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# Selection of Kalmyk Cattle in Kazakhstan

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**Abstract:** The purpose of the study is to determine the precocity of Kalmyk cattle breeding stock in Kazakhstan and the accuracy of productivity assessment by indices of breeding value. It is established that calves are born with a live weight of 22.4-25.7 kg, at the age of six months they reach a live weight of 165.2-175.3 kg. The average daily increase in live weight during 180 days is 787.2-840.8 g. In the first months of development from birth to one-year-old age, the daily increase is 1401-1586 g, from 210 days of age 169-219 g, from birth to one-year-old age 878-1006 g. The indices of breeding value were by live weight: At birth -5.16 and +5.00, at weaning -13.13 and +11.71, at one-year-old -16.92 and +17.41, adults -36.00 and +33.17. The indices of breeding value for milk production amounted to -16.39 and +16.25. The index of breeding value of daily growth of young Kalmyk cattle in 2022 from birth 205 days -346.25 and 29183, from 205 days of age to one-year-old -444.64 and +446.28, from birth to one-year-old -555.88 and 611.74. In 2023, the index of breeding value showed -203.17 and 259.03 from birth to one year of age. The shared distribution of accuracy was shown by qualitative replenishment of the database of the information-analytical system according to productive indicators. This indicates a potential opportunity in breeding to increase the average daily increase In 18-month-old Kalmyk bull-calves of the Kazakhstan population, the height at the withers was 126.5-126.8 cm, the height at the rump was 134.2-134.6 cm, the chest depth was 672-67.5 cm, the chest width was 45.2-46.1 cm, the oblique body length was 143.5-144.2 cm, the chest girth 192.5-196.4 cm, metacarpus girth 21.5-21.7 cm, width at the hip joints 42.8-43.2 cm, width at the coxal joints 44.4-44.6 cm, width at the ischial tuberosities -27.8-28.3 cm.

**Keywords:** Beef Cattle, Kalmyk Breed, Live Weight, Estimated Breeding Value, Body Measurements

## Introduction

However, according to several researchers, these qualities of animals have low heritability and without assessing the productivity of relatives and the combination ability of lines, the selection effect is limited (Kayumov *et al*., 2018).

Meat cattle breeds have a wide variety of economic and biotechnological features, in almost all natural and climatic zones of Kazakhstan (Amerkhanov *et al*., 2017).

In regions with natural pastures, it is traditional to keep beef cows. This is because the technology of rearing beef young animals according to the “cow-calf” principle has not changed: The calf is kept with its mother on the pasture and the suckling period lasts 6-8 months, after which the nursery period begins. Relatively cheap feed and the unpretentiousness of animals make this industry attractive to many farmers. The "cow-calf" system is mainly used by small farms that receive up to 60 weaned calves per year and many of them are also engaged in haymaking, growing corn, soybeans, and small grain crops. In 1987 there were 51% of farmers in the country with at least 10 thousand hectares of pastures (40.5 hectares), then in 2012, their number decreased to 44% (Terentieva, 2018).

By origin, Kalmyk cattle are closest to the type of Indian cattle. It represents a transitional form from Asian to European type. Many animals have a white head.
Kalmyk cattle are very promising for breeding in the semi-desert zones, they are not inferior to many other early-maturing meat breeds (Fedotova *et al*., 2020).

The meat of Kalmyk cattle (under the name "Cherkasy") has long been famous for its good qualities. Previously, it was more expensive in the markets than the meat of other breeds of cattle. With the spread of artificial insemination in beef cattle breeding and the spread of bull's daughters in many farms (herds), it became necessary to eliminate inter-herd paratypes differences (Yurchenko *et al.*, 2018a).

Genomic Selection (GS) is a form of MAS in which genetic markers are scattered throughout the genome and at least one of them is linked to a QT (Sermyagin *et al.*, 2018).

In practice, SNP markers are used instead of QTL to estimate breeding value. Such EBV approximations with a large number of SNPs approach the EBV estimates by the ideal method (Yurchenko *et al.*, 2018b; Macneil *et al.*, 2017).

In the Kalmyk breed, there has been a tendency towards differentiation of the following offspring: North Caucasians, lower Volga, Kazakhstani, and Siberian. Larger size and better development of meat forms are characteristic of the North Caucasian offspring. It was formed back in the pre-revolutionary period on the Don and in the Stavropol Territory and was called the Red Don breed. Animals have rounded bodies and deep chests. The back loins and rump are broad and long, well-muscled. (Abdelmanova *et al*., 2021).

The most popular accessible method for predicting the productive traits of beef cattle at an early age is genotyping for genes associated with productivity traits. Particularly relevant are studies on the identification of genetic polymorphism and qualitative parameters of the muscle and adipose tissue of beef cattle (Lewin *et al.*, 1999).

One of the main methods used in the search for polymorphisms significant for selection is the whole Genome Analysis of Wide Association Study (GWAS). GWAS is a further development of the Marker-Assisted Selection method (MAS) and in Linkage Disequilibrium (LD) with at least one of the Quantitative Traits (QTL) (Henderson *et al.*, 2005).

The assessment of the genomic breed composition of individual breeds in combined beef cattle breeding is carried out using (Li *et al.*, 2020).

### *Aim of Research*

To determine the precocity of Kalmyk cattle breeding stock in Kazakhstan and the accuracy of productivity assessment by indices of breeding value.

## Materials and Methods

The research material was cattle of the meat direction of productivity of the Kalmyk breed of the Kazakh population.

### *Research Methods*

The number of cattle in 2021 amounted to 747 animals, of which 25 bulls, 180 cows, heifers older than 18 months 250 animals, heifers under 18 months of age 139 animals, and young growth of the current year 153 animals. Animals are characterized by well-defined meat body shapes with well-developed muscles. They have a massive body on relatively high legs due to the large size of the body in width and depth.

As the research results, the work was started on developing a breeding program for improving the economic traits of the Kalmyk breed.

The number of farms from 5,000-10,000 animals increased from 2-5 (2021-2023 Year). Farms with livestock from 1,000-5,000 animals increased from 9-9. Farms from 200 heads to 500 heads increased from 16-16. Farms from 100 heads to 200 heads increased from 5-6. Farms with up to 100 heads increased from 111 to 111.

The hematological and biochemical blood investigations of young Kalmyk breed animals at 18 months of age in the amount of 20 animals, including 0 bulls and 10 heifers, were carried out.

The body measurements of Kalmyk bulls at the age of 18 months, in 2021 and 2022, were studied. This made it possible to determine 10 main measurements: Height at the withers, height at the rump, chest depth, chest width, oblique body length, chest girth, metacarpus girth, width at the hip joints, width at the coxal joints, width of the ischial tuberosities.

The slaughter rates of Kalmyk bulls at the age of 18 months were studied. For this purpose, a controlled slaughter of 10 animals was carried out, including 5 animals in 2021, and 5 in 2022. Subsequently, an analysis of the chemical and amino acid composition of an average sample of minced Kalmyk breed meat was performed.

In the process of research, all the principles of animal evaluation and selection adopted in beef cattle breeding have been observed (Li *et al*., 2020; Beishova *et al*., 2022; Bissembayev *et al*., 2021).

## Results

The precocity of the young Kalmyk breed was studied (Table 1).

It is established that calves are born with a live weight of 22.4-25.7 kg, at the age of six months they reach a live weight of 165.2-175.3 kg. The average daily increase in live weight for 180 days is 787.2-840.8 g. Cows of the Kalmyk breed of the Kazakh population are distinguished by a strong constitution and have a uniform color (Fig. 1).

**Table 1:** Precocity of young Kalmyk breed

| No. | Farm | n | At birth | At weaning (6 months) | n | At birth | At weaning (6 months) |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 1 | Musa | 86 | 22.4±1.49 | 173.6±11.12 | 67 | 19.6±4.82 | 167.7±10.18 |
| 2 | Moskovsky LLP | 6 | 25.7±0.33 | 175.3±4.81 | 72 | 21.0±0.28 | 193.0±5.45 _ |
| 3 | Zhana Bereke LLP | - | - | - | 46 | 20.1±0.05 | 170.9±0.82 |
| 4 | Sarsenov N.A. | 32 | 23.5±0.54 | 165.2±3.93 | 28 | 20.5±0.28 | 153.6±6.36 |
| Average daily gain, g | | | | | | | |
| 1 | Musa | 86 | 840.8±31.70 | | 67 | 822.7±38.50 | |
| 2 | Moskovsky LLP | 6 | 831.5±27.80 | | 72 | 693.0±8.60 | |
| 3 | Zhana Bereke LLP | - | - | | 46 | 837.9±4.52a | |
| 4 | Sarsenov N.A. | 32 | 787.2±36.60 | | | 739.4±48.90 | |

**Table 2:** Live weight of young Kalmyk cattle in ontogenesis

| Breed, age group | Live weight at birth, kg | | Live weight at weaning on day 210, kg | | Live weight for days, kg | | Live weight at 5 years and older, kg | |
|---|---|---|---|---|---|---|---|---|
| | n | $\bar{X} \pm S\bar{x}$ | n | $\bar{X} \pm S\bar{x}$ | n | $\bar{X} \pm S\bar{x}$ | n | $\bar{X} \pm S\bar{x}$ |
| The 2021 Year | | | | | | | | |
| bulls | 2413 | 24.70±0.090 | 2402 | 187.20±3.300 | 1650 | 309.8±5.0 | - | - |
| heifers | 10186 | 23.90±0.030 | 12543 | 173.10±1.800 | 8226 | 274.8±2.5 | - | - |
| The 2022 Year | | | | | | | | |
| bulls | 4436 | 25.56±0.048 | 4256 | 182.76±0.305 | 3128 | 305.32±0.359 | 4 | 536.75±9.168 |
| heifers | 10186 | 23,93±0.030 | 12543 | 173.08±0.180 | 8226 | 274,84±0.25 | 4 | 324.25±35.18 |
| The 2023 Year | | | | | | | | |
| bulls | 1097 | 25.94±0.130 | 1117 | 182.62±0.500 | 1034 | 305.3±0,3 | - | - |
| heifers | 475 | 24.44±0.260 | 467 | 174.09±0,600 | 475 | 274.84±0.25 | - | - |

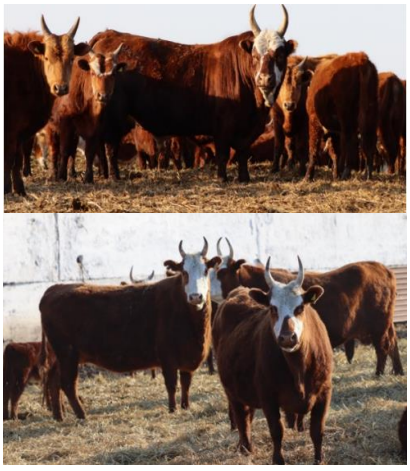

**Fig. 1:** Kalmyk breed of the Kazakh population

**Fig. 2:** Kalmyk breed of Kazakhstan population

In 2023, bulls had a live birth weight of 25.94 kg, 210 days 182.62 kg, 365 days 305.3 kg, and heifers 23.93-174.1-274.84 kg. The Kalmyk bulls corresponded to class 1, heifers-the elite class (Table 2).

Calves of the Kalmyk breed are well adapted to the pasture conditions of Kazakhstan (Fig. 2).

In the first months of development from birth to one-year-old age, the daily increase is 1401-1586 g, from 210 days of age 169-219 g, from birth to one-year-old age 878-1006 g (Table 3).

The indices of breeding value were by live weight: At birth -5.16 and +5.00, at weaning -13.13 and +11.71, at

one-year-old age -16.92 and +17.41, adults -36.00 and +33.17. The indices of breeding value for milk content were -16.39 and +16.25 (Table 4).

The breeding value index of the daily growth of young Kalmyk cattle in 2022 was 205 days from birth -346.25 and 29183, from 205 days old to one-year-old -444.64 and +446.28, from birth to one-year-old 555.88 and 611.74. In 2023, the breeding value index showed -203.17 and 259.03 from birth to one year old (Table 5).

The accuracy of the evaluation of productive indicators of Kalmyk cattle showed the effectiveness of the use of index evaluation in breeding (Tables 6-7).

**Table 3:** Daily growth of Kalmyk cattle

| Breed, age group | SP 0-210 | | SP 210-12 | | SP 0-12 | |
|---|---|---|---|---|---|---|
| | n | $\bar{X} \pm S\bar{x}$ | n | $\bar{X} \pm S\bar{x}$ | n | $\bar{X} \pm S\bar{x}$ |
| Bulls | 2267 | 1586.69±3.332 | 17 | 219.87±68.314 | 15791 | 006.26±2.529 |
| Heifers | 9036 | 1401.50±1.731 | 206 | 169.61±15.499 | 6497 | 878.37±1.185 |

**Table 4:** Index of breeding value of Kalmyk cattle

| Percentile (%) | Live weight, kg | | | Milking capacity of cows | Adult animal |
|---|---|---|---|---|---|
| | At birth | At weaning | At 12 months of age | | |
| 1 | 2 | 3 | 4 | 5 | 6 |
| The 2021 Year | | | | | |
| 0 | -6.38 | +36.19 | +37.69 | +45.65 | +36.71 |
| 5 | -0.90 | +8.27 | +7.57 | +7.34 | +7.99 |
| 10 | -0.48 | +5.08 | +4.03 | +4.40 | +4.37 |
| 20 | -0.17 | +1.38 | +1.48 | +1.65 | +1.59 |
| 30 | -0.06 | +0.47 | +0.56 | +0.60 | +0.61 |
| 40 | -0.01 | +0.13 | +0.16 | +0.17 | +0.18 |
| 50 | +0.01 | +0.01 | 0.00 | 0.00 | 0.00 |
| 60 | +0.06 | -0.06 | -0.11 | -0.05 | -0.11 |
| 70 | +0.15 | -0.22 | -0.36 | -0.36 | -0.35 |
| 80 | +0.29 | -0.54 | -0.81 | -0.86 | -0.81 |
| 90 | +0.64 | -1.35 | -1.83 | -1.83 | -1.83 |
| 95 | +1.08 | -2.47 | -3.15 | -2.94 | -3.14 |
| 100 | +12.98 | -31.97 | -32.72 | -44.97 | -35.91 |
| Minimum | -6.38 | -31.97 | -32.72 | -44.97 | -35.91 |
| Maximum | +12.98 | +36.19 | +37.69 | +45.65 | +36.71 |
| The 2023 Year | | | | | |
| 0 | -5.16 | +11.71 | +17.41 | +16.25 | +33.17 |
| 5 | -1.65 | +3.55 | +5.27 | +4.94 | +7.11 |
| 10 | -1.07 | +2.40 | +3.00 | +2.87 | +4.43 |
| 20 | -0.57 | +1.10 | +1.50 | +1.46 | +1.98 |
| 30 | -0.32 | +0.56 | +0.78 | +0.77 | +0.85 |
| 40 | -0.15 | +0.21 | +0.32 | +0.31 | +0.22 |
| 50 | -0.01 | -0.01 | -0.01 | -0.02 | 0.00 |
| 60 | +0.12 | -0.23 | -0.36 | -0.36 | -0.49 |
| 70 | +0.27 | -0.56 | -0.86 | -0.84 | -1.16 |
| 80 | +0.48 | -1.06 | -1.62 | -1.55 | -2.29 |
| 90 | +0.96 | -2.28 | -3.24 | -3.15 | -4.66 |
| 95 | +1.55 | -3.79 | -5.18 | -4.95 | -7.69 |
| 100 | +5.00 | -13.13 | -16.92 | -16.39 | -36.00 |
| Minimum | -5.16 | -13.13 | -16.92 | -16.39 | -36.00 |
| Maximum | +5.00 | +11.71 | +17.41 | +16.25 | +33.17 |

**Table 5:** The index of breeding value of the daily growth of young Kalmyk cattle

| | EBV for average daily growth, g/ day | | |
|---|---|---|---|
| Percentile (%) | SP 0-205 | SP 205-12 | SP 0-12 |
| The 2022 Year | | | |
| 0 | 291.83 | 446.28 | 611.74 |
| 5 | 69.29 | 121.17 | 166.92 |
| 10 | 59.79 | 102.53 | 143.36 |
| 20 | 48.85 | 80.95 | 113.65 |
| 30 | 38.79 | 65.21 | 81.04 |
| 40 | 27.69 | 49.20 | 52.34 |
| 50 | 15.81 | 30.14 | 31.18 |
| 60 | 6.54 | 11.34 | 12.39 |
| 70 | -0.77 | -2.14 | 1.56 |
| 80 | -11.88 | -16.45 | -8.04 |
| 90 | -28.00 | -38.59 | -31.82 |
| 95 | -42.82 | -61.21 | -68.40 |
| 100 | -346.25 | -444.64 | -556.88 |
| Minimum | -346.25 | -444.64 | -556.88 |
| Maximum | +291.83 | +446.28 | +611.74 |
| The 2023 Year | | | |
| 0 | +263.12 | +294.63 | +259.03 |
| 5 | +93.66 | +101.93 | +30.54 |
| 10 | +53.28 | +63.15 | +15.34 |
| 20 | +25.21 | +32.84 | +7.02 |
| 30 | +11.85 | +15.36 | +3.50 |
| 40 | +3.19 | +5.30 | +0.92 |
| 50 | -1.82 | -1.46 | -1.24 |
| 60 | -6.73 | -8.28 | -3.41 |
| 70 | -13.88 | -17.41 | -6.77 |
| 80 | -24.88 | -29.82 | -10.52 |
| 90 | -43.64 | -50.69 | -18.44 |
| 95 | -68.67 | -82.57 | -24.76 |
| 100 | -281.21 | -305.49 | -203.17 |
| Minimum | -281.21 | -305.49 | -203.17 |
| Maximum | +263.12 | +294.63 | +259.03 |

**Table 6:** The accuracy of productivity assessment according to the indices of the breeding value of Kalmyk cattle

| | Live weight EBV accuracy, kg | | | | |
|---|---|---|---|---|---|
| Percentile (%) | At birth | At weaning | At 12 months of age | Adult animal | Maternal milking capacity EBV accuracy |
| 1 | 2 | 3 | 4 | 5 | 6 |
| The 2021 year | | | | | |
| 0 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 5 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 |
| 10 | 0.002 | 0.002 | 0.002 | 0.001 | 0.000 |
| 20 | 0.009 | 0.004 | 0.004 | 0.001 | 0.012 |
| 30 | 0.014 | 0.010 | 0.010 | 0.002 | 0.022 |
| 40 | 0.039 | 0.023 | 0.021 | 0.007 | 0.049 |
| 50 | 0.068 | 0.048 | 0.046 | 0.014 | 0.082 |
| 60 | 0.145 | 0.080 | 0.079 | 0.030 | 0.128 |
| 70 | 0.227 | 0.155 | 0.139 | 0.052 | 0.176 |
| 80 | 0.459 | 0.223 | 0.252 | 0.090 | 0.219 |
| 90 | 0.522 | 0.295 | 0.327 | 0.161 | 0.358 |
| 95 | 0.532 | 0.318 | 0.365 | 0.207 | 0.422 |
| 100 | 0.940 | 0.849 | 0.881 | 0.230 | 0.915 |
| The 2022 year | | | | | |
| 100 | 0.872 | 0.695 | 0.756 | 0,.474 | 0.437 |
| 95 | 0.483 | 0.243 | 0.309 | 0.194 | 0.288 |

**Table 6: Continue**

| | | | | | |
|---|---|---|---|---|---|
| 90 | 0.472 | 0.221 | 0.282 | 0.176 | 0.287 |
| 80 | 0.455 | 0.191 | 0.236 | 0.149 | 0.235 |
| 70 | 0.430 | 0.165 | 0.169 | 0.106 | 0.190 |
| 60 | 0.346 | 0.123 | 0.163 | 0.103 | 0.072 |
| 50 | 0.149 | 0.063 | 0.092 | 0.066 | 0.072 |
| 40 | 0.148 | 0.050 | 0.052 | 0.039 | 0.049 |
| 30 | 0.144 | 0.032 | 0.050 | 0.031 | 0.043 |
| 20 | 0.094 | 0.032 | 0.036 | 0.023 | 0.000 |
| 10 | 0.028 | 0.025 | 0.014 | 0.011 | 0.000 |
| 5 | 0.023 | 0.018 | 0.011 | 0.008 | 0.000 |
| 0 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| The 2023 year | | | | | |
| 0 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 5 | 0.100 | 0.030 | 0.029 | 0.018 | 0.000 |
| 10 | 0.125 | 0.032 | 0.049 | 0.031 | 0.064 |
| 20 | 0.148 | 0.032 | 0.050 | 0.031 | 0.072 |
| 30 | 0.149 | 0.032 | 0.050 | 0.031 | 0.087 |
| 40 | 0.159 | 0.043 | 0.063 | 0.040 | 0.108 |
| 50 | 0.349 | 0.129 | 0.174 | 0.114 | 0.142 |
| 60 | 0.441 | 0.165 | 0.231 | 0.144 | 0.264 |
| 70 | 0.463 | 0.193 | 0.261 | 0.163 | 0.286 |
| 80 | 0.477 | 0.215 | 0.287 | 0.180 | 0.288 |
| 90 | 0.491 | 0.236 | 0.310 | 0.194 | 0.325 |
| 95 | 0.509 | 0.254 | 0.330 | 0.206 | 0.355 |
| 100 | 0.848 | 0.653 | 0.740 | 0.463 | 0.553 |

**Table 7:** Accuracy of estimation of daily increment by indices of breeding value of Kalmyk cattle

| | EBV accuracy for average daily gain, g/ day | | |
|---|---|---|---|
| Percentile (%) | SP 0-205 | SP 205-12 | SP 0-12 |
| The 2022 year | | | |
| 0 | 0.019 | 0.036 | 0.024 |
| 5 | 0.343 | 0.113 | 0.073 |
| 10 | 0.387 | 0.123 | 0.147 |
| 20 | 0.411 | 0.138 | 0.215 |
| 30 | 0.429 | 0.150 | 0.235 |
| 40 | 0.445 | 0.161 | 0.252 |
| 50 | 0.459 | 0.171 | 0.272 |
| 60 | 0.468 | 0.178 | 0.290 |
| 70 | 0.477 | 0.184 | 0.312 |
| 80 | 0.488 | 0.191 | 0.328 |
| 90 | 0.500 | 0.198 | 0.351 |
| 95 | 0.517 | 0.210 | 0.360 |
| 100 | 0.936 | 0.437 | 0.845 |
| The 2023 year | | | |
| 0 | 0.000 | 0.000 | 0.000 |
| 5 | 0.345 | 0.106 | 0.158 |
| 10 | 0.362 | 0.116 | 0.175 |
| 20 | 0.384 | 0.126 | 0.199 |
| 30 | 0.402 | 0.134 | 0.216 |
| 40 | 0.413 | 0.143 | 0.236 |
| 50 | 0.423 | 0.150 | 0.249 |
| 60 | 0.431 | 0.155 | 0.260 |
| 70 | 0.439 | 0.162 | 0.271 |
| 80 | 0.450 | 0.175 | 0.285 |
| 90 | 0.473 | 0.190 | 0.306 |
| 95 | 0.498 | 0.205 | 0.329 |
| 100 | 0.845 | 0.434 | 0.730 |

The share distribution of accuracy showed a qualitative replenishment of the database of the information-analytical system for productive indicators.

The live weight was at birth, at weaning, and at 12 months of age: Bulls 22-31, 178-228, 270-335 kg; heifers 23-27, 159-182, 274-281 kg (Table 8).

It was found that the erythrocytes and hemoglobin levels corresponded to the physiological norm (Table 9).

This was achieved through good feeding on natural pastures. In bulls, the concentration of erythrocytes was $8.1310^{12}$/L hemoglobin 135.2 g/L, leukocytes $9.63\times10^{9}$/L, and lymphocytes $5.21\times10^{9}$/L, which is significantly higher compared to heifers.

Total protein in both bulls and heifers also corresponded to the physiological norm: 77.26 and 65.82 g/L. The concentrations of albumins and globulins also met the physiological norm.

It was established that the Kalmyk bulls of the Kazakhstan population corresponded to the standard of the Kalmyk breed of class I (Table 10).

In 18-month-old Kalmyk bull-calves of the Kazakhstan population, the height at the withers was 126.5-126.8 cm, the height at the rump was 134.2-134.6 cm, the chest depth was 672-67.5 cm, the chest width was 45.2-46.1 cm, the oblique body length was 143.5-144.2 cm, the chest girth 192.5-196.4 cm, metacarpus girth 21.5-21.7 cm, width at the hip joints 42.8-43.2 cm, width at the coxal joints 44.4-44.6 cm, width at the ischial tuberosities 27.8-28.3 cm.

It was found that pre-slaughter live weight was significantly lower than the removal weight and the difference was 3.8-3.9% (Table 11). The yield of the hot carcass is 56.3-56.5%, the slaughter yield is 59.9-60.8%.

The chemical composition of an average sample of minced meat showed a moisture content of 61.2-61.5% and dry matter of 38.5-38.8% (Table 12). The ratio of essential to non-essential amino acids was 1.94-2.10. Protein qualitative indicator 6.36-6.39.

The obtained data show that determining the estimated breeding value of Kalmyk cattle using the BLUP method makes it possible to speed up the selection process to increase the early maturity of young animals.

**Table 8:** Individual changes in the live weight of young Kalmyk cattle

| No | Identification number of the animal | Year of birth | Live weight, kg | | |
|---|---|---|---|---|---|
| | | | At birth | Adjusted for 210 days | Adjusted 365 days |
| Bulls | | | | | |
| 1 | 145553583 | 2019 | 25 | 179 | 319 |
| 2 | 145553507 | 2019 | 26 | 181 | 320 |
| 3 | 145553887 | 2019 | 26 | 180 | 320 |
| 4 | 136185956 | 2019 | 23 | 178 | 286 |
| 5 | 136185984 | 2019 | 22 | 191 | 286 |
| 6 | 183806809 | 2020 | 25 | 211 | 295 |
| 7 | 183811101 | 2020 | 25 | 190 | 270 |
| 8 | 183604985 | 2020 | 30 | 195 | 314 |
| 9 | 183876986 | 2020 | 29 | 228 | 335 |
| 10 | 183876997 | 2020 | 31 | 182 | 315 |
| Heifers | | | | | |
| 1 | 6832674 | 2018 | 23 | 178 | 279 |
| 2 | 6832676 | 2018 | 25 | 179 | 279 |
| 3 | 6832679 | 2018 | 26 | 178 | 279 |
| 4 | 6833081 | 2018 | 23 | 182 | 279 |
| 5 | 6833082 | 2018 | 25 | 180 | 281 |
| 6 | 8130054 | 2019 | 26 | 161 | 276 |
| 7 | 8130056 | 2019 | 25 | 160 | 275 |
| 8 | 8130059 | 2019 | 27 | 160 | 274 |
| 9 | 8130063 | 2019 | 24 | 159 | 274 |
| 10 | 8130067 | 2019 | 24 | 160 | 275 |

**Table 9:** Hematological and biochemical blood investigations of young animals of the Kalmyk breed, at 18 months of age, (X ± Sx)

| Parameters | Unit | Norm | Bulls (n = 10), | Heifers (n = 10), |
|---|---|---|---|---|
| Erythrocytes | $10^{12}$/L | 5-10 | 8.13±0,21 | 6.27±0.18 |
| Hemoglobin | g/L | 80-150 | 135.22±0.77 | 125.96±0,68 |
| Leukocytes | $10^{9}$/л | 4-12 | 9.63±0.92 | 7.82±0.51 |
| Lymphocytes | $10^{9}$/L | 4.5-7.5 | 5.21±0.82 | 4.64±0.27 |
| Total protein | g/l | 60.0-85.0 | 77.26±2.44 | 65.82±2.63 |
| Albumins | g/l | 30.0-50.0 | 34.17±1.21 | 35.42±1.88 |
| Globulins | g/l | 29.0-49.0 | 43.09±1.35 | 30.40±1.17 |

**Table 10:** Body measurements of Kalmyk bulls at the age of 18 months (n = 10), (X ± Sx)

| Measurements, cm | 2021 | 2022 |
|---|---|---|
| Height at the withers | 126.5±0.3 | 126.8±0.2 |
| Height at the rump | 134.2±0.2 | 134.6±0.1 |
| Chest depth | 67.2±0.3 | 67.5±0.2 |
| Chest width | 45.2±0.2 | 46.1±0.3 |
| Oblique body length | 143.5±0.2 | 144.2±0.3 |
| Chest girth | 192.5±0.8 | 196.4±1.2 |
| Metacarpus girth | 21.5±0.2 | 21.7±0.1 |
| Width at the hip joints | 42.8±0.2 | 43.2±0.1 |
| Width at the coxal joints | 44.6±0.2 | 44.4±0.1 |
| Width at the ischial tuberosities | 27.8±0.2 | 28.3±0.1 |

**Table 11:** Slaughter indicators of Kalmyk bulls at the age of 18 months (n = 5), (X ± Sx)

| Indicator | 2021 | 2022 |
|---|---|---|
| Removable live weight, kg | 438.5±4.13 | 484.1±5.28 |
| Pre-slaughter live weight, kg | 421.3±3.21 | 465.7±4.71 |
| Weight of hot carcass, kg | 237.2±2.9 | 263.1±2.5 |
| Hot carcass yields | 56.3 | 56.5 |
| Internal fat weight, kg | 15.1±1.2 | 20.0±1.5 |
| Yield of internal fat | 3.6 | 4.3 |
| Slaughter weight, kg | 252.3 | 283.1 |
| Slaughter yield | 59.9 | 60.8 |

**Table 12:** Characteristics of the average sample of minced meat of the Kalmyk breed at 18 months of age, %

| Indicator | 2021 | 2022 |
|---|---|---|
| Chemical composition of an average sample of meat minced meat | | |
| Moisture | 61.5±1.1 | 61.2±1.4 |
| Dry matter | 38.5±1.4 | 38.8±1.6 |
| Protein | 21.1±0.5 | 21.9±0.3 |
| Fat | 16.4±0.7 | 15.9±0.8 |
| Ash | 1.0±0.04 | 1.0±0.3 |
| Amino acid composition of an average sample of meat minced meat | | |
| The sum of essential amino acids mg % | 10.5 | 10.3 |
| The sum of nonessential amino acids mg % | 5.0 | 5.3 |
| The ratio of essential to non-essential amino acids mg % | 2.10 | 1.94 |
| Tryptophan content, mg % | 352.1 | 358.2 |
| Hydroxyproline content, mg % | 55.1 | 56.3 |
| Tryptophan-hydroxyproline ratio (THR, protein-qualitative indicator) | 6.39 | 6.36 |

## Discussion

The Kalmyk breed of cattle of the meat direction of productivity represents a transitional form from the Asian to the European type. This breed was formed under the influence of natural and artificial selection, perfectly adapted to the harsh climate of Kazakhstan. In this regard, attention is paid to increasing the number of Kalmyk cattle. Along with traditional methods of breeding, they began to use an assessment based on the breeding value index (Yudin and Larkin, 2019).

Blood group antigen testing is used in Russia. At 18 months, bulls have a live weight of 468-497 kg, which is 9-11% higher than that of the descendants of the most widespread genealogical line (Prystupa *et al*., 2022).

The average daily increase in the live weight of young Kalmyk cattle from birth to one year of age exceeded 870 g. The use of breeding value indices in assessing the precocity of young animals by live weight and adult livestock allowed to increase in the efficiency and accuracy of targeted selection in all breeding farms for breeding Kalmyk cattle. The obtained research results will serve as a basis for improving the quality of breeding and breeding work in farms for breeding Kalmyk cattle of the Kazakh population.

## Conclusion

Kalmyk cattle are distinguished by great genetic diversity (Anisimova *et al*., 2023). Breeding value indices

allow us to accurately determine the productive parameters of young and adult animals. In this regard, the efficiency of breeding Kalmyk cattle of the Kazakh population is increasing. Breeding herds of Kalmyk cattle for 2021-2023 have become more homogeneous in terms of live weight, and daily growth.

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## Author's Contributions

**Anuarbek Temirbekovich Bissembayev:** Responsible executor, experimental part of the research. Share of implementation and contribution to the preparation of the article.

**Alzhan Smailuly Shamshidin and Zhanat Maratovich Kasenov:** Performer, analysis of experimental data. Share of implementation and contribution to the preparation of the article.

**Askhat Erbosynovich Chindaliyev:** Executor, Corresponding Author, Share of implementation and contribution to the preparation of the article.

**Yusupzhan Artykovich Yuldashbayev:** Share of implementation and contribution to the preparation of the article.

**Dastanbek Asylbekovich Baimukanov:** Author of the idea, analysis, and generalization of the obtained data. Share of implementation and contribution to the preparation of the article.

## Ethics

The research team confirms that there is no conflict of interest when writing the manuscript.

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