Physiological reaction of blood counts in lactating cows to the use of catosal

S Yu Zavalishina
Department of Adaptive Physical Culture and Recreation, Russian State Social University, 129226, Moscow, Russia

E-mail: svetlanazsyu@mail.ru

Abstract. In modern conditions, it is imperative to intensify livestock raising with an active search for reserves to increase the productivity of this industry. An important reserve for increasing the productivity of lactating cows is considered the use of various biological stimulants. Their effect is largely associated with the stimulation of the main hematological parameters. As a result of the use of catosal for six weeks at a rate of 20.0 ml per head per day, it was possible to achieve very physiologically beneficial changes in the biochemical and morphological parameters of blood in lactating black-and-white cows. The results obtained can be regarded as manifestations of positive changes in the metabolism of these animals developing against the background of catosal. The development of the found changes in the hematological parameters taken into account under the influence of catosal should be considered very favorable for the further course of lactation in the observed cows and contributing to an increase in their milk yield. In this regard, the drug catosal can be regarded as promising for further research on biological stimulation of lactating cows.

1. Introduction

Continuous research on various aspects of the physiology and biochemistry of cattle has made it possible to collect a large amount of scientific information that made it possible to form a clear idea of their condition at different age periods of animals [1,2].

It becomes clear that the state of blood counts largely determines the general status of animals at any age, and most importantly, their productive qualities [3]. For this reason, many authors consider it necessary to monitor blood parameters in farm animals during the period of their productive activity - during lactation [4]. By evaluating the blood parameters, one can accurately trace the dynamics of the general functional status of animals and find out the general vector of its changes [5]. This is necessary to search for approaches to a functionally safe enhancement of the lactation function of a cow with the provision of the most physiologically beneficial level of the body’s state, which can be judged by the content of basic cellular elements in her blood and the level of a number of biochemical parameters [6,7].

At present, the question of the need for further intensification of animal husbandry and the search for reserves to increase the productivity of this industry is increasingly being raised. A serious reserve for increasing the productivity of lactating cows is the use of various biological stimulants. This is due to their ability to raise the main hematological parameters to a functionally more favorable level [8].

Previous studies have emphasized the relationship between the blood composition of animals, on the one hand, and their physiological status and productive properties, on the other hand [9]. To
improve the state of hematological parameters in animals, various biologically active drugs have been used more than once, however, it is still very premature to talk about any of them as the most effective. It is necessary to conduct further long-term studies to clarify the nature of their effect on hematological parameters with prolonged use.

It is very important to keep track of those hematological parameters that largely determine the dynamics of productivity against the background of stimulation in young, lactating cows. This can help assess the biological potential of any test drug to affect a closely related hematological profile. In this regard, it seemed very promising to trace the dynamics of the level of blood corpuscles and biochemical parameters reflecting the main aspects of metabolism in young high-yielding black-and-white cows that began to lactate after calving.

Recently, the attention of researchers has been attracted by the biostimulating agent catosal, which can increase the level of viability in different species of productive animals. In addition, this drug has shown its ability to improve the morphological and functional parameters of animals, positively affecting various biochemical processes. At the same time, the question of the effect of catosal on hematological parameters in lactating cows remains unclear.

Objective: to consider the effectiveness of the use of catosal as a biological stimulant in relation to basic blood parameters in black-and-white cows that entered the second lactation.

2. Materials and methods

The work was carried out in full compliance with the ethical standards defined by the European Convention for the Protection of Vertebrate Animals Studied during Experiments (adopted in Strasbourg on March 18, 1986 and confirmed in Strasbourg on June 15, 2006). All conducted studies were approved by the local ethics committee of the Russian State Social University (protocol №11 of January 17, 2017).

The study was conducted on 48 healthy black-and-white cows successfully lactating within a month after a normal second calving. All cows had comparable general functional state, age, weight and productivity levels. A control and an experimental group of cows, 24 heads each, were randomly formed from them.

During the entire observation, all animals received a standard diet with standard premixes to it. During the observation period, the daily ration of all observed cows consisted of 8 kg of compound feed (61.0% grain mixture + 25.0% sunflower cake + 10.0% corn + 1.0% calcium phosphate + 1.0% table salt + 2.0 % vitamin-mineral premix), 3 kg of freshly prepared hay, 10 kg of fresh corn silage, 15 kg of haylage made from alfalfa, 1 kg of fresh molasses.

The cows that made up the experimental group received 6 courses of catosal injections (Bayer HealthCare LLC, USA), 20.0 ml daily, intramuscularly, in the morning. Each course lasted 7 days. Between the courses of application of catosal, the intervals of its application of 7 days were observed. The condition of the animals of both groups was assessed initially - when taken under observation and on the seventh day after the last injection of catosal in the sixth course of its use in the experimental group.

The physiological state of the observed animals in both groups was assessed by conducting a thorough examination and performing their hematological and biochemical blood tests. Blood sampling from the observed cows in all cases was carried out from the jugular vein in the morning before the start of feeding under strict aseptic conditions. In all cases, a 3% Trilon B solution was used as an anticoagulant.

The assessment of the morphological characteristics of blood was carried out within the framework of the methods generally accepted in biological research. In the blood of animals, the number of erythrocytes, platelets and the number of leukocytes was counted using a Goryaev camera. The level of hemoglobin in the blood of the cows taken into the study was assessed using the Sali method [10].

The level of total protein, amount of urea, creatinine concentration, glucose content, as well as levels of calcium, phosphorus, carotene, as well as the reserve alkalinity of blood serum were assessed in cows using an automatic biochemical analyzer "Express plus", Siemens (Germany).
Statistical processing of the obtained digital results was carried out using the software package “Statistics for Windows v. 6.0”, “Microsoft Excel”. Differences in data were considered significant if \( p < 0.05 \).

3. Research results and discussion

The initial morphological blood parameters in cows of both observation groups were comparable and were within the physiological norm.

During the study, the indicators in the control group did not experience statistically significant changes in the considered indicators. In the experimental group of lactating cows receiving catosal, there was a significant increase in the content of erythrocytes in the blood by 29.8%, reaching 129.7 ± 2.0 g/l. At the same time, by the end of observation in cows of the experimental group, this indicator exceeded that in the control group by 25.3%.

A similar dynamics was revealed in relation to the level of hemoglobin. Initially, its level was comparable in both groups. During the period of application of catosal, this indicator in the experimental group increased by 29.8%, and in the control group it remained without significant dynamics. As a result, in the experimental group the hemoglobin level by the end of the observation was 25.3% higher than in the control group.

A very important indicator characterizing the body's resistance is the number of leukocytes in the peripheral blood, which largely determines the level of their protection against infection [11,12]. The outcome in both groups showed similar levels of total leukocyte count. At the end of the observation in the experimental group, this indicator turned out to be higher than the outcome by 43.5% due to the fact that no significant dynamics of this indicator was found in the control group. In this regard, the level of this indicator in the experimental group at the end of the observation exceeded that in the control group by 39.1%.

As a result of the use of catosal, the initially comparable number of platelets in the blood of lactating cows decreased physiologically favorably by 16.3%. At the same time, in the control group, it remained unchanged. By the end of the observation in the experimental group, this indicator was lower by 19.8%. This contributed to the improvement of microcirculation processes in experimental animals.

When assessing the biochemical parameters of the blood of the examined animals, it was found that the introduction of catosal into the body of lactating cows was able to positively influence their level.

Proteins are an important component of blood in every living organism [13]. Assessment of the level of protein in the blood plasma of animals is of great diagnostic and indisputable prognostic value [14]. In the case of a low level of proteins in the blood in the body, growth is naturally inhibited and developmental processes slow down, which inevitably reduces its overall productivity [15]. At the same time, the level of total protein in the blood can accurately characterize the current state of protein nutrition of any organism [16].

The protein concentration in the blood plasma of experimental cows of both groups in the outcome corresponded to the level of the generally accepted norm and did not differ statistically significantly. During the study period, the levels of total protein experienced changes more pronounced in the experimental animals. During the observation period, the cows of the experimental group showed a significant increase in total protein (\( p < 0.05 \)) by 30.3% compared with the outcome, which indicated an improvement in nitrogen metabolism in them. At the same time, at the end of the observation, the level of total protein in the experimental cows exceeded that in the control by 24.5%.

In the work, the level of urea was assessed in animals - one of the very large fractions of residual nitrogen in plasma. Its level can be considered an important indicator of the severity of the use of proteins and the biological value of proteins subjected to digestion in the body. A significant part of it is excreted in the urine, and the smaller part returns to the scar along with saliva or enters its cavity through the scar wall [17].

The plasma level of urea in cows during the entire observation was within the generally accepted physiological norm. By the end of the observation, in the control group of cows, the amount of urea in
the plasma increased by 1.6%, and in the experimental group, its level, on the contrary, decreased by 10.9% compared to the outcome level. During the observation period, it was noted that in the experimental group of animals at the time of the end of the experiment, this indicator was below the control level by 13.1%, which indicated a significant increase in the efficiency of assimilation of nitrogen from the diet in the experimental cows against the background of the introduction of catosal.

Creatinine plays a similar role in the body, the level of which experienced similar dynamics during observation. By the end of the observation, its level in the experimental cows was 10.3% lower than the control ones.

The main source of energy in the cells of mammals, including lactating cows, is glucose, which is considered as the main precursor for the synthesis of milk sugar - lactose. From the gastrointestinal tract, glucose enters the bloodstream and then into the tissues. It can be temporarily deposited in the liver and muscles against the background of glycogen [18]. The performed assessment of the glucose level showed that its initial concentration in the blood in both groups was comparable, and throughout the study remained within the physiological norm. At the same time, in the experimental group by the end of the observation, its level was physiologically advantageously higher than that in the control group by 11.6%.

The performed determination of the state of indicators characterizing the processes of mineral metabolism in the blood of lactating cows showed that the initial concentrations of calcium and inorganic phosphorus were comparable and were within the physiological norm. In the course of the study in the control, they did not change, but in the experimental group, their concentration increased slightly. So by the end of the observation, the amount of calcium in the blood of the experimental animals was 4.6%, and inorganic phosphorus was 4.8% higher than those in the control group. At the same time, the increase in these indicators in the experimental group and their excess over those in the control by the end of the observation did not reach the level of statistical significance.

The state of reserve alkalinity plays an important role in maintaining acid-base balance in the blood. A low level of this indicator indicates a negative change in balance and the development of acidosis [19]. In the outcome of both groups, the reserve alkalinity was within the normal range and was comparable. By the end of the observation in the experimental group, there was a tendency for this indicator to increase by 5.1% compared to the level in the control group.

The amount of carotene in the blood plasma of cows at the exit stage did not have significant differences between both observation groups. Its level during the study in the experimental group of cows increased by 7.6%, remaining unchanged in the control group. At the end of the observation, the blood carotene content of the animals of the experimental group exceeded that of the control cows by 6.8%, but did not reach the level of statistical significance.

4. Conclusion

At present, the question of the need for further intensification of animal husbandry and the search for reserves to increase the productivity of this industry is increasingly being raised. A serious reserve for increasing the productivity of lactating cows is the use of various biological stimulants. This is due to their ability to raise the main hematological parameters to a functionally more favorable level. As a result of the use of catosal for six weeks at a rate of 20.0 ml per head per day in the work performed, it was possible to achieve very physiologically beneficial changes in the biochemical and morphological parameters of blood in black-and-white cows at the second lactation stage. The results obtained can be considered as manifestations of positive changes in metabolism in these animals that occurred against the background of catosal. The development of the found changes in the hematological parameters taken into account against the background of the introduction of catosal should be considered very favorable for the further course of lactation in the observed cows and contributing to an increase in their milk yield. In this regard, the drug catosal can be considered very promising for further research on biological stimulation of lactating cows.
Acknowledgement
The authors would like to thank their colleague for their contribution and support to the research. They are also thankful to all the reviewers who gave their valuable inputs to the manuscript and helped in completing the paper.

References
[1] Oshurkova Ju L and Medvedev IN 2018 Functional Features Of Platelets In Newborn Calves Ayrshire Breed RJPBCS 9(6) 313-8
[2] Vorobyeva N V and Medvedev I N 2018 Physiological Features Of Platelet Functioning In Calves Of Holstein Breed During The Newborn RJPBCS 9(6) 129-35
[3] Mal G S, Khartonov E L, Vorobyeva N V, Makhova A V and Medvedev I N 2018 Functional Aspects Of Body Resistance RJPBCS 9(6) 60-5
[4] Tkacheva E S and Medvedev I N 2020 Functional features of vascular hemostasis in piglets of milk and vegetable nutrition IOP Conference Series: Earth and Environmental Science 421(2) 022041. doi:10.1088/1755-1315/421/2/022041
[5] Vorobyeva N V and Medvedev I N 2020 Platelet function activity in black-motley calves during the dairy phase BIO Web Conf. International Scientific-Practical Conference “Agriculture and Food Security: Technology, Innovation, Markets, Human Resources” (FIES 2019) 17 00167 DOI: https://doi.org/10.1051/bioconf/20201700167
[6] Amelina I V and Medvedev I N 2008 Evaluation of the dependence of mutagenesis intensity on activity of nucleolus organizer regions of chromosomes in aboriginal population of Kursk region. Bulletin of Experimental Biology and Medicine 145(1) 68-71
[7] Glagoleva T I and Medvedev I N 2020 Physiological features of aggregation of the main formed elements of blood in calves at the beginning of early ontogenesis BIO Web Conf. International Scientific-Practical Conference “Agriculture and Food Security: Technology, Innovation, Markets, Human Resources” (FIES 2019) 17 00161 DOI: https://doi.org/10.1051/bioconf/20201700161
[8] Medvedev I N 2020 Problems of human nutritional behavior in modern society IJPR 1 1357-65
[9] Tkacheva E S and Medvedev I N 2020 Physiological and biochemical status of newborn piglets IOP Conference Series: Earth and Environmental Science 548(8) 082090
[10] Gilmudtinov R Ya and Kurbanov R Z 2000 Studies of animal blood: Methodological aspects (Kazan: publishing house of the Tatar State Humanitarian Institute) p 240
[11] Medvedev I N 2016 Platelet functional activity in clinically healthy elderly Advances in gerontology 29(4) 633-8
[12] Makhov A S and Medvedev I N 2018 The Physiological Role Of Mediators In The Central Nervous System RJPBCS 9(5) 579-83
[13] Medvedev I N 2018 Severity Of Vascular Disaggregation Effects On Erythrocytes In Patients With Arterial Hypertension With Abdominal Obesity And Dyslipidemia RJPBCS 9(3) 1161-5
[14] Medvedev I N and Savchenko A P 2010 Platelet activity correction by regular physical training in young people with high normal blood pressure Russian Journal of Cardiology 2(82) 35-40
[15] Mal G S, Vorobyeva N V, Makhova A V, Medvedev I N and Fayzullina I I 2018 Features Of Physical Rehabilitation After Myocardial Infarction RJPBCS 9(6) 280-5
[16] Oshurkova Ju L and Medvedev I N 2018 Physiological Indicators Of Platelets In Ayrshire Calves During The Dairy Feeding Phase RJPBCS 9(6) 171-6
[17] Vasylieva E A 1985 Clinical biochemistry of farm animals (Moscow: Agropromizdat) p 342
[18] Medvedev I N 2018 Correction of the image of the physical "I" in people with disabilities with hemiparesis who underwent a hemorrhagic stroke RJPBCS 9(2) 697-704.
[19] Zaripova L P 2002 Scientific basis for the rational use of protein in animal husbandry (Kazan: publishing house FEN) p 296