Biological and production capacities of Kazakh Bactrian camels of various pedigrees

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Abstract. Kazakh Bactrian (Camelus bactrianus) camels have biological and productive features. So far, there are no scientifically based data on modern breeding practices. The analysis of some peculiarities of Kazakh Bactrian female camels of various pedigrees and determination of their production features are of great importance to develop a productive camel breeding. In this paper some biological peculiarities of Kazakh Bactrian females and their production qualities are determined. It was found that with the decrease of pedigree fraction of Kazakh Bactrian camels the respiration rate increases up to the limit of the physiological standard, body temperature and pulse rate did not change with changing the pedigree of Kazakh Bactrian camels. The recorded data confirm that female camels are clinically healthy in all the physiological parameters. The data show the high level of changes in blood corpuscle concentration, which is 11% higher in red blood cells and 19% higher in white blood cells.

1. Introduction

On a global scale, camel breeding is the sector of productive livestock breeding which would provide the population of the Central Asia with the most sustainable food products. The role of camel breeding is especially developed in the arid and semi-arid regions of the Middle East and Northern Africa. In the late XX century camel breeding started to be developed successfully in the continental Eurasia as well.

In the Republic of Kazakhstan the most common camel species bred is the Kazakh Bactrian (Camelus bactrianus) well known for his meat and wool production qualities [1].

Despite the intensive development of camel breeding is still a sector underdeveloped in Kazakhstan compared to other animal breeding sectors. This situation is unfortunate since there are many areas in Kazakhstan that are unsuitable for common livestock (cattle, small ruminants, horses) breeding (Pre-Caspian, Pre-Aral and South).

Kazakh Bactrian camels are known for their peculiar biological and production features; however, there are no comprehensive scientifically based data relating to modern breeding practices. The available information is scarce and rather conflicting.
There are scientific data on the development of milk camel farming with dromedary camels (Camelus dromedarius) in Pakistan, UAE, KSA. Dromedaries are also farmed in the State of Israel, and The Netherlands as dairy animals. The capacity of milk and wool production of camels varies widely and depends on the breed, age, level of selection and breeding work, natural and climatic conditions and other factors [2]. Among the dromedaries, the most valued are productive animals, capable of producing milk in the harsh climatic conditions of Africa. Moreover, dromedaries are characterized by lower wool production [3].

The contents of protein, lactose, fat, ash, and total solids of Chinese Bactrian camel milk ranged from 3.55% to 4.45%, 4.23% to 4.92%, 4.83% to 5.71%, 0.66% to 0.94% and 14.17% to 15.4%, respectively. The mean values and standard deviation of milk composition were as follows: protein, 3.96 ± 0.41%; lactose, 4.50 ± 0.32%; fat, 5.32 ± 0.43%; ash, 0.83 ± 0.10%; total solids, 14.52 ± 0.51%. Which were comparable to the data (protein, 3.90 ± 0.52%; lactose, 4.51 ± 0.99%; fat, 5.44 ± 0.79%; ash, 0.75 ± 0.10% and total solids, 14.56 ± 1.15%) for the Bactrian camel in former USSR, Kazakhstan and Mongolia [4].

In Kazakhstan, camel breeds such as Bactrians, Dromedaries and hybrids are of scientific interest for the research of milk productivity and milk chemical composition [5]. Many important factors influencing milk yield are genetic and individual variation, age, parity, stage of lactation, nutrition, management, season, photoperiod, areas, technologies, etc. [6]. Camel milk has a certain value for providing the population with natural protein products [7]. In the world, dromedaries are of the greatest value as a dairy direction of productivity, in view of the diversity of the available gene pool in the world [8].

Changes in chemical composition of Alxa bactrian camels reared in Inner Mongolia (China) during lactation were investigated. Colostrum and milk samples from 10 nomadic female camels in their first season of lactation were collected periodically from parturition until 90 d postpartum (PP). The average contents of gross composition were 14.23% protein, 4.44% lactose, 0.27% fat, 0.77% ash, and 20.16% total solids in colostrum at 2 h PP, and the respective mean values were 3.55%, 4.24%, 5.65%, 0.87%, and 14.31% for regular milk on 90 days [9].

The Marecha camel is a good milk producer under the traditional management system. Its milk quality evaluated in current study proved to be an excellent, containing high protein, fat and lower lactose levels. The lower lactose content makes it an alternative for consumption by children who have food allergies to the lactose contents or when breast milk is in deficiency/not available. The moderate levels of fat make it a good choice for people with hypertension, arteriosclerosis and vascular diseases. In Pakistan malnutrition strikes to the people in remote areas where protein deficiency is a major issue. Camel husbandry system is in a state of flux as pastoralists are deviating from one place to another so make it difficult to take care of surplus milk. Camel milk could be a source of income if proper handling condition could be made available in remote areas. This definitely could become a source of income for poor pastoralists that will assist food security on a country level [10].

Due to the above-mentioned, the understanding of some biological peculiarities of Kazakh Bactrian female camels of various pedigrees breed lines and the determination of their production features are important issues to develop a productive camel breeding.

The purpose of the present work is to determine growth and development trends for young Kazakh Bactrian camels of various pedigrees lines and to study their attitude towards meat and wool production, further allowing the improvement of technology of camel breeding, farming and feeding in Kazakhstan. The analysis of scientific literature indicates the main directions of research in camel breeding, aimed at studying milk productivity.

2. Materials and methods
The study was carried out in Kazakh Bactrian camels of various pedigrees lines in “Bayserke Agro” Limited Liability Partnership of the Almaty region. To study blood corpuscles, blood was taken from the jugular veins of female camels and young camels at birth, at the age of 3, 6.5 and 18 months old.
The content of red and white blood cells and hemoglobin was analyzed under the standard procedure. Blood hemoglobin was determined with a Sahli hemoglobinometer. The calculation of red and white blood cells was made in a Goryaev's chamber.

To perform the study, in 2020 test groups of Kazakh Bactrian female camels were sampled from various pedigree in the amount of 24 animal units. Body weight, milk yield in the third month of lactation and shorn wool amount were recorded; in autumn, body measurements were taken and body built index was calculated. Fat content in milk was determined with Milkotester device (2017 YOM). Total protein content in milk was determined with AM-2 milk analyzer (2017 YOM).

The growth and development of young Kazakh Bactrian camels of various pedigrees lines, born in 2017, were studied from birth to the age of 42 months old. The body weight was studied by weighing young camels at birth, in the age of 6, 18, 30 and 42 months old. During these age period, the following body measurements were taken: oblique body length, height between the humps, chest and pastern girth according to the Camel Valuation Instruction [11]. Body built index was calculated under S Brody (quoted by D A Baimukanov etc.) [12]:

\[
\text{Lengthiness} = \frac{\text{oblique body length}}{\text{height between the humps}} \times 100\%
\]
\[
\text{Solidity} = \frac{\text{chest girth}}{\text{height between the humps}} \times 100\%
\]
\[
\text{Blokiness} = \frac{\text{chest girth}}{\text{oblique body length}} \times 100\%
\]
\[
\text{Boniness} = \frac{\text{pastern girth}}{\text{height between the humps}} \times 100\%
\]

Process parameters of young camel selection according to milk production was determined under the degree of lactation full value and its impact on milk yield and fat content in milk. The evaluation of female camels according to the degree of lactation full value was made into three ranks: up to 65-74; 75-84; 85 and higher. The degree of lactation full value in female camels was calculated with the formula (1):

\[
DLFV = \frac{AY \times 100}{ADY \times n},
\]

where, \( DLFV \) – degree of lactation full value; \( AY \) – actual yield for the whole period of lactation; \( ADY \) – average daily yield in liters in the third month of lactation; \( n \) – number of lactation days.

The milking capacity coefficient was determined by the ratio of the actual yield for the active lactation period to the body weight (2):

\[
MCC = \frac{MY}{BW},
\]

where, \( MCC \) – milking capacity coefficient; \( MY \) – milk yield for a lactation; \( BW \) – body weight.

The gradation according to the milking capacity coefficient was made into three ranks: up to 1.4 points; 1.5-1.9 points; 2.0 points and above. The digital study material was processed using biometric method [12] and analyzed in the comparative aspect of the studied camel groups.

3. Results and discussion

The captured data confirm that the clinical physiological parameters of female camels correspond to the standards (table 1). When studying the main physiological parameters of female camels it was found that with the decrease of pedigree fraction of Kazakh Bactrian and increasing the other lines pedigree fractions in camels the respiration rate increases up to the limit of the physiological standard from 6.2 to 11.9 per minute. Using body temperature (36.6-37.5 °C) and pulse rate (33.5-36.3 beats
per minute), the impact of the pedigree of Kazakh Bactrian camels on changing these parameters was not established.

In all domestic species, blood carries a large number of very useful information for the clinician or researcher in physiological or pathological investigation, due to its transport functions of nutrients and oxygen to the organs, tissues, and cells in the body [13].

The morphological parameters of blood and the leucogram of female camels of various pedigrees lines also corresponded to the standards. In Kazakh Bactrian female camels of various pedigree lines the red blood cell count was within 5.5-6.5 M/ml, hemoglobin concentration – 11.9-15.2 g/%, the white blood cell count – 11.4-14.7 M/ml, the platelet count – 386.3-629.7 K/ml (table 2).

Table 1. Physiological parameters of Kazakh Bactrian female camels.

| Parameters                          | Statistical parameters | Groups of young camels, n=6, Σ=24 |
|-------------------------------------|------------------------|----------------------------------|
|                                     |                        | Kazakh Bactrian (93.75%) | Kazakh Bactrian (87.5%) | Kazakh Bactrian (75%) |
| Temperature, °C                     | X±m, %                 | 37.5±1.6 | 36.6±1.3 | 37.2±1.2 | 36.9±0.9 |
| Standard                            |                        | 9.6     | 8.6     | 7.8     | 9.9     |
| Pulse rate (beats per minute)       | X±m, %                 | 38.5±2.4 | 49.7±2.3 | 43.2±2.8 | 45.4±1.8 |
| Standard                            |                        | 17.3     | 22.7     | 16.1     | 9.8     |
| Respiration rate (breaths per minute)| X±m, %                | 7.2±2.1 | 10.6±2.7 | 10.5±2.8 | 8.9±1.9 |
| Standard                            |                        | 9.5      | 15.1     | 18.6     | 11.4     |

Table 2. Morphological parameters of blood of Kazakh Bactrian female camels.

| Parameters                          | Statistical parameters | Groups of young camels, n=6, Σ=24 |
|-------------------------------------|------------------------|----------------------------------|
|                                     |                        | Kazakh Bactrian | Kazakh Bactrian | Kazakh Bactrian | Kazakh Bactrian |
|                                     |                        | (93.75%) | (87.5%) | (75%) |
| Red blood cell count, M/ml          | X±m, %                 | 6.3±0.4 | 6.5±0.3 | 5.8±0.7 | 5.5±0.5 |
| Standard                            |                        | 6.1     | 7.6     | 7.8     | 6.2     |
| Hemoglobin, g/%                     | X±m, %                 | 12.5±0.9 | 14.1±1.1 | 11.9±0.6 | 15.2±0.6 |
| Standard                            |                        | 11.2     | 12.5     | 7.1     | 7.3     |
| White blood cell count, K/ml        | X±m, %                 | 14.7±1.3 | 13.9±0.8 | 12.9±1.1 | 11.4±0.9 |
| Standard                            |                        | 14.1     | 11.6     | 9.3     | 12.8     |
| Platelets, K/ml                     | X±m, %                 | 487.4±46.2 | 386.3±33.1 | 552.9±41.4 | 629.7±38.3 |
| Standard                            |                        | 16.1     | 19.9     | 22.7     | 21.3     |

For clean-bred Kazakh Bactrian camels the following leucogram is typical: band neutrophils – 5.7%, segmented neutrophils – 48.7%, lymphocytes – 42.7%, monocytes – 2.9% (table 3).

Kazakh Bactrian female camels of various pedigrees lines were noted for high shorn wool amounts. Pure-bred Kazakh Bactrian female camels have the average shorn wool amount of 7.2 ± 0.3 kg at C_v = 12.4% and δ = 0.4 kg. Female camels with 93.75% pure pedigree fraction are inferior to pure-bred Kazakh Bactrian female camels of the same age by 10.8% in the shorn wool amount, with 87.5% pedigree fraction by 41.2%, with 75% pedigree fraction by 53.2%. It means that with the increase of pure pedigree of a Kazakh Bactrian camel the absolute shorn wool amount increases from 4.7 kg to 7.2 kg (table 4).
Table 3. White blood cells of Kazakh Bactrian female camels.

| Parameters          | Statistical parameters | Groups of young camels, n=6, ∑=24 |
|---------------------|------------------------|----------------------------------|
|                     | Kazakh Bactrian (93.75%) | Kazakh Bactrian (87.5%) | Kazakh Bactrian (75%) |
| Eosinophils         | X±mx, cv, % standard    | 3.1±0.3, 0.8, 2.0-9.0          | 4.9±0.4, 0.5, 0.7    | 5.3±0.6, 0.7   |
| Band neutrophils    | X±mx, cv, % standard    | 5.7±0.4, 0.9, 5.0-14.0          | 7.4±0.3, 0.5, 11.4-0.6 | 9.2±0.5, 0.4   |
| Segmented neutrophils| X±mx, cv, % standard    | 48.7±3.1, 11.2, 37.0-52.0       | 44.7±3.3, 10.3, 46.1±4.3 | 43.7±5.2, 11.6  |
| Lymphocytes         | X±mx, cv, % standard    | 42.7±5.3, 9.1, 31.0-45.0        | 41.2±5.1, 8.6, 34.5±3.9 | 38.7±4.8, 7.4   |
| Monocytes           | X±mx, cv, % standard    | 2.9±0.2, 0.4, 1.5-4.5           | 3.6±0.7, 0.6, 2.7±1.9 | 3.5±2.8, 0.4   |

Table 4. Production of Kazakh Bactrian female camels.

| Parameters          | Unit of measurement | Groups of young camels, n=6, ∑n=24 |
|---------------------|---------------------|-----------------------------------|
|                     | Kazakh Bactrian (93.75%) | Kazakh Bactrian (87.5%) | Kazakh Bactrian (75%) |
| Body weight, kg     | X±mx, cv, δ, Lim     | 546.7±5.7, 22.8, 485-590         | 585.2±9.4, 32.3, 496-620 | 620.2±12.2, 38.7, 495-650 | 595.9±9.5, 35.1, 490-630 |
| Shorn wool amounts, kg| X±mx, cv, δ, Lim     | 12.4, 0.3, 5.1-9.3                | 15.8, 0.4, 4.7-7.2    | 20.2, 0.8, 4.2-6.0       | 22.8, 0.9, 4.2-6.0        |
| Average daily milk yield in the 3rd month of lactation, kg | X±mx, cv, δ, Lim     | 4.8±0.3, 0.4, 2.5-7.0              | 6.3±0.2, 0.2, 3.5-7.0 | 5.2±0.3, 0.3, 2.9-8.0    | 7.2±0.3, 0.3, 4.0-9.0     |
| Fat content in milk, % | X±mx, cv, δ, Lim     | 2.5, 0.1, 5.8±                      | 3.8, 0.2, 5.4±        | 3.5, 0.2, 4.8±           | 3.2, 0.2, 4.3±            |
| Protein content in milk, % | X±mx, cv, δ, Lim     | 1.3, 0.05, 3.6-4.0                 | 1.8, 0.08, 3.6-4.2    | 1.8, 0.1, 3.6-4.2        | 1.9, 0.1, 3.6-4.2         |

We measured the characteristic of body development indices in Kazakh Bactrian female camels of various pedigrees lines (table 5). It was found that pure-bred Kazakh Bactrian female camels have the index of lengthiness, the solidity index, the bone index and the blockiness index of 87.3%, 112.4%, 11.8% and 140.2%; with 93.75% pedigree – 85.1%, 127.0%, 11.9% and 149.2%; with 87.5% pedigree – 80.4%, 130.1%, 11.7% and 161.8%; with 75.0% pedigree – 88.9%, 135.6%, 12.0% and 152.6%. The established body development index most accurately characterizes the modern population of Kazakh Bactrian female camels of various pedigrees.
Pure-bred Kazakh Bactrian female camels have the average body weight of $546.7 \pm 5.7$ kg, at $C_v = 7.1\%$ and $\delta = 22.8$ kg. It was found out that Kazakh Bactrian female camels with the pedigree lines from 75% to 93.75% fraction exceed pure-bred animals in body weight. The largest parameter is shown in female camels with 87.5% pedigree in Kazakh Bactrian camels; the difference was 73.5 kg or 13.4%.

As for daily milk yield, pure-bred Kazakh Bactrian female camels are inferior to Kazakh Bactrian female camels of the same age with 75% pedigree in 50%, with 87.5% pedigree – in 8.3%, with 93.75% pedigree – in 31.3%. At this, $C_v$ varies in the range of 6.8-9.2%, $\delta$ varies from 0.2 to 0.4 kg. Fat content in milk in clean-bred Kazakh Bactrian female camels is 5.8%, which is 0.4% higher than in Kazakh Bactrian female camels of the same age with 93.75% pedigree, 1.8% higher than in camels with 87.5% pedigree, 1.5% higher than in camels with 75% pedigree. High protein content in milk is noted for female camels with 75% pedigree and 87.5%, which is 3.9%, whereas in Bactrian camels with 93.75% protein content in milk was 3.8%, in pure-bred Bactrian camels – 3.6%. The recorded data allows reporting the impact of the pedigree breeding of Kazakh Bactrian camels on the formation of production features.

The study of exterior measurements and body built index in animals of various pedigree showed that Kazakh Bactrian female camels, born utilizing pure selection breeding methods, has the height between the humps of $175.8 \pm 1.4$ cm at $C_v = 1.35$ and $\delta = 2.8$ cm; the oblique body length of $153.4 \pm 1.9$ cm; the chest girth of $215.1 \pm 2.5$ cm and the pastern girth of $20.7 \pm 0.09$ cm (table 5). Kazakh Bactrian camels of various pedigrees lines have the peculiar trends of exterior formation. Kazakh Bactrian female camels with 93.75% pedigree exceed pure-bred Kazakh Bactrian female camels of the same age in the height between the humps by 1.7 cm, in the chest girth – by 10.5 cm, in the pastern girth – by 0.4 cm, but go behind the oblique body length in 2.2 cm. Kazakh Bactrian female camels with 87.5% pedigree are noted for a shortened body (146.7 cm), large chest girth (237.3 cm) and pastern girth (21.4 cm). This trend was earlier fixed by other researchers too [5, 11].

**Table 5.** Body measurements and body indexes of Kazakh Bactrian female camels.

| Parameters                          | Unit of measurement | Groups of female camels, n=6 , $\Sigma n=24$ |
|-------------------------------------|---------------------|---------------------------------------------|
|                                     | $X \pm m_x$         | Kazakh Bactrian | Kazakh Bactrian (93.75%) | Kazakh Bactrian (87.5%) | Kazakh Bactrian (75%) |
| Height between the humps, cm        | $C_v$               | 175.8±1.4       | 177.6±2.1                 | 182.4±2.7               | 185.5±1.6              |
|                                     | $\delta$            | 1.3             | 2.7                       | 3.1                     | 3.8                    |
|                                     | $L_{im}$            | 160-185         | 163-185                   | 165-190                 | 165-195                |
| Oblique body length, cm             | $C_v$               | 153.4±1.9       | 151.2±1.7                 | 146.7±0.9               | 164±2.2                |
|                                     | $\delta$            | 2.8             | 4.2                       | 6.4                     | 5.4                    |
|                                     | $L_{im}$            | 145-162         | 150-168                   | 140-155                 | 150-175                |
| Chest girth, cm                     | $C_v$               | 215.1±2.5       | 225.6±2.9                 | 237.3±3.6               | 251.6±3.1              |
|                                     | $\delta$            | 6.1             | 5.9                       | 4.5                     | 6.4                    |
|                                     | $L_{im}$            | 195-230         | 195-240                   | 205-260                 | 210-270                |
| Pastern girth, cm                   | $C_v$               | 20.7±0.09       | 21.1±0.12                 | 21.4±0.15               | 22.2±0.2               |
|                                     | $\delta$            | 1.4             | 1.8                       | 1.6                     | 2.6                    |
|                                     | $L_{im}$            | 87.3            | 85.1                      | 80.4                    | 88.9                   |
| Lengthiness index, %                | 87.3                | 85.1            | 80.4                      | 88.9                    |
| Solidity index, %                   | 122.4               | 127.0           | 130.1                     | 135.6                   |
| Boniness index, %                   | 11.8                | 11.9            | 11.7                      | 12.0                    |
| Blockiness index, %                 | 140.2               | 149.2           | 161.8                     | 152.6                   |
Kazakh Bactrian female camels with 75% pedigree exceed pure-bred Kazakh Bactrian female camels of the same age in the height between the humps by 5.5%, in the oblique body length – by 7.5%, in the chest girth – by 17.0% and in the pastern girth – by 7.2%.

We did not come across the data on the morphological blood content of Kazakh Bactrian young camels of various pedigrees in the available literature. Being an interesting parameter, blood as the study object in camels, is not only scientific but also of practical interest, as the morphological blood content reflects the physiological condition of camels and characterizes their biological features and production features. The studies of morphological blood content in Kazakh Bactrian young camels of various pedigrees in the age-dependent aspect, from birth to the age of 18 months were performed for the first time.

In the first days after birth a large variance of red blood cell count in shown in young camels of all the studied groups (table 6).

Table 6. Age-dependent variance of red blood cell count in young camels, M/mcl.

| Age          | Statistical parameters | Kazakh Bactrian (75%) | Kazakh Bactrian (87.5%) | Kazakh Bactrian (93.75%) |
|--------------|------------------------|------------------------|-------------------------|--------------------------|
| At birth     | X±mₐ                   | 9.46±3.6               | 8.6±3.3                 | 8.97±3.2                 | 9.32±3.1                 |
|              | Cv, %                  | 13.06                  | 11.9                    | 12.3                     | 12.4                     |
|              | Variance               | 8.5-10.8               | 7.8-9.1                 | 8.5-9.5                  | 9.0-9.6                  |
| 3 months old | X±mₐ                   | 10.01±3.45             | 9.83±3.2                | 9.99±3.3                 | 10.1±3.2                 |
|              | Cv, %                  | 13.5                   | 13.1                    | 13.3                     | 13.3                     |
|              | Variance               | 9.3-11.0               | 9.4-10.5                | 9.5-10.5                 | 9.7-10.4                 |
| 6.5 months old | X±mₐ                  | 10.52±3.55             | 10.43±3.3               | 10.5±3.2                 | 10.8±3.1                 |
|              | Cv, %                  | 14.1                   | 13.7                    | 13.7                     | 13.9                     |
|              | Variance               | 10.0-11.5              | 10.0-11.0               | 9.7-10.9                 | 10.2-11.0                |
| 15 months old | X±mₐ                  | 9.48±3.46              | 9.31±3.3                | 9.6±3.1                  | 9.6±3.2                  |
|              | Cv, %                  | 12.9                   | 12.6                    | 12.7                     | 12.8                     |
|              | Variance               | 8.9-10.3               | 8.7-9.7                 | 9.3-10.1                 | 9.0-10.0                 |
| 18 months old | X±mₐ                  | 9.93±3.2               | 8.99±3.2                | 9.25±5.1                 | 10.0±3.1                 |
|              | Cv, %                  | 13.2                   | 12.2                    | 14.4                     | 13.2                     |
|              | Variance               | 9.5-10.5               | 8.5-9.5                 | 9.0-9.5                  | 9.5-10.5                 |

The variance in red blood cell count is especially high in Kazakh Bactrian young camels at birth of various pedigrees lines (9.46 M/mcl – 8.6 M/mcl). At the same time we report that the high red blood cell count in young camels at birth is explained on the one hand with the transfer of large amount of placental blood, noted for high oxidizing properties, and on the other hand – the properties of colostrum milk, rich in mineral substances and vitamin A, which young camels eat in the first days of life after birth, to a more intensive hemoglobin synthesis in blood-making organs of newborn camels. The birth of camels is synchronous with spring in the desert (March-April) and is noted for a comparatively high level of pasture food consumed by female camels and for fast growth of camels.

At the age of 3 months old young camel calves start actively eating vegetable feeds in addition to milk food. In the period of milk and vegetable diet young camels experience morpho-physiological changes, which is reflected in oxidizing properties of their metabolism. All the studied animals show the increase of red blood cell count as compared with that at birth.

The age of 15 months old of young camels corresponds to the summer season. This period in the desert is characterized with the maximal air temperature, the minimal air humidity and the maximal amount of solar radiation, especially at noon. In this period, pasture plants are affected by high air temperature and lack of humidity in soils, turning into dry fodder. This resulted in the loss of valuable nutrients in young camel bodies with the high level of oxidizing properties against the insufficient...
replenishment of nutrients by pasture plants, and as a consequence, the decrease in red blood cells in the blood of Kazakh Bactrian young camels.

In whole, for the considered period, from the birth to the age of 18 months old the largest red blood cell count was recorded for the age of 6.5 months old. It must be noted that in all the studied age groups, pure bred Kazakh Bactrian young camels exceeded other camels of the same age in red blood cell count. The discovered trend of age-dependent changes in red blood cell count is considered by us as a characteristic feature of young animals, farmed in the desert and semi-desert zones of Kazakhstan.

Hemoglobin is a coloring material for blood, contained in red blood cells, which makes blood red. Hemoglobin is a respiratory pigment of blood. Passing through the capillaries of the lungs, hemoglobin links to oxygen and transforms it from the respiratory organs to the body tissues. Data on hemoglobin concentration in blood of the studied camels is presented in table 7. The recorded data is of interest; it shows one of the biological peculiarities of the physiology of Kazakh Bactrian camels.

### Table 7. Age-dependent variance of hemoglobin concentration in young camels, g/%

| Age of young camels | Statistical parameters | Groups of young camels, n=10, \( \Sigma=40 \) |
|---------------------|------------------------|-----------------------------------------------|
|                     | Kazakh Bactrian         | Kazakh Bactrian (75\% ) | Kazakh Bactrian (87.5\% ) | Kazakh Bactrian (93.75\% ) |
| At birth            | \( X\pm m_x \)         | 106.2±19.7                | 103.2±9.1                  | 107.6±12.0                  | 106.2±12.3 |
|                     | Variance                | 96.6-115.6                | 99.0-108.0                 | 102.0-114.0                 | 100.0-110.5 |
| 3 months old        | \( X\pm m_x \)         | 111.7±12.7                | 109.0±14.6                 | 111.7±16.9                  | 111.4±13.6   |
|                     | Variance                | 102.8-1158                | 102.0-117.0                | 109.0-115.0                 | 103.8-115.0  |
| 6.5 months old      | \( X\pm m_x \)         | 118.8±6.0                 | 104.7±10.05                | 106.0±8.2                   | 117.2±7.9    |
|                     | Variance                | 115.6-120.3               | 101.0-109.0                | 103-109                     | 113.0-120.0  |
| 15 months old       | \( X\pm m_x \)         | 112.3±10.4                | 99.1±5.5                   | 98.6±5.6                    | 109.5±5.7    |
|                     | Variance                | 107.1-117.6               | 97.0-102.0                 | 96.0-101.0                  | 106.3-112.3  |
| 18 months old       | \( X\pm m_x \)         | 120.6±10.2                | 106.8±13.3                 | 96.4±4.8                    | 116.2±4.8    |
|                     | Variance                | 115.1-124.1               | 100.2-115.0                | 95.0-98.0                   | 114.8-117.8  |

Data on the age-dependent changes of white blood cells in the blood of the studied young camels is shown in table 8. The study of age-dependent white blood cell count of the studied young camels shows that in Kazakh Bactrian camels, the white blood cell count increases from birth to the age of 6.5 month old, and next there is the decrease of white blood cells from the age of 6.5 month old to the age of 15 months old; later, the white blood cell count increases up to the age of 18 months old.

### Table 8. Age-dependent variance of white blood cell count in young camels, K/mcl.

| Age of young camels | Statistical parameters | Groups of young camels, n=10, \( \Sigma=40 \) |
|---------------------|------------------------|-----------------------------------------------|
|                     | Kazakh Bactrian         | Kazakh Bactrian (75\% ) | Kazakh Bactrian (87.5\% ) | Kazakh Bactrian (93.75\% ) |
| At birth            | \( X\pm m_x \)         | 18.2±3.4                   | 17.6±3.4                   | 18.3±3.8                   | 18.0±3.1     |
|                     | \( C_v \)               | 17.5-19.0                  | 17.0-18.5                  | 17.0-19.5                  | 17.5-18.4    |
|                     | Variance                | 20.1±4.1                   | 19.8±3.7                   | 20.0±3.6                   | 19.8±3.2     |
| 3 months old        | \( C_v \)               | 24.1                        | 23.5                       | 23.5                       | 23.0         |
|                     | Variance                | 19.2-22.0                  | 190.21.0                   | 190.0-21.0                 | 19.0-20.5    |
| 6.5 months old      | \( C_v \)               | 20.6±3.4                   | 19.2±3.8                   | 19.4±3.5                   | 20.3±3.3     |
|                     | Variance                | 24.0                        | 23.0                       | 22.9                       | 23.6         |
| 18 months old       | \( C_v \)               | 18.5±3.3                   | 17.5±3.1                   | 16.7±3.1                   | 19.9±3.3     |
|                     | Variance                | 21.8                        | 20.6                       | 19.8                       | 23.2         |
| Standard            | Variance                | 18.0-19.3                  | 17.0-18.0                  | 16.3-17.0                  | 19.5-20.8    |
|                     | \( C_v \)               | 11.0-18.0                  | 11.0-18.0                  | 11.0-18.0                  | 11.0-18.0    |
The recorded data show the high level of changes in blood corpuscle concentration, which is 11% higher in red blood cells and 19% higher in white blood cells. Here we do not exclude the impact both of genetic factors and of the individual response features in camel bodies on the environmental factors.

During the process of assessing the reproductive capacity, wool and milk productivity of the Kazakh Bactrian female camels in South Kazakhstan type of different pedigrees, a wide range of variation of the studied features was revealed (table 9).

### Table 9. Female camel productivity.

| Parameters                              | Unit of measurement | Groups of female camels, n=10, ∑n=40 |
|-----------------------------------------|---------------------|--------------------------------------|
|                                         |                     | Kazakh Bactrian (75%) | Kazakh Bactrian (87.5%) | Kazakh Bactrian (93.75%) |
| Mated animals                           | animals             | 10                      | 10                       | 10                       |
| Fertilized                              | animals             | 8                       | 9                        | 9                        |
| Colted (given birth)                    | animals             | 6                       | 7                        | 7                        |
| Preservation of colts                   | animals             | 5                       | 6                        | 6                        |
| Preservation of colts                   | %                   | 83.3                    | 85.7                     | 85.7                     |
| Wool production                         | kg                  | 6.2±0.3                 | 4.9±0.2                  | 5.3±0.2                  |
| Average daily milk yield in the 3rd month of lactation | kg | 5.5±0.2 | 7.7±0.3 | 6.5±0.4 |
| Fat in milk                             | %                   | 5.9±0.07                | 5.1±0.06                 | 5.5±0.05                 | 5.7±0.06 |

It was found that pure-bred Kazakh Bactrian females had 60% of colting and 70% among crossbreds. The preservation of camels in crossbred female camels is 2.4% higher than in pure-bred ones. In terms of wool production, the female camels of the Kazakh Bactrian reliably surpass the hybrid ones by 26.5%, 17.0%, 8.8%.

As for the average daily milk yield, crossbred female camels reliably surpass purebred mates by 25.5%, 18.2%, 7.3%. With an increase in the pedigree fraction of Kazakh Bactrian, the fat content in milk significantly rises, from 5.1% for Kazakh Bactrian (75%) to 5.9% for Kazakh Bactrian (100%).

The results of estimating camel females according to the degree of lactation full-value for 150 days of lactation showed the effectiveness of formation a milking herd from among animals of the 2nd rank (table 10). With an increase in the pedigree fraction of Kazakh Bactrian, milk yield decreases proportionally, an increase in fat content in milk.

### Table 10. The results of estimating female camels according to the degree of lactation full-value for 150 days of lactation.

| Female camel groups | Parameters        | Rank 1 Degree of lactation full-value, % | Rank 2 Degree of lactation full-value, % | Rank 3 Degree of lactation full-value, % |
|---------------------|-------------------|------------------------------------------|------------------------------------------|------------------------------------------|
|                     |                   | 65-74 | 75-84 | 85 and above |
| Kazakh Bactrian     | Milk yield, kg    | 695.5±15.4 | 835.8±21.7 | 779.7±18.4 |
|                     | Fat content in milk,% | 6.0±0.07 | 5.9±0.08 | 5.8±0.05 |
| Kazakh Bactrian (75%) | Milk yield, kg    | 942.3±16.9 | 1272.3±22.4 | 1105.9±27.8 |
|                     | Fat content in milk,% | 5.2±0.07 | 5.1±0.07 | 5.1±0.06 |
| Kazakh Bactrian (87.5%) | Milk yield, kg    | 768.3±18.4 | 1029.8±21.2 | 905.9±28.6 |
|                     | Fat content in milk,% | 5.5±0.05 | 5.3±0.06 | 5.3±0.06 |

The results of the estimating female camels by the coefficient of milking capacity for 150 days of lactation showed the effectiveness of forming a milking herd of female camels from the number of animals of the 2nd rank (table 11).
Evaluation of the Kazakh Bactrian female camels according to the coefficient of milking capacity made it possible to establish that the optimal parameter for selection is the rank of 1.5-1.9 points, in comparison to 1.4 and 2.0 and higher. This is due to the optimal indicator of the mass fraction of fat in milk in all female camels of the Kazakh Bactrian of various pedigrees. With an increase in pedigree fraction of Kazakh Bactrian, milk yield decreases proportionally, with an increase in fat content in milk.

Table 11. The results of the estimating female camels by the coefficient of milking capacity for 150 days of lactation.

| Female camel groups | Parameters                        | Rank 1          | Rank 2          | Rank 3          |
|---------------------|-----------------------------------|-----------------|-----------------|-----------------|
|                     |                                   | Coefficient of milking capacity |                 |                 |
|                     |                                   | up to 1.4 points | 1.5-1.9 p. | 2.0 and higher |
| Kazakh Bactrian     | Milk yield, kg                    | 472.5±17.9      | 627.9±23.2 | 733.8±22.7     |
|                     | Fat content in milk,%             | 5.9±0.07        | 6.0±0.08 | 5.9±0.05       |
| Kazakh Bactrian     | Milk yield, kg                    | 1100.3±31.3     | 1427.6±33.2 | 1611.9±35.3    |
| (75%)               | Fat content in milk,%             | 5.3±0.07        | 5.3±0.07 | 5.1±0.06       |
| Kazakh Bactrian     | Milk yield, kg                    | 718.7±28.2      | 992.2±32.8 | 1269.5±21.5    |
| (87.5%)             | Fat content in milk,%             | 5.3±0.06        | 5.5±0.07 | 5.3±0.06       |
| Kazakh Bactrian     | Milk yield, kg                    | 651.4±23.5      | 845.1±21.9 | 993.9±32.4     |
| (93.75%)            | Fat content in milk,%             | 5.5±0.06        | 5.6±0.05 | 5.5±0.05       |

4. Conclusion

Thus, some biological peculiarities of Kazakh Bactrian female camels of various pedigrees, detected by us, should be considered when standardizing the stock in order to implement the biological resource potential of their production qualities through the genetic mechanisms of hereditary information transmission.

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