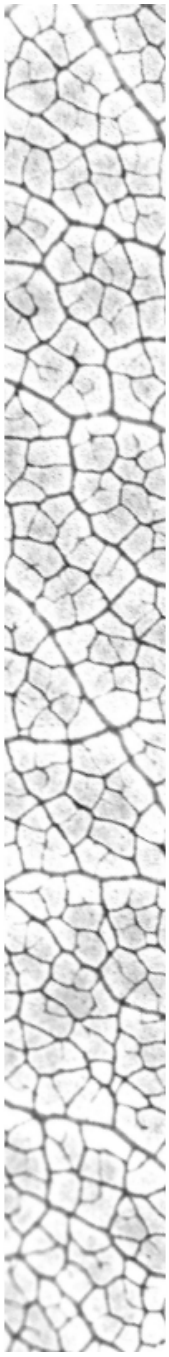

EurAsian Journal of BioSciences
Eurasia J Biosci 13, 523-527 (2019)

Biological study of changes in transaminases and lactate dehydrogenase in the blood of heifers of different cattle breeds

E. G. Rotmistrovskaya [1*], V. I. Eremenko [2]

[1] Kursk State Medical University, Kursk, RUSSIA
[2] I. Ivanov Kursk State Agricultural Academy, Kursk, RUSSIA
*Corresponding author: E. G. Rotmistrovskaya

Abstract
Biologically the most important factor that influences development of dairy and beef cattle breeding is the selection of cattle. For this purpose, a detailed biological study of interior and exterior indicators, which would reflect the breed features of cattle, is required. It is known that blood metabolites are closely correlated with the level of milk production. In addition, metabolic reactions are extremely consistent with each other. A special role is played by transaminases: alanine aminotransferase, aspartate aminotransferase - blood plasma enzymes and lactate dehydrogenase, which catalyzes the oxidation of lactic acid to pyruvic acid. In this regard, it is necessary to study the activity of these enzymes in cattle of different breeds. *Objective and tasks of the research.* Objective of this paper was to study the activity of AST, ALT and LDH in black-and-white Holstein, Simmental, Aberdeen-Angus heifers, as well as in crossbred heifers (Simmental's Aberdeen-Angus). The experiments involved all breeds, 10 animals from each, of similar age. The level of feeding of animals was the same and corresponded to the level of their physiological state. Blood for the study of enzymes was collected from the tail vein, before the morning feeding once in a month in the neonatal period, at the age of 3, 6, 12 and 15 months. The activity of the AST, ALT and LDH enzymes was determined on a Saphire 400 biochemical analyzer using standard BioSistems reagent kits. The experimental data were processed using Student's t-test in Microsoft Office Excel 2007. It follows from the analysis that the activity of ALT, AST and LDH increases with increasing age of the heifers from birth to 15 months of age. In the black-and-white Holstein and Simmental heifers the activity of ALT and AST is lower compared to the compared group of Aberdeen-Angus breed and crossbred animals. Opposite data were obtained in the study of the enzyme LDH; thus, the activity of LDH in the blood of black-and-white Holstein and Simmental heifers is slightly higher compared to the group of Aberdeen-Angus breed and crossbred animals.

Keywords: biological analysis, cattle, breeds, Holstein, Simmental, Aberdeen-Angus, cross-bred heifers (Simmental x Aberdeen-Angus), heifers, transaminases, lactate dehydrogenase

Rotmistrovskaya EG, Eremenko VI (2019) Biological study of changes in transaminases and lactate dehydrogenase in the blood of heifers of different cattle breeds. Eurasia J Biosci 13: 523-527.

INTRODUCTION

The most important factor that influences development of dairy and beef cattle breeding is the selection of cattle. For this purpose, a detailed biological study of interior and exterior indicators, which would reflect the breed features of cattle, is required. It is known that blood metabolites are closely correlated with the level of milk production. In addition, metabolic reactions are extremely consistent with each other.

A special role is played by enzymes: alanine aminotransferase, aspartate aminotransferase - blood plasma enzymes. The main function of transaminases is reduced to the transfer of amino groups between amino acids and keto acids. ALT and AST are common in the tissues of the heart, liver, skeletal muscles, kidneys, less in the pancreas, spleen, lungs. An equally important role is played by lactate dehydrogenase - an enzyme that reversibly catalyzes the oxidation of lactic acid to pyruvic, which is also crucial in the metabolism of cattle (Dikson and Webb 1997). According to various authors, the activity of enzymes varies in different periods of ontogenesis. Vladimirov V.L., Milushev R.K. indicate significant changes in AST activity in ontogenesis (Htwe et al. 2016, Vladimirov and Milushev 1988, 1992). Other authors suggest using this data when predicting the growth and development of animals (Lopez Alonso et al. 1997, Rabbani et al. 2014, Trifonova 1976). The literature includes data on that the indicators of these enzymes stabilize at 9 months of age and the prediction

Received: August 2018
Accepted: December 2018
Printed: May 2019

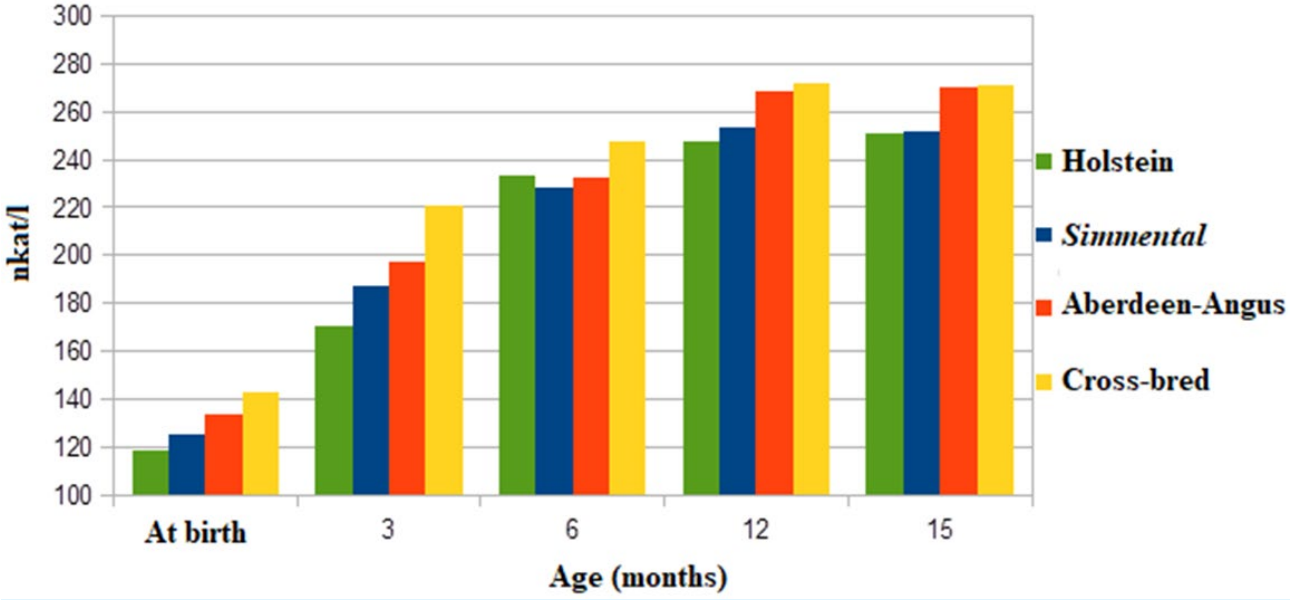

Fig. 1. Changes in the activity of alanine aminotransferase in heifers of different breeds

of productivity is most effective at this moment (Budinkova et al. 1985, Ersoy et al. 2017, Kyselovic and Debreceni 1990, Stoianovskii et al. 1989).

In this regard, it is necessary to study the activity of these enzymes in cattle of different breeds.

Objective and tasks of the research. The objective of this paper is to study the activity of AST, ALT and LDH in the black-and-white Holstein, Simmental, Aberdeen-Angus heifers, as well as cross-bred cows (Simmental x Aberdeen-Angus).

To accomplish this goal the following tasks should be done:

1. To study the changes in the activity of lactate dehydrogenase, alanine aminotransferase and aspartate aminotransferase in the blood of different breeds of heifers.
2. To conduct a comparative analysis of the data obtained between the experimental groups of heifers of different breeds.

MATERIALS AND METHODS

The object of the study was the heifers of Holstein black-and-white breed, Simmental, Aberdeen-Angus and a mixture of Simmental and Aberdeen-Angus breeds. The experiments involved all breeds, 10 animals from each. The level of feeding of animals was the same and corresponded to the level of their physiological state. Blood for the study of enzymes was collected from the tail vein before the morning feeding once in a month in the neonatal period, at the age of 3, 6, 12 and 15 months. The activity of the AST, ALT and LDH enzymes was determined on a Saphire 400 biochemical analyzer using standard BioSistems reagent kits. The experimental data were processed using Student's t-test in Microsoft Office Excel 2007.

DISCUSSION

Alanine aminotransferase. The study of ALT in the blood of experimental heifers found that at birth the concentration of this indicator in the black-and-white Holstein and Simmental heifers was about the same. The group of Aberdeen-Angus and crossbred animals had a slightly higher concentration of ALT. There are no statistically significant differences between the experimental groups of heifers during this period. The changes in ALT in the blood of experimental heifers are presented in **Fig. 1**.

The data show that in the neonatal period the activity of ALT was: in Holstein breed - 118.6±3.1 nkat/l, in Simmental - 125.8±3.6 nkat/l, in Aberdeen-Angus - 134.1±3.3 nkat/l and in crossbred animals - 143.1±4.2 nkat/l. By the age of 3 months, the ALT level in the blood of Holstein heifers was 170.4±4.1 nkat/l, in Simmental - 187.7±3 nkat/l, and in Aberdeen-Angus - 197.1±3.9 nkat/l. The highest concentration of ALT at 3 months of age was observed in the crossbreds - 221.3±4.1 nkat/l. By six months of age, these values slightly increased in all experimental animals, in Holstein - to 233.6±6.0 nkat/l, in Simmental - to 228.1±5.7 nkat/l, in Aberdeen-Angus - to 232.7±5.1 nkat/l, in cross-bred animals - to 247.7±5.2 nkat/l.

Further, in the course of growth of animals, the activity of alanine aminotransferase in the blood of experimental heifers gradually increased. In cross-bred heifers, the values of this indicator at 6 months of age amounted to 247.8±5.2 nkat/l, which is 10% more than in Simmental heifers. Other experimental heifers had approximately the same ALT level in the blood. In the Holstein breed, this indicator was 233.6±6.0 nkat/l, in Aberdeen-Angus - 232.7±5.1 nkat/l.

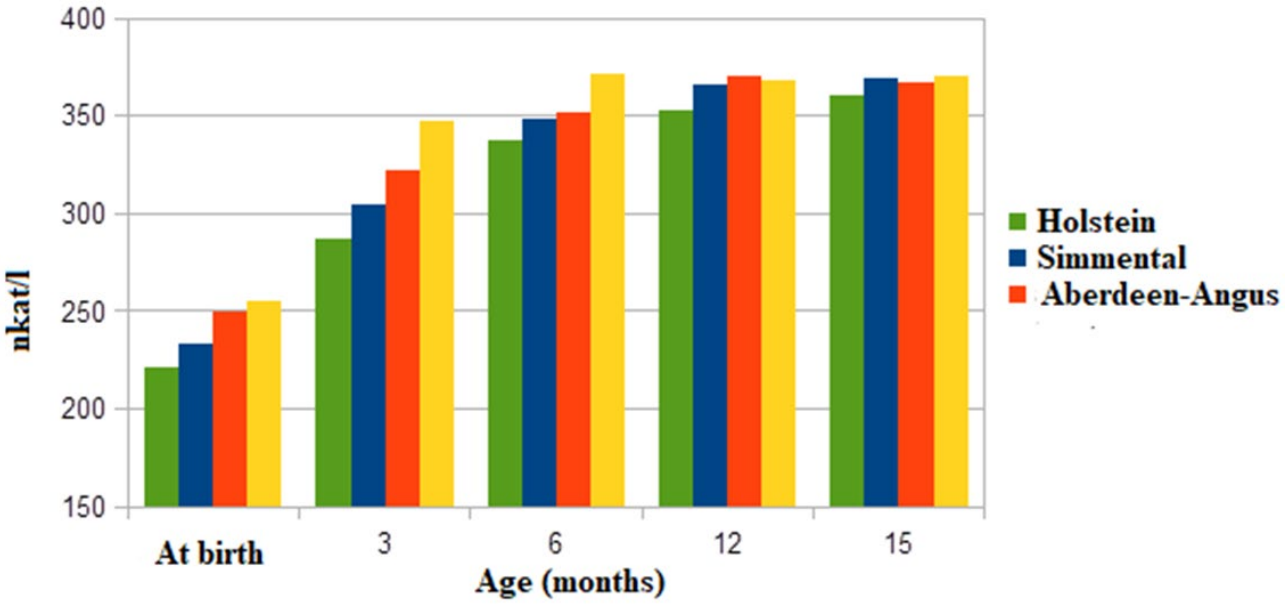

Fig. 2. Changes in the activity of aspartate aminotransferase in heifers of different breeds

By the age of 12 months, ALT activity continued to increase. In the Holstein breed it was 247.3±6.6 nkat/l, in Simmental - 253.1±5.4 nkat/l, in Aberdeen-Angus - 268.4±4.8 nkat/l and in the crossbred animals - 272.1±6.5 nkat/l. At 12 months of age, statistically significant differences (P<0.05) were established between the level of ALT activity in the black-and-white Holstein breed, ALT in the Aberdeen-Angus breed and crossbred animals. The maximum values of this indicator were noted at the age of 15 months in crossbred animals - 270.7±6.1 nkat/l; in the Aberdeen-Angus breed the level of ALT was - 270.0±5.9 nkat/l. The activity of this indicator was slightly lower in the Holstein breed - 250.7±6.2 nkat/l, and in the Simmental breed it was 251.7±4.6 nkat/l. At 15 months of age, statistically significant differences (P<0.05) were established between the level of ALT activity in the black-and-white Holstein breed, ALT in the Aberdeen-Angus breed and crossbred animals. Comparing the results of groups of heifers of different breeds, it can be noted that higher ALT activity was in heifers of the Aberdeen-Angus breed and cross-bred animals (Simmental x Aberdeen-Angus).

Aspartate aminotransferase. A study of the AST level in the blood of heifers showed that the course of changes is similar to changes in ALT. The data obtained are presented in **Fig. 2**.

In newborn calves, the AST level in their blood was 221.2-255.7 nkat/l. By the age of three months, the values of this indicator in the experimental groups of heifers increased, on average, by 15% and amounted to 287.7±3.9 nkat/l in the Holstein breed, 304.3±4.5 nkat/l in the Simmental breed, Aberdeen-Angus - 322.4±4.4 nkat/l; and in cross-bred heifers - 347.4±5.5 nkat/l.

By 6 months of age, the concentration of AST continued to increase in the Holstein, Simmental, Aberdeen-Angus heifers and crossbred animals to the level of 337.2±4.5 nkat/l, 348.5±5.2 nkat/l, 352.2±6.1 nkat/l, 371.2±6.0 nkat/l, respectively. By the age of 12 months, the AST concentration in the blood of the heifers continued to increase. It should be noted that since the age of 3 months, the AST level in the blood was slightly higher in the Aberdeen-Angus breed. By the age of 12 months, AST activity continued to increase. In the Holstein breed it was 352.6 ± 4.8 nkat/l, in Simmental - 366.3±5.3 nkat/l, in Aberdeen-Angus - 370.0±8.2 nkat/l and in the crossbred animals - 368.0±4.5 nkat/l. At 12 months of age, statistically significant differences (P<0.05) were established between the level of AST activity in the Aberdeen-Angus breed and crossbred animals and AST activity in the black-and-white Holstein breed.

By the age of 15 months, the highest concentration of AST was in the cross-bred heifers - 370.0±3.9 nkat/l. In Aberdeen-Angus breed - 367.4±9.9 nkat/l. The least active AST were in the black-and-white Holstein heifers - 360.4±8.3 nkat/l and the Simmental heifers - 369.7±6.0 nkat/l. At 15 months of age, statistically significant differences (P<0.05) were established between the level of AST activity in the Aberdeen-Angus breed and crossbred animals and ALT activity in the black-and-white Holstein breed.

Thus, the level of AST in the blood has a tendency to slightly exceed the productivity in the beef heifers, compared to the group of dairy breeds.

*Lactate dehydrogenase.*The activity of this indicator in all experimental animals at birth was about 2.0-2.1 nkat/l, that is, practically with no differences between the groups established. The data obtained are presented in **Fig. 3**.

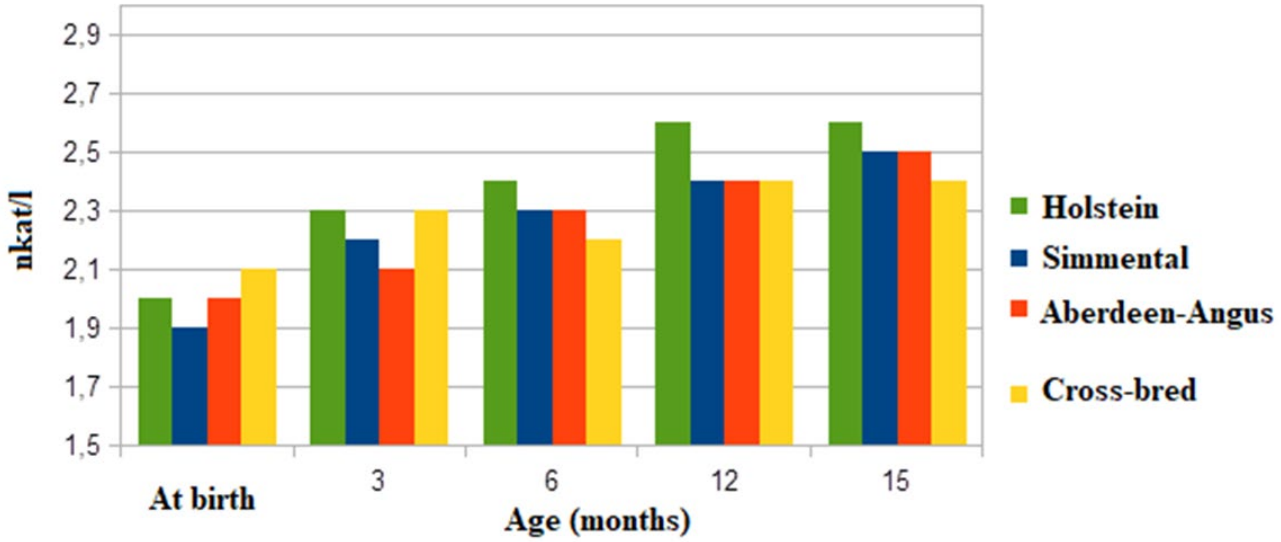

Fig. 3. Changes in the activity of lactate dehydrogenase in heifers of different breeds

Further, by the age of three months, the level of LDH in the blood of the heifers slightly increased to 2.1-2.3 μkat/l. A slight increase in this indicator in the heifers was observed at 3 months of age. The level of LDH in 3-month-old Holstein heifers was 2.3±0.4 mkat/l, and in Simmental - 2.2±0.3 mkat/l. In beef heifers - Aberdeen-Angus and crossbred animals, this indicator slightly differed - 2.1±0.2 μkat/l and 2.3±0.3 μkat/l, respectively.

By the 12th month of age, no regular changes in the level of LDH in the blood of the animals were established; it was about the same as at 6 months of age. Comparing this indicator in the experimental groups, it can be seen that the level of LDH in the blood at all ages was slightly higher in the dairy animals.

The activity of this enzyme in the Holstein breed was: 2.6±0.5 μkat/l, in Simmental - 2.4±0.4 μkat/l, in Aberdeen-Angus - 2.4±0.3 μkat/l, in the crossbred heifers - 2.4±0.3 μkat/l.

The maximum values of this indicator were noted at 15 months of age in Holstein breeds and amounted to 2.6±0.6 kkat/l, while in the Simmental breed the level of LDH was 2.5±0.4 μkat/l. Slightly lower activity of this indicator was in crossbred animals - 2.4±0.3 μkat/l. Thus, the level of LDH in the blood tends to slightly exceed the black-and-white Holstein heifers, compared to the group of Aberdeen-Angus breed and crossbred animals.

CONCLUSION

It follows from the analysis that the activity of ALT, AST and LDH increases with increasing age of the heifers from birth to 15 months of age. In the black-and-white Holstein and Simmental heifers the activity of ALT and AST is lower compared to the compared group of Aberdeen-Angus breed and crossbred animals. Opposite data were obtained in the study of the enzyme LDH; thus, the activity of LDH in the blood of black-and-white Holstein and Simmental heifers is slightly higher compared to the group of Aberdeen-Angus breed and crossbred animals.

REFERENCES

Budinkova AV, Pasechnik AP, Fotiadis FV (1985) Relationship of biochemical parameters of blood of heifers and their growth energy and body weight. Bulletin of All-Russian Institute of Livestock Breeding. Podolsk, (78): 29-31.

Dikson M, Webb E (1997) Enzymes. (Trans. LM Ginodman and MI Leviant, ed. AI Oparin) M.: Mir, 1966. 816 p.

Ersoy AÖ, Öztaş E, Özler S, Ersoy E, Topçu HO, Fındık RB, et al. (2017) The evaluation of the low risk pregnant women who gave birth to macrosomic infants. J Clin Exp Invest., 8(4): 114-9. https://doi.org/10.5799/jcei.382414

Htwe O, Naicker AS, Pei TS (2016) Spinal epidural hematoma due to anticoagulant therapy: a case report and literature review. European Journal of General Medicine, 13(3): 61-2. https://doi.org/10.29333/ejgm/81908

Kyselovic J, Debreceni O (1990) Zmeny biochemickych ukazovatel'ov v krynom sere teliat po stresovej zatazi. Acta zootechn. Nitra, (46): 53-9.

Lopez Alonso M, Miranda M, Hernandez J, Castillo C, Ayala I, Benedito JL (1997) Seasonal variation of glutathione peroxidase, CK and AST in sheep in a low-selenium region. J. Anim. Feed Sc., 6(3): 343-51. https://doi.org/10.22358/jafs/69530/1997

Rabbani M, Bagherzadeh N, Rafiei H (2014) Calculating raw material and work-in-process inventories in MTO. MTS production. UCT Journal of Research in Science, Engineering and Technology, 2(3): 109-16.

Radchenkov VP, Matveev VA (1997) Methods of blood test. Methods of bio-chemical analysis (reference book). Borovsk: 165-200.

Stoianovskii VG, Aksenova GV, Spitinskii VV (1989) Influence of chlorpromazine and phenazepam on the development of adaptive reactions and productivity in young cattle under transport-induced stress. Abstracts of reports. New pharmacological agents in veterinary medicine: 98-9.

Trifonova LR (1976) Activity of cattle blood enzymes associated with sex, age, milk production, and season of the year. Works of North-Western Institute of Dairy and Grassland Farming. Arkhangelsk, 9: 166-71.

Vladimirov VL, Milushev RK (1988) Biochemical processes in purebred and crossbred heifers in ontogenesis. Bulletin of scientific papers. All-Russian Institute of Livestock Breeding. Podolsk, 92: 77-80.

Vladimirov VL, Milushev RK (1992) Biochemical processes in purebred and crossbred heifers in ontogenesis. Bulletin of scientific papers. All-Russian Institute of Livestock Breeding. Podolsk, 108: 96-9.