Changes in live weight and protein parameters of blood in growing heifers and steers up to the age of 13 months

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Abstract. The studies were conducted on bulls and heifers of Holsteinized black-breed. Two groups of 10 animals were formed in each group according to the analogy principle. In the first group, there were heifers and in the second group, there were steers. Feeding and growing conditions were the same. Blood for biochemical studies was taken at 1,3,6,9,12 and at 13 months of age. The live weight of the heifers and steers was monitored at the same time and we calculated the average daily gain. Total protein and albumin were determined by the colorimetric method. The number of globulins and the value of protein coefficient (albumin/globulins) were calculated by the calculation method. With increasing age of experimental animals, the level of total blood protein gradually increased. Thus, in heifers the concentration of total protein by 13 months of age increased by 9.3 g/l and amounted to 70.1±0.9 g/l. In steers, the increase was 11.3 g/l and amounted to 72.0±1.1 g/l. Comparing the indices of total protein between experimental animals it was found that during the experiment the level of total protein in blood was not significantly higher in steers. The amount of albumin in heifers from 1 to 13 months of age increased by 9.8 g/l, and in steers by 12.3 g/l. In all periods of the experiment, the level of albumin was higher in steers in relation to heifers. The level of globulins from 1 to 13 months of age in heifers and steers changed irregularly. There were no differences in this index between heifers and steers. The value of protein index increased with increasing age of heifers and steers. The live weight of the heifers at 13 months of age was 353.0±1.7 kg, and of the steers 377.7±2.1 kg.

1 Introduction

One of the main factors in cattle breeding under industrial conditions is the control over the health of farmed animals [1-5]. Various methods are used to assess the metabolic state of animals [6]. One of the main methods of control is the biochemical method based on blood parameters [7] with the use of reference data [8, 9]. In growing animals, the most important indicator is their live weight [10] and growth-related metabolic indices of blood [11-13]. One of such indicators is protein metabolism, due to which the organism is provided with plastic

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materials [14, 15, 16, 17, 18, 19]. The formation of a young animal organism is associated with different phases of its nutrition. Such periods are the period of newborn, the period of maturation and the period of physiologic formation. During ontogenesis, the most important role is played by blood protein parameters [20]. The process of protein metabolism formation in the period of animal growth is directed to the synthesis of proteins of own body [21]. The main indicator of protein metabolism is the level of total protein in the blood of the animal, which is associated with the formation of the digestive system [22, 23]. The main fractions of proteins such as albumin support blood homeostasis, and globulins perform the transport function of nutrients, as well as perform the protective function of the organism [24, 25]. In this regard, the aim was set to study the dynamics of blood protein parameters in growing heifers and steers in different periods of ontogenesis from 1 to 13 months of age.

2 Materials and Methods

Experimental studies were carried out on steers and heifers of Holsteinized black-breed. Two groups of 10 animals in each group were formed according to the principle of analogs. In the 1st group there were heifers and in the second group there were bulls. Feeding and growing conditions of experimental animals were the same and corresponded to zootechnical requirements. Blood for biochemical studies was sampled before morning feeding from the tail vein at the age of 1,3,6,9,12 and at 13 months of age. At the same time the live weight of heifers and steers was monitored and we calculated the average daily gain. Total protein and albumin were determined by colorimetric method. The number of globulins and the value of protein coefficient (albumin/globulins) were calculated by the calculation method. The obtained results were subjected to biometric processing using Student's criterion in Microsoft Excel program. The results were considered statistically reliable at $p<0.05$.

3 Results

Protein indicators of blood provide growth and development of living organisms. Our studies of blood protein indicators such as total protein, albumin and globulin show that these indicators during the growth of steers and heifers changed significantly. Thus, the total protein in the blood of experimental animals at one-month of age was almost the same and amounted to 6.08±0.6 g/l and 60.7±0.7 g/l (Figure 1).

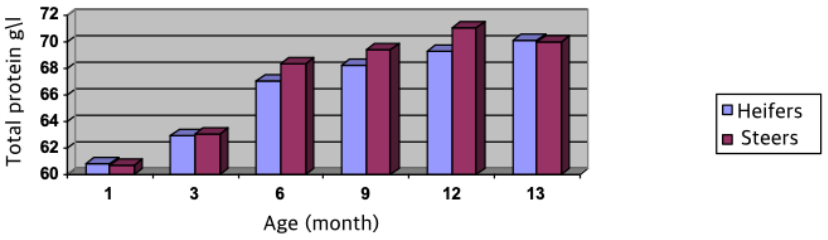

Fig. 1. Dynamics of total protein in the blood of experimental heifers and steers

With increasing age of experimental animals, the level of total blood protein gradually increased. Thus, in heifers the concentration of total protein by 13 months of age increased by 9.3 g/l and amounted to 70.1±0.9 g/l. In steers, the increase was 11.3 g/l and amounted to 72.0±1.1 g/l. In relation to the data of 1-month age in heifers and bulls from 3 months of age and in subsequent periods of growth, the differences were noted as statistically significant

($p<0.05$). Comparing total protein values between experimental steers it was found that during the experiment the level of total protein in blood was not significantly higher in steers. The established differences were not statistically reliable ($p>0.05$).

The increase in total protein in the blood of growing heifers and steers reflects the body's supply of protein as a plastic material [26]. However, it should be noted that the level of albumin during the growth period of experimental animals increased gradually with increasing age, while the level of globulin practically did not change. It is known that albumin is a protein that performs a transport function in animal blood and is a plastic material for muscle tissue [14].

Dynamics of albumin changes in the blood of experimental heifers and steers is presented in Figure 2.

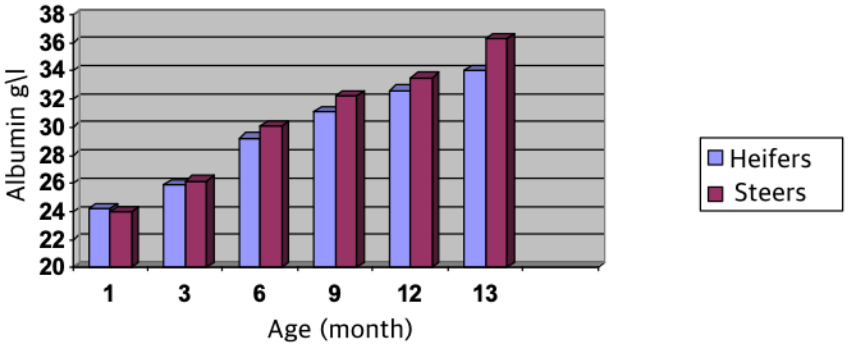

Fig. 2. Change of albumin in the blood of experimental heifers and steers

Thus, at one month of age, the amount of albumin in the blood of heifers and steers was approximately the same and amounted to 2.43±0.2 and 24.0±0.3 g/l in heifers. By 3 months of age, the level of albumin in heifers and bulls increased to 2.59±0.2 and 26.2±0.3 g/l, respectively. Further with increasing age of animals the tendency to increase the content of albumin continued. Thus, in heifers, at 6,9,12 and 13 months of age the content of albumin at the indicated age was 29,2±0,3; 31,1±0,7; 32,6±0,5; 34,0±0,6 g/l, respectively. In relation to 1 month of age in all growth periods, the differences were statistically significant ($p<0.05$).

There was also a similar increase in this index and it was 30.1±0.4; 32.2±0.6; 33.5±0.6 and 36.3±0.6 g/l at 6, 9, 12 and 13 months of age, respectively. In all periods of growth relative to 1 month of age, the differences were statistically significant ($p<0.05$). In general, the increase of albumin in the blood of heifers was by 9.8 g/l, and in steers by 12.3 g/l. It should also be noted that in all periods of growth from 3 to 13 months of age, the level of albumin in the blood was higher in steers in relation to the analogous data of heifers. Thus, at 3 months of age the differences amounted to 0.3 g/l; at 6 months of age - 0.9 g/l, at 9 months of age - 1.1 g/l, at 12 months of age - 2.3 g/l. At 13 months of age, these differences were statistically significant ($p<0.05$). The results obtained for globulins are shown in Figure 3.

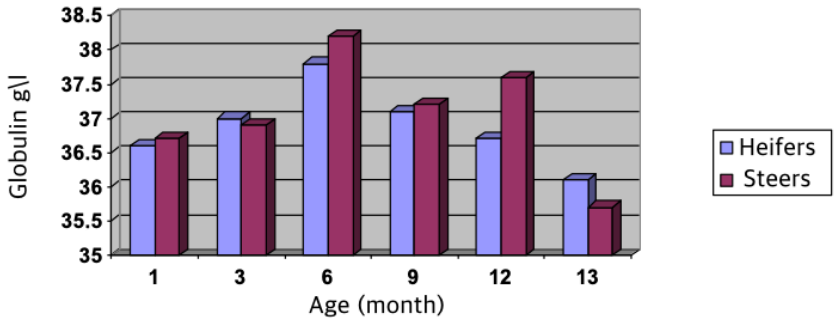

Fig. 3. Globulin concentration in the blood of experimental heifers and steers

The presented data show that the level of globulins in the blood of experimental animals during the period of growing of experimental animals up to 13 months of age changed irregularly. Also, on this indicator no differences between heifers and steers were established. Changes in the value of protein coefficient during growing of experimental animals are presented in Figure 4.

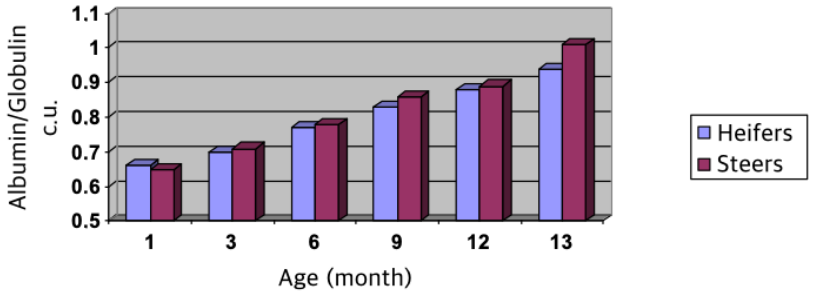

Fig. 4. Dynamics of protein coefficient in steers and heifers up to 13 months of age

As can be seen, the value of this coefficient increased with increasing age of experimental heifers and steers. In heifers this increase occurred from 0.66 to 0.94, and in steers from 0.65 to 1.01. The differences were statistically significant ($p<0.5$) in relation to the indicators of one-month age in all periods of growth.

Dynamics of changes in live weight of experimental animals of heifers and steers is shown in Table 1.

Table 1. Growth parameters of experimental animals

ANIMALS	Age (month)					
	1	3	6	9	12	13
heifers	40.2±0.3	77.6±0.5	142.2±0.5	233.0±0.6	322±0.6	353.0±1.7
steers	40.6±0.4	78.0±0.6	146.3±0.7	239.2±0.7	336±1.2	377.7±2.1

At one month of age, the average live weight of experimental animals was practically the same. In heifers it was 40.2±0.3 kg, and in steers 40.6±0.4 kg. From 6 months of age, differences in live weight were noted. The live weight of heifers at this age was 142.2±0.5

kg, and steers were on average 4.1 kg heavier, their live weight was 146.3±0.7 kg. By 13 months of age, the live weight of heifers was 353.0±1.7 kg. Bulls were heavier by 24.7 kg and their live weight was 377.7±2.1 kg. The differences were noted as statistically significant ($p<0.05$). Average daily gains in heifers and steers from 1 to 3 months of age were similar and averaged 623.3 gm.

Table 2. Dynamics of average daily gains in experimental animals (gr.)

ANIMALS	Age (month)			
	1-3	3-6	6-9	9-13
heifers	623.3±9.5	709.8±8.8	997.8±18.1	983.3±38.2
steers	623.3±9.0	750.5±9.7	1020.8±26.6	1135.2±46.4

In the interval from 3 to 6 months of age, average daily weight gain in heifers increased and amounted to 750.5±9.7 g. Further average daily weight gain continued to increase. In the interval from 6 to 9 months of age average daily gains in heifers amounted to 997.8±18.1 g, in steers they were higher on average by 23 g, and amounted to 1020.8±26.6 g. From 9 to 13 months of age, this index in heifers averaged 983.3±38.2 g, and in bulls 1135.2±46.4 g.

4 Conclusions

1. As the age of heifers and steers increases from 1 to 13 months of age, the level of total protein and albumin in their blood increases.

2. The content of globulins in the blood of heifers and steers during the period of their growing did not change significantly.

3. In all periods of growth the content of total protein and albumin were higher in steers in relation to heifers.

4. The value of protein coefficient from 1 to 13 months of age increased in heifers and steers.

5. The value of live weight and average daily gain in growing steers is higher than that of comparable heifer heifers of the same age.

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