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The Variability of Productive Traits Estimation in Kalmyk Cattle.

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ABSTRACT

The aim of the research was to assess the variability of productive traits in new factory types "Aita" and "Voznesenovskiy" in Kalmyk breed of cattle. The material for the studies was obtained on two groups of bull-calves (n = 12) for control growing of experimental animals in breeding farm APC "Druzhba" in Stavropol Territory. The final and pre-slaughter live weight, hot carcass weight, fat, carcass weight and yield were measured during the control slaughter of 3 bulls (15 months of age). Based on the boning data the content of pulp, bones, cartilage and tendons were established, as well as the yield of pulp per 1 kg of bones. The advantage of Voznesenovsky type was 8.5 kg by the final stage of control growing. Analysis of the average daily gain showed the superiority of Voznesenovskiy type in front of their peers by 21.1 g. A significant determination of live weight at birth of calves from the "factory type" component - 53,26% was established by analysis of variance. The highest proportion of the informal factors influence was recorded at weaning, reaching 99.94% of the total variability of the trait. A minimal effect of genetic component (0.19%) on the variability of average daily gain were detected in calves in the pre-weaning period. The impact of "factory type" gradation was increased up to 17.92% after weaning. The slaughter mass of bull-calves "Aita" was characterized by a minimum level conceded to the average value of peers by 30.6 kg. The maximum amount of pulp was obtained from "Voznesenovskiy" type, the advantage was up to 12.0 kg. The difference in meat yield per 1 kg of bones were 0,34 kg in favor of the young bulls of "Voznesenovskiy" genotype.

Keywords: Kalmyk breed, bull-calves, factory type, Aita, Voznesenovskiy, variability, live weight, beef productivity.

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INTRODUCTION

The beef cattle breed is a dynamic structural unit. A wide range of climatic factors, as well as the use of artificial selection tools, with the purposeful participation of a person, using artificial selection tools, creating opportunities for modifying and differentiating rocks into separate elements: types, lines, related groups, families, crosses [1, 16]. By combining the structural units of the rocks that differ in the productive, biological and adaptive features, by improving heterogeneous and homogeneous selection, animals with a new hereditary complex of superior to the original genotypes can be obtained [2, 17]. Therefore, the need to artificially expand and maintain variability in the properties of individuals in the breed for livestock cannot be overemphasized.

Cattle of the Kalmyk breed is the oldest. On the territory of Russia appeared about 400 years ago, thanks to the Kalmyk nomadic tribes. This livestock is characterized by the duration of economic use, has a strong and harmonious constitution. A distinctive feature of the breed is the absence of the occipital crest on the head. The horns have the shape of a "half moon" and are directed to the sides, up and inwards. The live weight of cows in the adult state is 450-480 kg, the bulls-producers are 800-950 kg [3, 18]. The livestock of Kalmyk cattle at the end of 2015 is 138.3 thousand heads or 22.5% of the total number of pedigree beef cattle. Good adaptability to zones with extreme climatic conditions (predetermined a wide range of distribution of Kalmyk cattle, showing good fertility, survival, and excellent maternal qualities in such unfavorable conditions for most meat breeds. Beef, obtained from these animals, has outstanding taste qualities, marbling and tenderness are not inferior to world standards [4, 19]

Kalmyk breed cattle are cultivated in the areas of the North Caucasus, the southeast of the Volga region and the Urals, the Far East, Eastern Siberia, and Kazakhstan. The variety of ecological zones of distribution of Kalmyk livestock is predetermined by the formation of intra-breed types: Zimovnikovsky, South Ural, Ayta, and Voznesenovsky. Zimovnikovsky type is derived in the North Caucasus and the Rostov region [5, 20]. Animals of the Zimovnikovsky type are characterized by a significant deposition of intramuscular fat. Full-grown cows of this type exceed the standard of the breed by 1.8-8.8% for live weight and 14.0-22.2% for milk, adult bulls are heavier than the breed standard by 6-15%. The South Ural type was created on the territory of the Orenburg region [6]. Animals of this type are characterized by relative biological delay, having a longer period of intensive growth, mainly due to the increase in muscle tissue. In addition, South Ural youngsters have a lower content of raw fat (by 6.4-14.8%) in carcasses [7, 21].

The long-term strategy of breeding and breeding in the breeding of the grounds of the Kalmyk cattle - Aita (the Kalmykia) and the SEC Druzhba (Stavropol Territory) was completed in 2015 by the creation and approbation of two factory types of Kalmyk cattle - Aita and Voznesenovskiy [8, 22]. "Voznesenovskiy" type is distinguished by a large format of physique. These are tall, stretched animals, capable of maintaining high growth intensity for a long time. The factory type "Aita" is characterized by high adaptability to semi-desert zones of breeding, while showing high productivity. Cows of this type are distinguished by high milk content (according to the live weight of the calf at the age of 205 days), which allows us to get well-formed young animals to weaning. According to the principle of the principles of the formation of the milk, the milk-feeding wetness, the long-term growth, the productive longevity [eleven]. The perfection of newly-created types continues with the introduction of a marker of dependent selection and assessment of genetic parameters for monitoring and predicting the productive qualities of new genotypes the Aita and Voznesenovskiy in the Kalmyk breed [9, 23].

MATERIALS AND METHODS

Experimental data were obtained from two groups of bull-calves ($n = 12$ each) of the factory types "Aita" (group I) and "Voznesenovskii" (group II) of the Kalmyk breed. Control cultivation of experimental animals was carried out under the same feeding conditions and maintenance of the Druzhba pedigree plant in the Apanasenkovskiy district of the Stavropol Territory in the SPK. Groups were formed from newborn calves while taking into account the timing of birth, the difference in age did not exceed 30 days in the context of all the investigated genotypes. Newborn bulls were kept according to the technology adopted in beef cattle: up to 8 months of age on a suck-up under their mothers, after weaning and up to 15 months they were transferred to a testing station. The content of experimental animals during this period was small-group (for 12 heads in each card), loose on the walk-fodder yards with a mound and a deep non-replaceable resting mat and equipped with light-type rooms.

The growth and development of the experimental bulls were measured by the monthly weighing on the electronic scales in the morning before feeding, based on the live weight data. Control slaughter of 3 bull-calves (15 months) from each group was carried out at a meat-packing plant in the village. Wonderful Apanasensky district of the Stavropol Territory. Meat production was studied according to the methods [10, 24]. At the same time, we took into account the removable and pre-destructive live mass, the mass of the steam carcass, the internal fat-raw material, the slaughter mass and the yield. The morphological composition of the carcasses was studied when dividing and boning the right halves. On the basis of boning data, the content of pulp, bones, cartilage, and tendons was established, as well as the yield of pulp per 1 kg of bones. When processing the experimental data, the ANOVA (variance analysis) of the Statistica 6.0 program was used to determine the reliability and significance of differences in arithmetic mean values, as well as in the calculation of the determination coefficient h^2 , which shows how much of the total variability of the trait. At the same time, the coefficient of determination was calculated as the ratio of the factorial sum of squares (SSfact) to the total (SSobsch.), Expressed as a percentage:

$$h^2 = \frac{SS_{fact}}{SS_{total}} \times 100\%$$

To analyze descriptive statistics, use the Microsoft Office Excel (2003) application.

RESULTS

Relative small fruiting characterized the young "Voznesenovskogo" type. Their live weight at birth was 1.1 kg (5.07%, $P < 0.001$) less than the factory-type peers Aita (Table 1).

Table 1: Dynamics of live masses and average daily increments of bull calves of different plant types

Age	Factory type			
	Aita		Voznesenovskiy	
	$X \pm Sx^a$	Cv^b	$X \pm Sx$	Cv
Live weight, kg				
0 months	21.7±0.13***	2.08	20.6±0.19	3.25
7 months	216.5±2.81	4.49	216.1±2.20	3.53
12 months	307.6±4.15	4.67	318.0±4.66	5.08
15 months	397.5±1.64	1.43	406.0±6.83	5.83
Average daily gain, g				
0 months	950.1±13.61	4.96	953.6±10.64	3.87
7 months	569.5±19.16	11.65	637.2±24.27*	13.19
12 months	988.1±33.59	11.77	967.0±46.94	16.82
7 months	721.0±11.41	5.48	756.6±23.74	10.87
0 months	824.1±3.64	1.53	845.2±14.81	6.07

Note: a - $X \pm Sx$ - the arithmetic mean and the standard error of the arithmetic mean; b - Cv is the coefficient of variation; * - the reliability of the difference $P < 0.05$, ** - $P < 0.01$, *** - $P < 0.001$

By the end of the suckling growing period (7 months), the bulls of the investigated types of significant intergroup differences in weight growth were not shown. The minimum advantage of 0.4 kg (0.19%) with an unreliable difference in the mean values was assigned to factory-type animals "Aita". After weaning from mothers, as the growth and development began, the differences became more significant and by 10 months reached 10.4 kg (3.38%; $P > 0.05$) with the superiority of the Voznesenovskaya breeding animals. By the final stage of control cultivation (15 months), the advantage of Voznesenovskogo youngster relative to peers of the Ayata type was somewhat reduced to 8.5 kg (2.14%, $P > 0.05$).

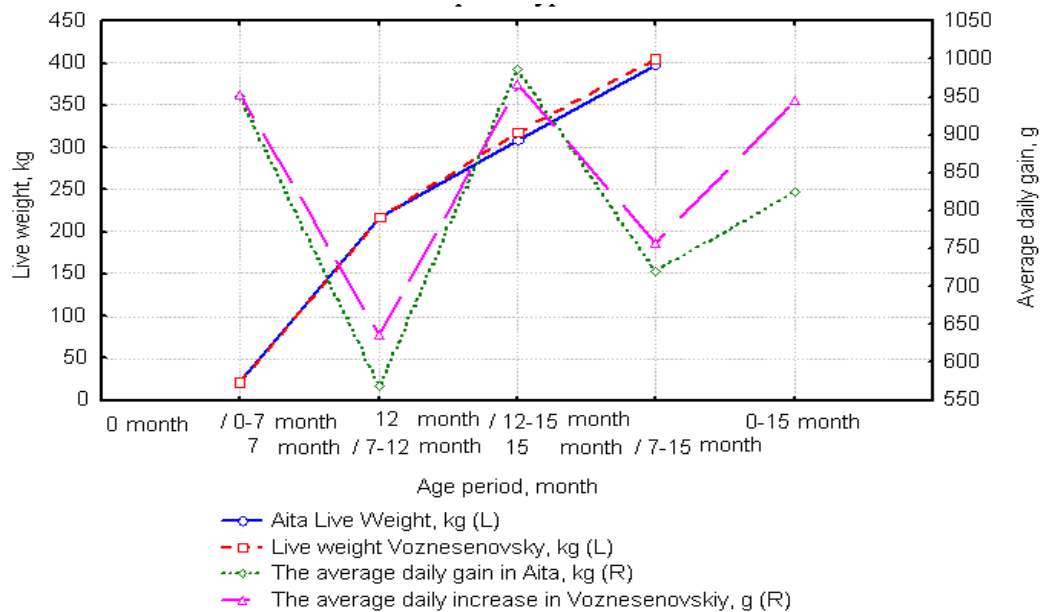


Figure 1: Dynamics of live weight and average daily increments of bull calves of different plant types

The features of the growth of the live mass of the youngest of the investigated genotypes characterize the dynamics of average daily growth more fully. Observations showed that during the period from birth to the end of the cod-season of bull-calves, the differences in growth intensity were minimal - 3.5 g (0.37%, $P > 0.05$). After weaning calves from mothers, a sharp decrease in the average daily growth in animals of the types investigated was established. In particular, the reduction of the analyzed trait in the bull-calves of Ayata breeding was 380.6 g (40.06%, $P < 0.001$), in the Voznesenovskiy group - 316.4 g (33.18%, $P < 0.001$), respectively. The reason for this is a modification of the structure of rations and technology of growing young animals, transferring them to small-group maintenance in the conditions of a testing station. It should be noted that the young plant type "Voznesenovskiy" is less susceptible to these stress factors. As a result, they were found to be reliable on the first threshold ($P < 0.05$) in terms of growth intensity - 67.7 g (11.89%). In the process of adaptation of the organism of animals to changing conditions of feeding and growing, the level of average daily growth was restored to 967.0-988.1 g per day. A statistically unreliable advantage ($P > 0.05$) was established in the bulls of the genotype "Ayta" - 21.1 g (2.18%). The analysis of the obtained data for the entire period of the control cultivation (from birth to the age of 15 months) showed the superiority of the young Voznesenovskii type in comparison with their peers by 21.1 g (2.56%; $P > 0.05$).

The level of development of signs of weight growth of bull-calves of different genotypes was strongly dependent on the limits of external factors. Often the share of non-genetic factors accounts for a significant part of the variability of quantitative traits. The main task of specialists engaged in breeding pedigree beef cattle is to minimize the impact of unorganized factors on economic and useful qualities in favor of strengthening the influence of the genotype. Our investigations established the expansion of the phenotypic variability of the live weight with age. In this case, a significant determination of the mass of the bull body of different genotypes at birth from the component "factory type" is noted - 53.26% ($P < 0.001$). This situation seems to be very reasonable, since the impact of environmental factors is minimal on the variability of the live weight of the newborn calf. At weaning (7 months) bull-calves the maximum share of influence of paratypic factors on weight growth of young animals is fixed, reaching 99.94%. The most important parameters that determine the variability of the live weight at this stage are the maternal qualities of the nursing cows. Stress, caused by a change in the type of feeding and the content system, also acts as a limiting factor for a more complete realization of the genotypic value of the young. In the process of development of bull-calves in the post-loosen period, there was an increase in the conditionality of the variability of the living mass from the organized factor "factory type". Thus, at the age of 12 months, the weight increase in experimental animals by 11.24% ($P > 0.05$) was determined by the genotype of the livestock. And by the age of removal of bull-calves from control cultivation (15 months), there was some weakening of the effect of the organized factor to 6.25% ($P > 0.05$).

Analysis of the variability of the growth results, that the minimal effect of the genetic component (0.19%, $P > 0.05$) on variability was detected in the bull-calves in the suckling period. The reason for this is the predominance of intragroup (unorganized) dispersion of the average daily growth rate in comparison with the intergroup (gradation "factory type"). The variability of the weight growth rate in the post-shoot period was subjected to strong pressure factors of the non-genetic component of variability (mainly milk production of mothers), limiting the expression of the genotype in the animal phenotype.

After weaning, the effect of gradation "factory type" was increased to 17.92% ($P < 0.05$) for the growth rate of the young. Apparently, the main role is played by a different level of fitness of organisms to a change in the nature of feeding and content, due in large part to the heredity of the experimental animals. At the final stage of control growth of young animals (from 12 to 15 months), there was a sharp decrease in the increase in the heredity of the average daily weight gain-up to 0.6% ($P > 0.05$). With a small and unreliable difference in the average rates of weight growth, a wide range of intra-group variability of the trait was noted. As a result, for the time of the research, the determination of the average daily gain from the factor "factory type" was 8.05% ($P > 0.05$).

The data of the variance analysis show that the study of the nature of the variability of economic and useful qualities does not enable us to build a clear strategy for breeding beef cattle, since different in strength and direction of the vector are created at different stages in the ontogeny of the young, contributing to the overall variability of the quantitative trait.

Before the control slaughter, the Voznesenovski bulls of the factory type were characterized by relative heaviness (Table 3), exceeding peers by the size of the removable live weight by 20.2 kg (5.28%, $P < 0.05$). They also had better adaptation to transport stress and 24-hour hungry aging. Thus, the loss of live weight at the moment of slaughter in the selection of "Ayta" was 34.5 kg (9.02%), which is 13.1 kg (3.71%) higher than the similar indicator of peers. Together, these factors caused a significant difference (33.3 kg, 9.57%, $P < 0.01$) in the pre-bait live weight of the experimental young with the advantage of the "Voznesenovskii" genotype. As a result, pair of carcasses of 22.5 kg (10.56%, $P < 0.05$) were easier compared to analogues from factory-type bull-calves "Aita". At the same time, they were also characterized by a minimal index on yield of carcass, yielding to young growth of "Voznesenovskiy" genotype of 1.2%.

An analysis of the data obtained on the nature of fat deposition convincingly demonstrates the significant intergroup differences, both in absolute and in relative terms, due to the heredity of the experimental animals. Thus, the mass of internal fat-raw in the bulls of the "Voznesenovskii" genotype was 8.0 kg (101.27%, $P < 0.01$), which exceeded the similar indicator of the "Ayta" breeding animals. A significant advantage in the deposition of adipose tissue of Voznesenovskogo young growth was reflected in the yield of internal fat-raw material, the advantage was 1.9% ($P < 0.01$). Thus, the size of the slaughter mass of the factory-type bull-calves "Ayta" was characterized by a minimum indicator, yielding to the average peer value of 30.6 kg (13.31%, $P < 0.05$). In addition, their killer yield was 3.0% lower.

Table 2: Results of control slaughter of bull-calves

Index	Factory type			
	Aita		Aita	
	X±Sx	Cv	X±Sx	Cv
Pre-slaughter live weight, kg	348.0±3.87	1.57	381.3±3.49**	1.29
Weight after slaughter carcass, kg	191.4±5.74	4.24	214.0±3.08*	2.04
Yield of carcass,%	55.0±1.46	3.75	56.2±1.17	2.94
Weight of raw fat, kg	7.9±0.21	3.76	15.9±1.10**	9.78
Slaughter weight, kg	199.3±6.92	4.91	229.9±3.17*	1.95
Slaughter yield,%	57.3±1.22	3.01	60.3±1.08	2.53
Half-carcase weight, kg	93.0±2.52	3.83	105.0±2.77*	3.73
Pulp, kg	74.7±1.42	2.69	86.7±1.92**	3.13
Bones, kg	15.8±0.38	3.40	17.1±1.23	10.17
Cartilage and tendons, kg	2.5±0.27	15.27	1.2±0.39	45.96
Yield of pulp per 1 kg of bones	4.73±0.02	0.60	5.07±0.12*	3.35

Analysis of indicators of control slaughter of young animals of different origin established intergroup differences determined by the genotype of animals. The preferred set of characteristics studied were the bulls of the new factory type "Voznesenovskiy" of the Kalmyk breed of cattle.

A further evaluation of the formation of meat of young animals of different genotypes was studied on the basis of an analysis of the morphological composition of the right halves. Bulls of the Stavropol selection 12.0 kg (12.90%, $P < 0.05$) of their peers. The maximum amount of pulp was obtained by 12.0 kg (16.06%, $P < 0.01$), the type of Kalmyk cattle was trimmed, the advantage reached 12.0 kg. On the output of the pulp, the superiority was also on their side, the amounting to 2.3%. The formation of a strong harmoniously developed skeleton for beef cattle is a prerequisite for the optimal buildup of muscle tissue on it. The superiority of the bulls of the Voznesenovskiy type was found to be 1.3 kg (8.23%), relative to the analogues. At the same time, in the structure of the carcass, this component accounted for a smaller proportion (by 0.7%), compared with the youngest selection of "Aita". As a result, the difference in the yield of the pulp by 1 kg of bone tissue was 0.34 kg (7.19%, $P < 0.05$) in favor of the young Voznesenovskii genotype.

DISCUSSION

Scientists note the importance of purebred breeding with the maximum use of Intra spheric resources, this is facilitated by the widespread introduction of modern methods of animal reproduction (artificial insemination and embryo transplantation) into cattle breeding practices [11]. The system of pedigree work with Kalmyk breed cattle is also aimed at finding in-breed reserves to improve economically significant qualities [12]. The identification of the productivity potential of the two new breeding achievements in the Kalmyk breed of livestock was the main task of our work. Our study included control growth of young animals under the same conditions of feeding and maintenance. The bulls of new breeding achievements were characterized by a rather high productivity, reaching 397.5-406.0 kg by the end of the live weight experiment. In a similar work [13], the young Kalmyk breed noted the superiority of the estimated animals with the parameters of the top bonitizing class, the elite record for weight gain at 15 months of age by 3.25-5.45%. The dynamics of average daily growth in our study also indicates a high genetic potential, showing growth during the period of control cultivation at the level of 824.1-845.2 g.

The main attention to the use of selection and genetic parameters in breeding work with meat cattle was noted [14]. We have analyzed the degree of influence of genetic variability in the formation of the bull-calf phenotype over the periods of cultivation. The results of statistical processing indicate the possibility of early assessment and selection of repair young animals for reproduction of the herd. Genetic conditionality of the value of live weight in the post-shoot period of cultivation in our studies varied within the range of 6.25-11.24%, and the average daily gain reached 17.92%. To such conclusions in their studies came [15], noting the high determinism of weight growth after weaning factors of hereditary nature.

As a result of our research, it was established that the realization of the meat production potential of the experimental bulls was closely related to the origin of the animals. The superiority of the group of "Voznesenovskogo" youngsters differed in the reliability of the first and second thresholds for most indicators. In particular, the difference in weight of paired carcasses was 22.6 kg, the mass of internal fat-raw material was 8.0 kg, the slaughter weight was 30.6 kg, the pulp weight was 12.0 kg. Many researchers have also established the effect of the genotype on the amount of products obtained.

CONCLUSION

Controlling the growth of Kalmyk bull calves of new factory types of the Kalmyk breed of cattle "Voznesenovskiy" and "Ayta" revealed some peculiarities in the formation of economic and useful qualities. So, in the suckling period, bull-calves of the "Aita" genotype had a slight superiority in terms of live weight by 0.4 kg (0.19%). After weaning, the rank of distribution of groups by weight growth changed in favor of Voznesenovskiy type animals, the advantage was 8.5-10.4 kg (2.14-3.38%). The genotype factor caused, on 0.06-53.26%, the variability of the live weight over the growth periods. Determination of the heredity of the average daily increase was 0.19-17.92%. The slaughter of the experimental animals showed the advantage of the "Voznesenovskiy" bulls of the factory type for a number of studied characteristics in comparison with the coevals of the "Aita" genotype: 10.56% by mass of the carcass, 101.27% of the internal fat-fat, 13.31% of the slaughter mass, pulp at 16.06%.

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