Influence of Feed Supplement ZIGBIR on Biochemical Parameters of Mature Dry Cows

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Abstract. At present, the enterprises of the agro-industrial complex report many cases of cows having liver dysfunctions caused by the failure of metabolic processes. As a rule, in the early stages of the disease, clinical signs are absent; it leads to a productivity decrease, the birth of weak young animals with low adaptive capabilities, and pathologies of the reproductive system. There is a need in drugs and biologically active feed supplements that can prevent and eliminate pathological processes in the liver at early stages, adjusting physiological metabolic processes. The article presents the research results on the use of the herbal feed supplement ZIGBIR having hepatoprotective properties in cows’ diets. Biochemical studies of blood serum have shown a positive effect of the feed supplement on most parameters in relation to physiological norms. Since the studied parameters are referred to as hepatic (they have a diagnostic value for the liver), it is possible to assume an improvement in the functional state of the liver.

1. Introduction
Metabolic disorders hinder the effective use of the genetic potential of dairy cows. Cows are especially susceptible to such disorders during the dry period, since a large amount of nutrients and minerals which cannot be replenished from the diet are taken out with milk during lactation. Metabolic disorders often do not have any clinical picture; however, they lead to a decrease in productivity, impaired reproductive function, and gynecological pathologies. The liver occupies a central place in the dynamics of homeostasis and plays an important role in the implementation of metabolic processes. It is most susceptible to pathological changes in this situation. A key function of the liver is a protective function, which is to detoxify harmful substances coming from outside. These can be drugs, hormones, toxic amines [1, 2, 3]. Therefore, in order to regulate all types of metabolism, the functional state of the liver should be supported with various kinds of drugs, biologically active supplements, both artificially synthesized and of plant origin [1].

The increasing popularity and growing demand are gaining alternative feed supplements, which could increase productivity, stimulate the immune system and provide antioxidant protection [3, 4]. Herbal supplements are currently of particular interest, since they have properties capable of mildly, physiologically acceptable effect on the body of animals, causing practically no harm and side effects. Moreover, they are effective and not inferior in therapeutic effect to synthetic drugs [5, 6].

Veterinary medicine has used herbs and plant extracts as an alternative treatment for decades. Manufacturers who care about the quality of their products are contemplating changes in the feeding strategy, showing interest in replacing antibiotics and growth stimulants with herbal preparations and...
feed supplements that have a positive effect on the oxidative stability of meat and its composition [7, 8, 9, 10].

The feed supplement ZIGBIR used in the research consists of a mixture of dried and crushed medicinal plants. It contains creat (Andrographis paniculata), spreading hogweed (Boerhavia diffusa), gale of the wind (Phyllanthus amarus) and black nightshade (Solanum nigrum). All four plants have hepatoprotective properties, protecting the liver from various toxins. According to foreign sources, ZIGBIR is not toxic to animals, on the contrary, it contains components that tone the liver, improve its functions, accelerate regeneration processes and stimulate sluggish parenchyma. It also improves the secretion and outflow of bile, promoting the metabolism of fats. Tests carried out on various animals have shown that the presence of andrographolide, the main active component of A. paniculata and diterpenoid lactone, contributes to antihepatotoxic activity. The use of A. paniculata extract in the treatment regimen led to a noticeable increase in cellular antioxidant components, while simultaneously reducing lipid peroxidation [11].

Therefore, the feed supplement ZIGBIR, consisting of a set of plants that affect the state and recovery of hepatocytes, is unique and of interest for research.

The research purpose was to study the effectiveness of using the herbal feed supplement ZIGBIR in the diet of mature dry cows and its effect on biochemical parameters of blood.

2. Material and methods

The research experiment was carried out on dry cows in the agricultural cooperative “Imeni Ilyicha” of the Novgorod region. According to the principle of analogs, three groups of animals were formed – the control and two experimental (n = 10 in each) groups – consisting of cows in the start period in regards to the date of the planned calving. The animals of the control group consumed the main diet of the feed available on the farm, adjusted on the basis of the obtained data of their chemical composition. Animals of the first experimental group, in addition to the main diet, received a feed supplement ZIGBIR in the amount of 20g /per head /a day, the second experimental group – 25 g/ per head /a day. The cows are kept tie-down. The animals’ blood was taken from the caudal vein before morning feeding for the study of biochemical parameters.

3. Research results

Blood is the main indicator used to reveal metabolism in the body of animals. As one of the most important structures of the body, blood plays a key role in its functioning and indicates the appearance of the first deviations that do not have clinical symptoms. At the same time, it is necessary to select such indicators that comprehensively reflect the metabolism and health status of animals.

Table 1. Indicators of cows’ blood.

|                      | Control group | Experimental group I | Experimental group II |
|----------------------|---------------|----------------------|-----------------------|
| Total protein, g/l   | 75.33±2.18    | 75.33±2.03           | 76.66±1.85*           |
| Albumin, g/l         | 30.00±0.00    | 34.67±2.60           | 33.33±2.35            |
| Globulin, g/l        | 45.33±1.20    | 40.66±4.63           | 43.33±1.45            |
| Urea, mmol/l         | 4.20±0.12     | 4.77±0.82            | 3.57±0.34             |
| Creatinine, μmol / l| 102.33±2.73   | 110.00±13.01**       | 99.67±4.63            |
| Glucose, mmol / l    | 2.37±0.20     | 2.37±0.28            | 1.83±0.38             |
| Bilirubin total, μmol/l | 2.03±0.24    | 3.30±1.32*          | 3.83±1.39**           |
| AST, IU/l            | 90.33±9.61    | 116.50±5.63          | 99.00±9.53            |
ALT, IU/l  
Alkaline phosphatase, IU/l  
Potassium, mmol/l  
Calcium, mmol/l  
Phosphorus, mol/l  
Gamma - GT, IU/l

|                | Control (25.00±2.65) | Experimental (30.00±2.52)** | Experimental (23.67±2.40) |
|----------------|----------------------|-----------------------------|--------------------------|
| ALT, IU/l      | 25.00±2.65           | 30.00±2.52**                | 23.67±2.40               |
| Alkaline phosphatase, IU/l | 149.33±10.98 | 101.00±18.58                | 132.67±13.32*           |
| Potassium, mmol/l | 4.10±0.15          | 5.10±0.56                   | 3.97±0.23                |
| Calcium, mmol/l  | 2.97±0.09           | 3.17±0.07                   | 3.03±0.20                |
| Phosphorus, mol/l | 1.40±0.17          | 1.60±0.25                   | 1.37±0.18                |
| Gamma - GT, IU/l | 11.85±0.65         | 20.26±1.71                  | 14.09±1.42              |

*P < 0.05; ** P < 0.01; *** P < 0.001

In the dry residue of blood serum, the largest share belongs to the protein, which consists of albumin and globulins. Serum protein affects the viscosity and blood clotting, osmotic pressure; it is involved in the transport of many substances and regulates blood pH and immune processes. In the studied cows, the indicators of total protein corresponded to the physiological norm, with an insignificant difference in the groups. Albumin, synthesizing specific tissue proteins, creates an amino acid reserve in the body and, with a sharp decrease in their indicators, may indicate an amino acid and protein deficiency in the body of cows. In our studies, the concentration of albumin and globulins was within normal limits. The protein index (the ratio of albumin to globulins) indicating protein metabolism intensity was 0.66 in animals of the control group, which is 27% below the lower physiological limit. In the experimental groups that received the feed supplement ZIGBIR in addition to the main ration, this indicator increased, its values (0.9 and 0.8) approached the norm.

The concentration of urea and creatinine, indicating the rate of excretion of protein metabolism products by the kidneys, in all groups of experimental animals is within the physiological norm. The diagnostic indicator of the ratio of urea to creatinine, which allows detecting the early development of renal failure, (0.08 or less) is not exceeded. The normal concentration of bilirubin is 0.7–14 μmol/l, the table data for this indicator in all groups of cows does not go beyond the minimum and maximum values.

The concentration of glucose in the blood is the main indicator of carbohydrate metabolism. Sufficiently low values of glucose in cows participating in the experiment (2.37 mmol/l in cows in the control and first experimental groups and particularly in the second experimental group — 1.83 mmol/l) indicate a deficiency of easily digestible carbohydrates in the cows’ diet. In addition, with the growth of the fetus, the hormonal status is significantly rearranged, which leads to an increase in insulin secretion and a decrease in glucose concentration.

An important diagnostic aspect of biochemical analysis is aminotransferases, an increase in their activity indicates the onset of pathological changes in the liver even before clinical manifestations. Analysis of the research results revealed a slight deviation of ALT and AST values by groups, however, in animals of the first experimental group, the AST activity increased by 22 %, ALT by 17% relative to the control group. Calculation of the ratio of AST to ALT (De Ritis Ratio) showed an excess of normal values. In the control group, its value was 3.61, in the first experimental group – 3.88, in the animals of the second experimental group – 4.18, which indirectly indicates an early stage of chronic hepatitis, but may be a response to an increase in the load on the liver during fetal growth.

The highest content of alkaline phosphatase was found in the animals of the control group – 149.33 IU/l; the inclusion of the feed supplement in the diets reduced its activity in the first experimental group by 47.8%, in the second experimental group — 12.5%. It is noted that an increase in the concentration of alkaline phosphatase is a sign of calcium-phosphorus metabolism disorder, while, at first, there are no changes in the concentration of calcium and phosphorus in the blood serum. Potassium is the main cation in tissue cells, where its constituent, of the total in the body, is 98 %. In our studies in animals of the second experimental group, which received an increased dose of the feed supplement ZIGBIR, a decrease in the concentration of potassium by 12.8% was noted mainly in relation to the first group.
There is an assumption about the negative response of potassium metabolism to an increase in the dose of the feed supplement.

The introduction of the feed supplement ZIGBIR to the diet had a positive effect on the metabolism of both calcium and phosphorus. The concentration of calcium in the blood serum of animals in the first experimental group increased by 6.3%, in the second experimental group – by 2.0%. The value of the phosphorus concentration in the animals of the control group was equal to 1.40 mmol/l; it did not correspond to the physiological norm; in the second experimental group, its content decreased by 0.03 mmol/l more. Presumably, the use of 20 g of ZIGBIR in the diet of the first experimental group of cows increased the amount of phosphorus in the serum by 0.20 mmol/l and brought this indicator to normal values.

Gamma glutamyl transferase (GGT) belongs to a group of peptidases that catalyze the transfer of amino acids from one peptide to another. Its presence is noted in all cells of the body, excluding muscle cells. Nevertheless, the presence of GGT in the blood serum is determined by the synthesis of an enzyme in the liver, and from the point of view of diagnosis, this test is very sensitive regarding the liver pathologies. In our studies, the level of GGT increased by 1.7 times in cows of the first experimental group, and by 18.9% in cows of the second experimental group. However, despite the significant increase in the enzyme values in both groups, they did not exceed the physiological norm, which does not allow speaking about the presence of any liver pathology. An increase in the concentration of the enzyme is possible when amino acids are used mainly for building the body of the fetus, during the period of its intensive growth.

4. Conclusion

The research carried out in the Novgorod region on mature dry cows have shown that the inclusion of the herbal feed supplement ZIGBIR in the diet had a positive effect on the biochemical parameters of the blood serum of animals. The most noticeable effect was found when feeding 20g /per head /a day; increasing the dose is not rational.

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