in our country and abroad is developing and improving based on the achievement of science and technology. Recognizing the leading role of traditional breeding methods, it should be noted that the use of only classical breeding can no longer provide the proper level of breeding efficiency.

The main sources of mutton production in Kazakhstan are specialized meat and lard breeds, which include the Edilbay and Kazakh fat-tailed breeds [1-4].

A distinctive feature of sheep of these breeds is their good adaptability to year-round grazing in the most extreme conditions. They easily carry long distances to pastures located in areas from deserts to high mountains [5, 6]. However, the comparative productivity and quality of meat of one-year-old ram hogs of these breeds, depending on the natural and economic conditions of farms, is not well understood.

Materials and research methods. The studies were conducted in the conditions of the Bakdaulet farm (sheep of the Kazakh fat-tailed breed-KF) of the Kyzylorda region and the Nauryz peasant farm (sheep of the Edilbay breed-E) of the West Kazakhstan region. Sheep herd in both farms is adequately provided with pasture feed using natural pastures. Only during lambing or during prolonged low temperatures, in addition to rough feed, animals eat concentrates.

The experiments were carried out following the standard methods for organizing zootechnic experiments [7]. The productive traits of rams, ewes, and their offspring were estimated by live weight, wool, and meat productivity.

DNA screening was performed on 189 sheep of the Kazakh fat-tailed breed. The biological material for the study included samples of preserved blood. DNA was extracted using an Extran-2 reagent kit for extraction of genomic DNA from animal tissue (Sintol, Russia) and columns of Nexttec Biotechnologie GmbH, Germany) in accordance with the manufacturer's protocol. The purity and integrity of genomic DNA were assessed using gel electrophoresis and NanoDrop 8000 spectrophotometer. The concentration of DNA preparations was determined using the Qubit™ fluorometer (Invitrogen™). DNA analysis and PCR were performed using standard methods.

The growth and development of experimental animals were studied by indicators of live weight at birth, at the age of 4, 7 and 12 months. Based on the obtained data, the absolute, average daily and relative growths were calculated. The investigation of linear growth was carried out by taking measurements and calculating body build indices.

The wool productivity of the experimental sheep was determined by taking into account the shearing in the physical mass and washed fiber.

Reproductive qualities of ewes were determined by evaluating the results of mating and lambing, taking into account the number of live and stillborn lambs.

The survival rate of young animals was defined by taking into account the safety of the lambs from birth to weaning, i.e. up to 4 months of age. Ewe milking capacity was estimated by the gain in live weight of young animals from birth to the age of 20 days.

Meat productivity was studied by control slaughter of 3 ram hogs from each group at the age of 4, 7 and 12 months. Slaughter of animals, assessment of the slaughter qualities of sheep was carried out according to the Federal Science Center for Animal Husbandry method [8]. To characterize the meat qualities and determine the morphological composition of the carcasses, the carcasses were deboned and trimmed following GOST 7596-81 [9]. The chemical composition and calorific value of the pulp were determined according to generally accepted methods.

Research results. The most important condition for improving the existing and creating the new, more highly productive breeds and types of animals, is the use of genetic methods. Genetic progress in sheep breeding can be achieved only as a result of the integrated application of traditional breeding methods and modern DNA technology using molecular genetic markers (genes) associated with the main

economically useful traits. The identification of such genes allows, in addition to traditional selection, breeding to be carried out directly at the DNA level, i.e. by genotype.

In this regard, there is a need for research aimed at studying the role of marker assessment of sheep using DNA markers. Of particular importance among the polygene systems of the body are blood protein systems such as genes for growth hormone (bGH), insulin-like growth factor 1 (IGF-1), myostatin (MSTN), and fatty acid-4 binding protein (FABR4).

It should be noted that much fewer works have been devoted to the study of polymorphism of blood proteins in sheep than in other animals (17,18,19,20,21,22,23). The main goal of our research is to study the polymorphism of the main blood proteins of sheep of meat-lard breeds and to establish its relationship with economically useful traits. In the study of polymorphic systems of blood proteins, the differentiation degree of the genetic structures of breeds according to alleles and genotypes of polymorphic proteins, as well as their relationship with productive traits, was determined.

The analysis of polymorphism in the genes of growth hormone (GH2), insulin-like growth factor-1 (IGF-1) was carried out using test systems that were specifically designed to perform research in the laboratory of molecular foundations of the selection at the Federal Science Center for Animal Husbandry named after L.K. Ernst.

Growth hormone is a protein hormone consisting of a single polypeptide chain, it is synthesized and secreted by anterior pituitary eosinophil cells in vertebrates. GH growth hormone can speed up metabolism and promote the growth of many organs and tissues, especially bone, muscle, and visceral organs. Besides, the effects of growth hormone on dairy productivity and animal health are known. The growth hormone gene (GH2) has a direct impact on the synthesis and secretion of growth hormone, and thereby plays an important role in the growth of animals.

The growth hormone also affects animal organism through indirect effects, including the secretion of insulin-like growth factor (IGF-1).

Insulin-like growth factor 1 (IGF-1) is an important growth factor involved in the regulation of such significant physiological processes as reproduction, fetal development, and animal growth. It is assumed that IGF-1 is associated with the size of fatty tails, the weight of unwashed hair, the quality and quantity of semen in rams, the lactation resistance of milk sheep, and the size of offspring. Due to their role in the regulation of cell proliferation, the development of muscle tissue through the stimulating effect of growth hormone and testosterone and animal growth, the IGF-1 gene is considered as a candidate marker for growth indicators and meat productivity in farm animals.

In the course of the studies, the frequency of complex genotypes in animals was simultaneously determined by the genes for growth hormone (bGH) and insulin-like growth factor 1 (IGF-1).

As a result of testing, it was revealed that the GH2 gene is polymorphic in the studied sheep population. The highest frequency of occurrence was in the G allele (0.7169), which was found in the homozygous state in 97 (51.4%) sheep and in the heterozygous state in 77 (40.7%) sheep. The frequency of occurrence of allele A and genotype AA was 0.2831 and 7.9%, respectively.

As a result of the analysis, it was found that the CC genotype for gene 1 (IGF-1) was predominant in the studied sheep population (70.9%). The frequency of occurrence of the C allele was significantly higher than the T allele: 0.8386 and 0.1614, respectively. The homozygous TT genotype was defined as the rarest in the studied sample of sheep (3.2%).

As a consequence, data on the frequency of occurrence of genotypes in the two studied genes associated with the growth rate and meat quality of sheep were first obtained. It was found that in the studied sheep, the GH2 and 1(IGF1) genes were polymorphic.

While studying the influence of the above-mentioned genes on the live weight of meat and lard fat-tailed sheep, it was established that animal carriers of heterozygous types (AG of GH2 gene and CT of IGF1 gene) grew more intensively compared to homozygous genotypes. Their superiority in terms of average daily gain was 9.5%.

When assessing the ram hogs by slaughter and meat indices, depending on the genotypes of the studied genes, it was found that groups of animals with different polymorphic variants of the GH2 and IGF1 genes differ in the yield of internal lard and fat tail, as well as in the slaughter yield. So, in the group of animals with the SS genotype of the IGF1 gene, the slaughter yield was 53.7%, which is 9.0% more than the CT genotype. A similar pattern is observed for the GG genotype of the GH2 gene.

Identification of quantitative trait loci and candidate genes associated with meat productivity traits of meat-lard sheep is a prerequisite for the development of marker-based selection programs. We performed an analysis of genotypes associations of DNA markers of growth hormone (GH2) and insulin-like growth factor (IGF1).

Assessment of the dynamics of live weight of rams at different age periods depending on the genotypes of the studied genes showed that rams with the genotype GG of the growth hormone (GH2) and the genotype CC of insulin-like growth factor (IGF1) at the age of one year exceeded on average by 8.5% the live weight of their peers with other genotypes. It should be noted that animals with those genotypes had rather good indicators of live weight over all analyzed periods of growth and development.

It was established that the sheep with the AG genotype of the GH2 gene and the CC genotype of the IGF1 gene exceeded their peers with other genotypes in slaughter weight by 1.7 and 1.9 kg, respectively. However, in animals with the GG genotype of the GH2 gene, the slaughter yield was 5.3% higher in comparison with the average indicators of other genotypes animals.

When analyzing the polymorphism of the GH2 and IGF1 genes, the presence of associated bonds of different genetic variants with meat quality indicators was not revealed. A slight association of polymorphism of GH and IGF1 genes with the total number of the obtained lambs and death under one year of age was revealed.

The main indicator of the meat productivity of sheep is their live weight. To determine the live weight of individual sex and age groups of sheep, we carried out weighing. At the same time, the average live weight of stud rams of the Kazakh fat-tailed breed was 85.7 kg, of ewes - 64.8 kg. The similar indices for the Edilbay breed were 91.3 and 68.1 kg, respectively (table 1).

Table 1 – Productive qualities of rams and ewes

Sex and age group	Breed	live weight, kg	wool clip, kg	wool yield, %	milking capacity, kg
Stud rams	KF	85.7	3.24	68.4	–
	E	91.3	3.47	71.8	–
Ewes	KF	64.8	2.12	67.9	21.9
	E	68.1	2.25	69.3	23.8

The stud rams of Kazakh fat-tailed breed had a wool cut of 3.24 kg with a wool yield of 68.4%. These indicators are lower than in animals of the Edilbay breed by 6.6 and 4.7%, respectively. The milking capacity of the ewes ensured a good growth of the young stock in the first 20 days of life. So, in the rams of the Kazakh fat-tailed breed, the live weight was 8.95 kg, in young animals of the Edilbay breed - 10.1 kg. The yield of lambs per 100 ewes was 106.8% in the Kazakh fat-tailed, and 104.1% in the Edilbay breed. The livability of the Edilbay lambs was 97.7%, while in the Kazakh fat-tailed breed this indicator is slightly lower - 96.4%.

According to the indicators of live weight, wool clip and body measurements (table 2), rams and ewes of both breeds meet the standard requirements for animals of these breeds.

Table 2 – Body measurements of rams and ewes

Sex and age group	Breed	Measurements, cm					
		Oblique body length	height at the withers	chest depth	chest width	chest girth	Metacarpus girth
Stud rams	KF	77.8	75.1	34.8	20.4	87.2	9.2
	E	84.2	81.3	39.2	21.9	94.0	9.4
Ewes	KF	71.6	69.0	29.5	19.5	83.8	8.5
	E	76.1	74.5	32.9	20.5	90.7	9.1

In Kazakhstan, for the mutton production, the sale of young meat and lard fat-tailed sheep breeds of high early maturity is of great importance.

In the course of the experiment, the growth and development of young meat-lard breeds from birth to 12 months of age was monitored by weight and linear analysis taking into account the dynamics of changes in live weight and exterior indicators that reflect the type of constitution and animal productivity.

In all periods of growth and development, the ram hogs in both farms grew rapidly, indicators of live weight and average daily gain are shown in table 3.

Table 3 – Dynamics of live weight of young meat-lard sheep

Indicators	Kazakh fat-tailed		Edilbay	
	Ram hogs	Ewe hogs	Ram hogs	Ewe hogs
Live weight, kg				
- at birth	3.9	3.7	5.2	4.4
- at the age of 4 months	30.7	28.4	34.5	31.7
- at the age of 7 months	34.2	30.7	39.7	35.4
- at the age of 12 months	55.4	47.8	61.1	52.6
Average daily gain, g				
0-4 months	219.7	204.2	239.7	225.7
0-7 months	141.6	126.2	159.8	144.8
0-12 months	141.1	120.8	153.7	132.1
Relative gain, %				
0-4 months	155.0	153.4	145.0	150.8
0-7 months	159.1	157.0	155.3	155.8
0-12 months	173.7	171.3	169.7	169.1

As can be seen from the data in Table 3, young animals of both breeds in the suckling period grew at a steady rate. By the time of weaning from mothers, the live weight of rams and ewes of the Kazakh fat-tailed breed was 30.7 and 28.4 kg, and the live weight of the rams and ewes of the Edilbay breed were 34.5 and 31.7 kg, respectively. Analyzing the growth dynamics of the live weight of lambs for this time, it should be noted that young animals of both breeds have had the highest growth energy in the first month and at the time of weaning. Such high gains in live weight in fat-tailed lambs from birth to 4 months of age should be explained, first of all, due to the genetic rhythmicity of postnatal ontogenesis developed during the evolution of fat-tailed sheep and high milking capacity of ewes.

After weaning, the lambs were fed till the age of 7 months. This circumstance negatively affected the growth and development of young animals. The average daily gain during this period was the smallest and amounted to 38.5 and 25.3 g for rams and ewes of the Kazakh fat-tailed, and 63.7 and 40.6 g for the Edilbay breed, respectively.

At the age of one year, the Edilbay breed sheep had a live weight of 61.1 kg, which is 5.7 kg, or 9.7% higher than that of young Kazakh fat-tailed sheep. The Edilbay ewes had a similar advantage. So, at the age of 12 months, the difference in favor of the Edilbay breed was 4.8 kg or 10.1%.

At the age of 12 months, we took measurements and calculated the 6 main body indices (table 4).

The young stock of the Edilbay breed was massive and less extended than the ram hogs of the Kazakh fat-tailed breed. The massiveness index for Edilbay sheep amounted to 128.2%, and for young Kazakh fat-tailed sheep - 125.8%, consequently, the bone index was higher for Edilbay rams (12.4%), and for the Kazakh fat-tailed breed - 12.1%.

Thus, at the age of 12 months, the Edilbay sheep were distinguished by a higher live weight, massiveness, a better-developed hindquarter, and a relatively rough skeleton.

The main indicators of sheep meat productivity are live weight, slaughter weight, and slaughter yield. The value of the parameters of these traits depends on many factors (10, 11, 12, 13, 14, 15, 16). The live weight of meat-lard sheep is the leading economically useful breeding trait and is determined by the degree of the growth rate of the tissues that form the meatiness of the carcass. However, this indicator

Table 4 – Body measurements and indices of young animals at the age of 12 months

Parameters	Kazakh fat-tailed		Edilbay	
	Ram hogs	Ewe hogs	Ram hogs	Ewe hogs
Measurements, cm				
height at the withers	62.7	58.0	65.2	61.4
oblique body length	63.3	57.4	65.3	61.1
chest depth	28.8	24.7	31.4	27.2
chest width	16.8	15.2	17.4	15.8
chest girth	78.9	74.4	83.6	80.4
Metacarpus girth	7.6	7.0	8.1	7.5
Indices, %				
long legs	54.1	57.4	51.8	55.7
extension	101.0	99.0	100.2	99.5
breast	58.3	61.5	55.4	58.1
blockiness	124.6	129.6	128.0	131.6
massiveness	125.8	128.3	128.2	130.9
bone	12.1	12.1	12.4	12.2

cannot give a complete and correct idea of the meat qualities of sheep. Therefore, only a control slaughter provides accurate information on the degree of development of muscle, especially fatty tissue. The results of the control slaughter show the presence of certain interbreed differences in the main indicators.

At the age of one year, all animals had enough high pre-slaughter live weight; well-developed carcasses were obtained from them (table 5).

Table 5 – The results of the control slaughter of ram hogs at the age of 12 months

Indicators	Kazakh fat-tailed	Edilbay
Pre-slaughter weight, kg	53.7	59.0
Carcass weight without a fat tail, kg	22.3	24.9
Fat tail mass, kg	2.74	3.24
Internal fat mass, kg	1.07	1.30
Slaughter weight	26.11	29.44
Slaughter yield, %	48.6	49.9

From the data in Table 5 it follows that at one year of age, young animals of the Edilbay breed exceeded their peers of the Kazakh fat-tailed breed by 9.9% in terms of pre-slaughter live weight, and by 11.7% in carcass weight without a fat tail. In terms of fat deposition, the sheep of the Kazakh fat-tailed breed are somewhat inferior to the Edilbay peers, but this fact does not reduce the meat qualities within the requirements for meat-lard sheep breeds. The slaughter yield for the groups was 49.9 for the Edilbay breed and 48.6% for the Kazakh fat-tailed breed, which is 2.7% lower.

It is known that the quality of the carcass is determined by its morphological composition, the main components of the carcass include muscles, fat, bone, and tendons. Evaluation of the morphological composition of the carcass is of considerable interest in the study of meat productivity and early maturity of animals, since only it can give the correct impression of meat and the ratio of tissues - muscle, fat, and bone, which form the meatiness of sheep.

For a complete description of the meat qualities, the carcasses were deboned and trimmed following GOST 7596-81. According to the results of deboning carcasses, its morphological composition was defined (table 6). In terms of the absolute and relative mass of pulp and fat, relatively high parameters were observed in young stock of the Edilbay breed than in sheep of the Kazakh fat-tailed breed.

Table 6 – Morphological composition of meat of the ram hogs at the age of 12 months

Indicators	Kazakh fat-tailed	Edilbay
Weight, kg:		
- chilled carcass	22.3	24.9
- pulp and fat	17.7	20.0
- bones and tendons	4.6	4.9
Meatiness coefficient	3.85	4.08

The relative weight of pulp and fat is 80.4% for young animals of the Edilbay breed, and 79.3% for the Kazakh fat-tailed sheep. This means that per 1 kg of carcass weight in the Kazakh fat-tailed breed, 793.8 g of pulp is accounted for, and in young Edilbay sheep - 803.3 g. Accordingly, the mass of bones and tendons in the Kazakh fat-tailed sheep is 5.7% more.

One of the main and objective indicators of meat qualities is the ratio of pulp and bones in the carcass - the meatiness coefficient. The value of this indicator largely depends on the breed characteristics, age, fatness and sex of the animals. According to this indicator, the Edilbay sheep had an advantage over their peers - by 6.0%. These data show that with proper growth at all age periods, the rams of both the Edilbay and the Kazakh fat-tailed breeds are characterized by quite satisfactory meat qualities as early as at the age of one year.

The varietal assortment of carcasses is an important indicator of meat productivity since the nutritive value of meat in different parts of the carcass is not the same. To study in details the meat advantages of young animals of different origin, after slaughter, high-quality carcasses were cut. Moreover, according to the current standard, the scapular-back, lumbar and hip cuts were assigned to the 1st grade. Certain differences in the yield of the most valuable 1-grade cut in young animals were revealed, depending on the genotype. Butchering the carcasses of young animals slaughtered at the age of 12 months showed that in the carcass of the Edilbay animals, the yield of 1-grade meat (81.3%) is 0.9% higher than that of the young Kazakh fat-tailed animals.

The cross-sectional area of the longest muscle of the back ("rib eye") has a conjugation with the meatiness of the carcass. Thus, a positive correlation between the mass of muscles in the carcass and the area of rib eye in young sheep is 0.64-0.77. Therefore, the meatiness of carcasses can be judged by the cross-sectional area of the rib eye. The data obtained during the measurement showed that the young stock of the Edilbay breed exceeded their peers of the young Kazakh fat-tailed animals by 6.2% in the cross-sectional area of the longest muscle of the back.

To study the meat qualities of animals, in addition to the quantitative characteristics of their meatiness, information on the quality and nutritive value of meat is needed. As known, the quality of meat is largely characterized by its chemical composition and energy value.

Physico-chemical methods of study allowed to establish some differences in the quality of meat between the ram hogs of the studied breeds. Compared to the meat of young animals of the Edilbay breed, Kazakh fat-tailed breed meat contained 2.1% more moisture, and Edilbay sheep fat pulp contained 3.2% more fat (table 7).

Table 7 – The chemical composition and calorific value of meat of the 12-month-old ram hogs

Indicators	Kazakh fat-tailed	Edilbay
Pulp composition, %:		
- water	68.6	67.2
- far	15.8	16.3
- protein	14.7	15.6
- ash	0.9	0.9
Calorific value, kcal	207.2	215.6

During the slaughter, the ratio of protein and fat in the pulp of the ram hogs of the Kazakh fat-tailed breed was 1:0.93, and in the young Edilbaev breed sheep - 1:0.96. The unequal content of protein and fat

in the meat led to different calorific values: high - 215.6 kcal for sheep of the Edilbay breed, and 207.2 kcal for young Kazakh fat-tailed sheep, which is 3.9% lower. In general, the meat composition of the Edilbay breed of sheep was more mature than the meat of young stock of the Kazakh fat-tailed breed.

Blood values are the most important indicators related to the intensity of oxidation-reduction reactions, the level of general metabolism and the growth and development processes. In both groups of animals, a higher content of red blood cells was found in rams. Thus, their level in the Kazakh fat-tailed breed is higher by 8.6% in ram hogs compared to the ewe hogs, and in the Edilbay breed, it is higher by 3.2%. This to some extent indicates that in the body of ram hogs, redox processes occur at a higher level.

Differences were also revealed in the content of leukocytes, and the indicators of the rams of both breeds exceeded the same indicators in the ewes. This shows the functional state of the hematopoietic organs of experimental animals and, above all, the increased activity of the leukopoietic apparatus in rams.

In terms of hemoglobin content, the rams of both breeds also exceeded the ewes. The rams of the Kazakh fat-tailed breed had a particularly noticeable advantage over their peers - by 3.1%. The increased content of hemoglobin in the blood of rams compared with ewes suggests an increase in the intensity of blood formation processes, as well as accelerating the rate of redox processes in their body.

The physiological state of animals most accurately is reflected by the biochemical composition of the blood, which indicates not only metabolic disorders in the body, but also errors in protein feeding, lack of vitamins, microelements and other biologically active substances in the diets.

The amount of total protein in serum indicates the level of protein metabolism in the body. The higher the protein content, the higher the protein metabolism and animal productivity. According to the results of the analyses, it was found that at the age of 12 months in experimental rams, in general, the protein content in the blood serum was relatively high and amounted to 76.1-74.4 g/l (table 8).

In the process of protein metabolism in the body, not only the total amount of protein, but also individual fractions of the protein play an important role. It should be noted that the increase in the level of total protein in the blood of rams and ewes of both breeds occurred mainly due to the albumin fraction. As is known, albumin creates colloid-osmotic blood pressure, as a result of which the equilibrium of water and electrolytes between plasma and tissues is regulated. An analysis of the ratios of protein fractions showed that the rams of the Kazakh fat tail breed were superior to peers from the group of animals of the Edilbay breed in the content of albumin by 0.9 g/l (3.2%).

Table 8 – Morphobiochemical composition of the blood of animals at the age of 12 months

Parameters	Kazakh fat-tailed		Edilbay	
	Ram hogs	Ewe hogs	Ram hogs	Ewe hogs
Red blood cells, million/mm^3	10.1	9.3	9.8	9.5
Hemoglobin, g/l	10.2	9.9	10.5	10.3
Leukocytes, thousand/mm^3	9.9	9.4	9.6	9.1
Total protein, g/l	76.1	70.4	74.4	73.2
Including albumin, g/l	29.8	28.3	28.9	26.9
Calcium, mmol/l	2.93	2.81	2.72	2.55
phosphorus, mmol/l	1.66	1.72	1.73	1.76

Erythrocytes in the blood are lower (by 2.9%) in the Edilbay sheep, but in terms of hemoglobin, they are superior to peers from the Kazakh fat-tailed breed (by 3.0%), which ensures a normal breathing process.

In the research process, the content in the blood of the main minerals – calcium and phosphorus – was studied. At the age of 12 months, certain differences were observed in favor of the Kazakh fat-tailed breed sheep in terms of calcium content and in young Edilbay breed sheep in terms of phosphorus content. Thus, the calcium content in the blood of the Kazakh fat-tailed rams was 7.8% higher than that of Edilbay sheep, while phosphorus content was lower by 4.0% than that of Edilbay sheep. The calcium-phosphorus ratio by breed was in the range: 1.63-1.76 for the Kazakh fat-tailed and 1.45-1.57 for the Edilbay breed. An analysis of the data revealed that, in general, the morphobiochemical parameters of blood in young animals of both breeds were within the physiological norm.

Thus, the studied meat-lard breeds have quite distinguishable biological and productive traits, indicating an independent genesis and individual characteristics of these animal populations. Further improvement of meat productivity indicators and their directed use in breeding practice is the most important task in working with meat-and-lard breeds of Kazakhstan.

Meat productivity and growth rate are important economically useful traits in sheep. The identification of the molecular-genetic mechanisms underlying the formation of these traits is of particular importance in terms of the growing market demand for mutton.

Conclusion. Growth hormone testing results showed that the GH2 gene is polymorphic in the studied sheep population. The highest frequency of occurrence was characterized by the G allele (0.7169), which was found in the homozygous state in 51.4% of sheep and in the heterozygous state - in 40.7% of sheep.

As a result of the analysis, it was established that according to the gene of insulin-like growth factor - 1 (IGF-1), the CC genotype was predominant in the studied population - 70.9%. The frequency of occurrence of the C allele was significantly higher than the T allele: 0.8386 and 0.1614, respectively.

It was also found that animals-carriers of heterozygous genotypes (AG of the GH2 gene and CT of the IGF1 gene) grew more intensively compared to homozygous genotypes. According to live weight, the one-year-old rams with the genotype GG of growth hormone (GH2) and the genotype CC of insulin-like growth factor (IGF1) surpassed their peers with other genotypes by 8.5%.

When analyzing the polymorphism of the GH2 and IGF1 genes, no associated bonds of different genetic variants with meat quality indicators were revealed.

The indicators of growth, development, and meat productivity of the Edilbay and Kazakh fat-tailed breeds have quite distinguishable biological and productive traits, which speak of an independent genesis and individual characteristics of these animal populations.

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ЕТТІ-МАЙЛЫ ТҰҚЫМДЫ ҚОЙ ЕТІНІҢ ДНК-МАРКЕРЛЕРІ БОЙЫНША СИПАТТАМАСЫ (ӨСУІ, ДАМУЫ ЖӘНЕ ЕТТІ ӨНІМДІЛІГІ)

Аннотация. Мақалада ет-май тұқымдас қойлардың өсуін, дамуын және ет өнімділігін, сондай-ақ ет-май тұқымдас қойлардағы гендердің полиморфизмін зерттеу нәтижелері келтіріледі.

Қойларды маркерлік бағалаудың рөлін зерттеуге бағытталған зерттеулер нәтижесінде екі зерттелген гендерде генотиптердің өсу жылдамдығымен және қойдың ет қасиеттерімен байланыстырылған кездесуі жиілігі туралы деректер алынды. Зерттелген таңдауда GH2 және 1(IGF1) гендері полиморфты болды. Зертте-летін белгілердің қандай да бір деңгейімен әртүрлі генетикалық нұсқалардың ассоциацияларының бар болуы анықталды.

Тәжірибе барысында тірі салмағы мен сыртқы көрсеткіштерінің өзгеру динамикасын есепке ала оты-рып, салмақтық және аталық ізі бойынша талдау арқылы туғаннан бастап 12 айлық жасқа дейінгі етті-майлы қойлар төлінің өсуі мен дамуы байқалды. Екі тұқымды жас төлде өсудің ең жоғары энергиясы бірінші айда және кетіру кезінде байқалады. Дене салмағының ең аз өсуі 4-тен 7 айлық жасқа дейінгі кезеңде болды, яғни бағылу кезеңінде.

12 айлық жасында еділбай тұқымындағы қойдың тірі салмағы 61,1 кг болған,бұл қазақтың құйрықты тұқымындағы төлінен 5,7 кг немесе 9,7% жоғары. Осындай артықшылыққа еділбай тұқымының жарықтары да ие болды. Сонымен, осы жаста Еділбаев тұқымының қой пайдасына айырмашылық 4,8 кг немесе 10,1% құрады.

Бір жастағы қойлардың бақылау союсының нәтижелері негізгі көрсеткіштер бойынша тұқымаралық айырмашылықтардың бар екендігін көрсетті. Сою алдындағы массасы бойынша Еділбаев тұқымының төл-дері өзінің құрдастарынан – қазақты құйрықты қойынан 9,9%-ға, ал тұтас еттің салмағы бойынша 11,7%-ға асып түсті. Тұтас еттің салмағы: Еділбаев тұқымында – 49,9, қазақ құйрықты тұқымында – 48,6% құрады, бұл 2,7% төмен. Еттегі протеин мен майдың біркелкі емес құрамы әртүрлі калориялық болып есептілді:

жоғары – Еділбаев тұқымдас қошқарларда – 215,6 ккал, ал қазақ құйрықты тұқымдарында – 207,2 ккал, бұл 3,9% төмен.

Морфобиохимиялық талдау көрсеткендей, екі тұқымды төлде қанның жалпы параметрлері физиология-лық норма шегінде болды.

Түйін сөздер: етті-құйрықты қой шаруашылығы, селекция, ет өнімділігі, қанның морфобиохимиялық құрамы, гендердің полиморфизмі, ДНК-маркерлер.

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ХАРАКТЕРИСТИКА ПО ДНК-МАРКЕРАМ БАРАНЧИКОВ МЯСОСАЛЬНЫХ ПОРОД (РОСТ, РАЗВИТИЕ И МЯСНАЯ ПРОДУКТИВНОСТЬ)

Аннотация. В статье приводятся результаты изучения роста, развития и мясной продуктивности овец мясосальных пород, а также наличия полиморфизма генов у овец мясосальных пород.

В результате исследований направленных на изучение роли маркерной оценки овец были получены данные о частоте встречаемости генотипов в двух исследованных генах, ассоциированных со скоростью роста и мясными качествами овец. Было установлено, что в изучаемой выборке овец гены GH2 и 1(IGF1) были полиморфными. Выявлено наличие ассоциаций различных генетических вариантов с тем или иным уровнем изучаемых признаков.

В ходе опыта проследили рост и развитие молодняка мясосальных овец с момента рождения до 12-месячного возраста путем весового и линейного анализа с учетом динамики изменения живой массы и экстерьерных показателей. Установлено, что у молодняка обеих пород наиболее высокая энергия роста наблюдается в первый месяц и к моменту отьема. Наименьший прирост массы тела был в период от 4 до 7-месячного возраста, т.е. в период нагула.

В 12-месячном возрасте бараны эдильбаевской породы имели живую массу 61,1 кг, что на 5,7 кг или на 9,7% выше чем у молодняка казахской курдючной породы. Аналогичное преимущество имели и ярки эдиль-баевской породы. Так, в этом же возрасте разница в пользу ярок эдильбаевской породы составила 4,8 кг или 10,1%.

Результаты контрольного убоя годовалых баранчиков показали наличие определенных межпородных различий по основным показателям. По предубойной массе молодняк эдильбаевской породы превосходили своих сверстников – баранчиков казахской курдючной породы на 9,9%, а по массе туши без курдюка на 11,7%. Убойный выход составил: у эдильбаевской породы – 49,9, у казахской курдючной – 48,6%, что на 2,7% ниже. Неодинаковое содержание протеина и жира в мясе обусловило разную калорийность: более высокая – у баранчиков эдильбаевской породы – 215,6 ккал, а у молодняка казахской курдючной породы – 207,2 ккал, что на 3,9% ниже.

Морфобиохимический анализ показал, что в целом параметры крови у молодняка обеих пород были в пределах физиологической нормы.

Ключевые слова: мясосальное овцеводство, селекция, мясная продуктивность, морфобиохимический состав крови, полиморфизм генов, ДНК-маркеры.

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