Physiological changes in the blood of calves by plant food when using Katozal

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Abstract. An increase in livestock productivity is closely linked to an increase in calf vitality. This can be achieved using a number of approaches, including through the use of a number of biological stimulants in calves. The effectiveness of their use can be determined during the assessment of the main hematological parameters. As a result of 7 courses of daily use of 15.0 ml of Katozal plant nutrition in calves per animal, physiologically optimal changes in blood parameters were achieved. The results obtained as a result of regular injections of Katozal are regarded as highly physiologically beneficial for increasing the viability of animals and increasing their productive potential. The achieved dynamics of hematological parameters can be considered as a marker of the formation in the body of calves under the influence of Katozal of the situation, contributing to a pronounced increase in the processes of anabolism. The use of the drug Katozal is very promising for biological stimulation of calves at the end of early ontogenesis.

1. Introduction
Long-term previous studies on the dynamics of physiological indicators of cattle in ontogenesis helped to accumulate a large amount of information that provides a clear understanding of the main physiological processes in their bodies under various environmental conditions [1,2].

From the level of science, the relationship between the nature of the composition blood and general physiological status, which determines the level of productivity of farm animals. At the same time, it is the quantitative indicators of blood that are the most reliable marker of the current general status of productive and unproductive animals during the entire ontogenesis [3]. For this reason, it is considered extremely important to regularly assess many hematological parameters in farm animals in the process of completing their rearing [4]. By monitoring them, it is possible to find out the current general functional status of each animal, and make a forecast about its dynamics in the near future [5]. This is of great importance for improving the options for stimulating anabolism in calves and optimizing their physiologically beneficial state for a long time ahead [6,7].

The constructiveness of social development is possible with the sufficiency of food products, including those obtained in the course of animal husbandry. This is possible during the continuation of the active intensification of the production of its products [8]. A serious reserve for increasing the growth processes of calves is the use of effective stimulants. With their help, it is possible to activate all types of metabolic processes, which can be judged by the dynamics of hematological parameters [9].
To optimize hematological parameters in many animal species, a large number of biologically active substances have been tested. At the same time, it remains unclear which of them stimulate to a greater extent and at what stages of animal development they should be used. For this reason, it is necessary to continue to conduct large and versatile studies of the effect of biostimulants on the morphological and biochemical parameters of blood.

Of particular importance is the assessment of hematological parameters in calves at the end of early ontogenesis, associated with the potential level of their productivity under conditions of biostimulation. This can help to track the severity of the stimulating capabilities of each monitored factor by the nature of the dynamics of the hematological profile. In this regard, it is very promising to assess changes in the blood of morphological and biochemical parameters, reflecting the metabolic activity in calves completing growth processes.

One of the most actively studied recently in relation to various aspects of the effect on animals is the biostimulant Katozal. At the same time, its effect on hematological parameters in calves during the plant feeding phase cannot be considered clear.

**Purpose:**
to trace the effectiveness of the course application of Katozal in relation to the dynamics of hematological parameters in calves of plant nutrition.

### 2. Materials and methods

The study was carried out in full compliance with the ethical requirements set forth in the European Convention for the Protection of Vertebrate Animals Taken into Experiments (adopted in Strasbourg on March 18, 1986 and fully confirmed in Strasbourg on June 15, 2006). The work was supported by the local ethics committee of the Russian State Social University (Protocol No. 11 of January 17, 2017).

The study was performed on 54 healthy black-and-white calves at the age of 6 months. All animals were completely healthy prior to inclusion in the study and remained healthy after the end of the study. A control group and an experimental group of 27 animals were randomly formed from these calves. During the entire observation, all calves received a standard diet with standard mineral supplements to the feed. The calves of the control group did not receive any additional supplements and stimulants and were kept under standard conditions. Calves that made up the experimental group received 7 courses of injections of Katozal solution (Bayer HealthCare LLC form, USA) 15.0 ml intramuscularly in the morning before feeding. Each course of Katozal administration lasted 7 days. The courses were alternated with periods without the use of the drug for 7 days. All calves were examined at the end, before the first injection of the drug, and on the seventh day after the last injection of Katozal during the seventh course, its use in calves of the experimental group.

Evaluation of the condition of calves in two observation groups was carried out by determining during a careful general examination and determining the main hematological parameters. In all cases, blood sampling for analysis from calves was carried out in the morning from the jugular vein until the time of their morning feeding in strictly aseptic conditions. In all analyzes, a 3% Trilon B solution acted as an anticoagulant.

The morphological parameters of the blood of animals were determined using traditional methods. In all calves, the number of erythrocytes, platelets and leukocytes in the blood was determined using a Goryaev camera, the hemoglobin content in the blood of animals observed in the study was determined according to the standard Sali method [10].

In the blood of calves, using an automatic analyzer "Express plus", Siemens (Germany), the level of total protein, the concentration of creatinine, the content of urea, the amount of glucose, phosphorus, calcium, carotene were monitored, and the reserve alkalinity of the blood was determined.

Mathematical processing of the results of the study was carried out using the “Statistics for Windows v. 6.0 ”,” Microsoft Excel ”. The presence of reliability was established under the condition p<0.05.

### 3. Research results and discussion

The initial morphological parameters of blood in calves of both groups of observation were similar and were within the normal range (table 1).
During the study, the state of indicators in animals of the control group did not experience significant dynamics. In the experimental group of plant-based calves receiving catosal, an increase in the level of erythrocytes by 62.2% was noted, reaching a value of $7.3 \pm 0.45 \times 10^{12}$/l. At the end of the observation, in the calves that formed the experimental group, this parameter exceeded the control indicator by 52.1%.

**Table 1. The number of blood cells in calves during the study.**

| Indicators, units | Calf groups, M±m |
|-------------------|------------------|
|                   | control, n=27    | experienced, n=27 |
| **Indicators at the beginning of observation** |                     |
| Erythrocytes, 10^{12}/l | 4.6±0.31         | 4.5±0.39         |
| Hemoglobin, g/l    | 93.6±1.33        | 94.6±1.61        |
| Leukocytes, 10^{9}/l| 4.3±0.27         | 4.0±0.30         |
| Platelets, 10^{9}/l | 312.3±1.26       | 311.4±1.54       |
| **Indicators at the end of observation** |                     |
| Erythrocytes, 10^{12}/l | 4.8±0.27         | 7.3±0.45**       |
| Hemoglobin, g/l    | 98.5±1.46        | 116.7±1.39**     |
| Leukocytes, 10^{9}/l| 4.7±0.25         | 7.0±0.33**       |
| Platelets, 10^{9}/l | 320.1±1.85       | 280.3±1.41*      |

Note: the reliability of the dynamics of parameters during the observation time * - p <0.05; ** - p <0.01. No differences were found in baseline values for both groups.

Changes of a comparable nature were also found in the level of hemoglobin. Initially, its level in calves was comparable in both groups. After the application of Katozal, its level in calves of the experimental group increased by 23.3%, and in the control group it did not experience significant changes. As a result, the hemoglobin level in the calves of the experimental group at the end of the study was 18.5% higher than the control level.

The level of leukocytes in the blood is very important for the resistance of the organism [11,12]. When taken into the study, the leukocyte counts in both groups of calves were comparable. At the end of the study, the number of leukocytes in calves in the experimental group increased by 75.0%, in the absence of their significant dynamics in the control. At the very end of the observation, this indicator in the calves of the experimental group was higher than in the calves of the control group by 48.9%.

The initially comparable level of platelets in both groups of calves by the end of the observation began to differ. The use of Katozal led to its decrease in calves of the experimental group by 11.1%. In calves of the control group, this indicator remained without significant dynamics. At the time of the end of the study in the experimental group, this indicator became 14.9% lower than the control. Obviously, such differences in the level of platelets provide more effective microcirculation in experimental calves and intensify metabolism.

When assessing the level of biochemical parameters in the calves taken in the study, their positive dynamics was found against the background of the use of Katozal (table 2).

Proteins are a very important biological part of the blood of an animal [13]. Finding out their level in the blood of calves of any age is very important for determining their overall viability [14]. A low amount of total protein in the blood always indicates a weakening of anabolism, which inhibits the growth and development of the animal and lowers the future productivity of the animal [15]. In addition, the content of total protein in the blood is considered a reliable marker of the overall usefulness of the level of proteins in feed in animals [16].

The levels of protein in the blood of the examined calves of both groups were initially at the normal level and comparable. In the course of the study, the total protein content increased significantly in the
During the entire observation period, these calves showed a significant increase in the level of total protein (p<0.01) by 23.4%. At the end of the study, the amount of total protein in calves of the experimental group exceeded its level in control calves by 18.2%.

Table 2. Biochemical markers of blood in calves during the study.

| Indicator, units          | Calf groups, M±m |
|--------------------------|------------------|
|                          | control, n=27    | experienced, n=27 |
| Total protein, g/l       | 65.3±0.67        | 64.2±0.62        |
| Urea, mmol/l             | 5.36±0.31        | 5.40±0.28        |
| Creatinine, mmol/l       | 89.2±1.26        | 88.7±1.11        |
| Inorganic phosphorus, mmol/l | 1.73±0.28    | 1.72±0.15        |
| Reserve alkalinity, volume% | 50.10±1.12      | 50.15±1.16       |
| Carotene, mmol/l         | 7.80±0.13        | 7.79±0.20        |
| Glucose, mmol/l          | 2.35±0.14        | 2.38±0.32        |
| Calcium, mmol/l          | 2.51±0.27        | 2.49±0.24        |

| Indicator, units          | Calf groups, M±m |
|--------------------------|------------------|
|                          | control, n=27    | experienced, n=27 |
| Total protein, g/l       | 67.0±0.45        | 79.2±0.56**       |
| Urea, mmol/l             | 5.39±0.30        | 5.20±0.24        |
| Creatinine, mmol/l       | 91.0±1.16        | 82.3±1.02*       |
| Inorganic phosphorus, mmol/l | 1.75±0.17    | 1.86±0.20        |
| Reserve alkalinity, volume% | 51.16±1.10      | 55.20±1.12       |
| Carotene, mmol/l         | 7.85±0.27        | 8.52±0.30        |
| Glucose, mmol/l          | 2.43±0.32        | 2.72±0.29*       |
| Calcium, mmol/l          | 2.53±0.26        | 2.72±0.31        |

Note: the significance of the dynamics of indicators during the study: * - p <0.05, ** - p <0.01. Baseline values were comparable in both groups.

During the study, the level of urea, a metabolically significant fraction of nitrogen in the blood, was assessed in calves. Its level is considered an important indicator of the course of the entire protein metabolism and a marker of the biological value of proteins consumed by calves with feed [17].

The blood urea level in calves during the study was maintained at the level of the generally accepted norm. By the end of the observation in the control group, the amount of urea in the blood of calves did not change, and in the calves of the experimental group, its amount decreased by 3.8% in relation to the first study. In the experimental group of calves, by the end of the experiment, this indicator was lower than the control value by 3.6%, which indicates a slight tendency towards an increase in the efficiency of assimilation of nitrogen from feed in the experimental calves against the background of Katozal.

Creatinine has a similar value to urea in animals. Its level in the course of the study underwent comparable changes. By the end of the observation period, its concentration in calves from the experimental group was 10.6% lower than that in calves from the control group.

The leading source of energy generation in all organs of animals is glucose. Its level is very important for maintaining the life of all cells. Its main source is food entering the gastrointestinal tract and glycogen deposited in the liver and muscles [18]. The amount of glucose in the blood at the beginning of the study in calves in both groups was similar. It remained within the normal range throughout the study. By the end of the study, in the calves of the experimental group, its level exceeded the level in the control by 13.2%.

Blood indices characterizing mineral metabolism experienced characteristic dynamics. In the end, the concentrations of calcium and inorganic phosphorus in both groups were similar and could be
considered normal. During observation in the control, they remained stable, and the calves of the experimental group experienced a tendency to growth. At the end of the study, the level of calcium in the experimental calves exceeded the level in the control by 7.5%, and the concentration of inorganic phosphorus in them exceeded that in the control by 6.3%.

To maintain the acid-base balance of the blood of animals is of great importance its reserve alkalinity [19]. Initially, in both groups, this indicator was similar and normal. By the end of the study, the experimental calves developed a tendency to increase (by 8.0%) this parameter in comparison with the control level.

The plasma concentration of carotene in the calves of both groups did not differ in outcome. After the application of Katozal in animals of the experimental group, its level increased by 9.3%. In the control group, the indicator remained unchanged. In the last study, the amount of carotene in the plasma of experimental calves tended to prevail over the control level by 8.3%.

4. Conclusion

The growth of food needs of modern society is increasingly raising the issue of continuing the intensification of animal husbandry. Increasing the viability of calves at the end of early ontogenesis, including through the use of biological stimulants, can contribute to solving this problem. Great prospects for this approach are associated with the ability to stimulate all types of metabolism in this way. This is indicated by the dynamics of the main hematological parameters. As a result of the use of seven weekly courses of Katozal at 15.0 ml per day per head in calves of plant nutrition, a very positive dynamics of hematological parameters was achieved. The dynamics of blood parameters obtained with the use of Katozal indicated positive changes in metabolic processes in the observed calves. The changes in the hematological parameters taken into account in them can be considered very favorable for the further development of these calves and their productive potential. In this regard, the use of Katozal in calves at the end of early ontogenesis can be considered very promising for stimulating their growth and resistance.

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