Metabolic processes of sheep body in treatment of oestrosis with Iversan

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Abstract. The article describes the metabolic processes occurring in the body of sheep during the treatment of oestrosis with Iversan. The final data, in comparison with the initial results, reliably, within the reference ranges, demonstrate a pronounced response of the body, manifested in an increase in the activity of the enzyme alanine aminotransferase by 15.5%, urea by 16.7%, glucose by 9.5%, albumin by 13.6%. A significant decrease in the number of leukocytes by 12.8% was established. There is an insignificant decrease in ESR by 2.6%; the number of erythrocytes increases insignificantly by 3.6% and the level of hemoglobin by 3.8%.

1. Introduction
The Stavropol Territory of the Russian Federation is one of the developed agricultural regions, a significant part of fine-wool sheep population is concentrated here. The problem of cavitary and tissue myiasis expansion is a significant determinant that restrains the intensification of raising small ruminants in the region [1]. During long-term observations, it has been established that the causative agent of ovine oestrosis is a representative of parasitic Diptera Oestridae family from the infraorder of circular-seamed flies, the gadfly Oestrus ovis which inhabits vast territories of the Stavropol Territory steppe zone [1].

In the scientific literature there is a large amount of data on the description of the biology and ecology of the pathogen, its epizootology, pathomorphology, the development of methods of prevention and means of combating this invasion [2]. There are a number of reports on the degree of influence of the larval forms of the nasopharyngeal gadfly Oestrus ovis on the dynamics of metabolic processes in the organism of the parasitic carrier.

In infested sheep, parasitation of gadfly larvae in the nasal cavity, frontal sinuses and spaces of the horny processes is accompanied by a violation of biochemical homeostasis. The development of pathological processes in the body is accompanied by a change in the activity of enzymes, inactivation of metabolic products, activation of cellular immunity, sensitization of the body by the elimination of toxic agents entering the body from the external environment [1, 2].

When studying the effect of the preimaginal O. ovis phases in sheep, a decrease in the hemoglobin level, the number of erythrocytes, and leukocytosis was noted. The analysis of the leukocyte formula made it possible to establish an increase of stab and segmented neutrophils, eosinophils, basophils,
monocytes. The pathological process development is accompanied by an increase in the number of lymphoid T-cells and B-cells, the formation of CIC in the blood, an increase in the activity of enzymes (LDH, γ-GGT, AST, ALT, ALP) [1, 2, 3, 4, 5, 6].

Experimental infection of lambs with gadfly larvae by day 15 revealed a significant decrease in the number of erythrocytes by 18.1% and hemoglobin by 17.7%. On the third day of the experiment, the number of leukocytes significantly increased by 15.3%, stab neutrophils by 46.6%, and the segmented - 42.5%, and on the thirtieth day, these indices reached the level of primary values. On the 15th day of the trial, an increase in basophils by 52.6%, monocytes by 30.0%, and eosinophils by 11.9% was reliably established [1].

At experimental infection of rabbits with O. ovis larvae after 10, 30 days led to leukopenia of 28 and 32% respectively, hemoglobin content decreased by 15, 19 %. AST and ALT activity increased several times.

Therefore, a successful solution to the problem of finding means and perfect methods of combating ovine oestrosis in the region has a significant economic value.

The predominant method for combating oestrosis is chemical, aimed at influencing the larval phase of the parasite. The preference for this method is due to the speed and stability of the therapeutic and prophylactic effect [1].

With parenteral infusion, a 100% efficacy of the drugs hypodectin and bimec was established in sheep infested with larvae of Oestrus ovis [7].

The use of 0.01% cyperil emulsion with oestrosis on the skin does not cause changes in clinical status, hematological and biochemical parameters, provides 100% intens- and extens-efficiency [1].

In scientific and economic experience, with a single treatment, the effect of cypermethrin on sheep body with oestrosis in the composition of a smoke aerosol was studied (1 cm³ of preparation per 1 m² of room). The number of erythrocytes, leukocytes and the content of hemoglobin before and after treatment in animals of the experimental and control groups were within the physiological norm. An increase in the amount of AIT and AST by 8 - 11% was recorded 2 hours after the treatment, and on the 14th day the indices returned to the initial level.

The aim of the study is to describe the exchange processes in the body of sheep for the treatment of oestrosis with the Iversan (series: 020418) drug from the company NVC Agrovetprotection LLC [7–10].

2. Objects and methods of research

The production test of the Iversan preparation (series 020418 by NVC Agrovetprotection LLC) was carried out in the experimental farm of the vil. Tsimlyansky, Shpakovsky district of the Stavropol Territory.

25 lambs of the North Caucasian breed of the experimental (15 animals) and control (10 animals) groups with live weight of 25-35 kg were spontaneously infested with oestrinae larvae. The diagnosis of the invasion presence was based on the clinical and postmortem examination of the mucous nasal cavities and paranasal sinuses of two dead animals, and the discovery of Oestrus ovis larvae in them.

To an experimental group of animals, the preparation Iversan was administered individually, individually, once in a dose of 1 ml per 200 kg of animal weight (200 µgr of ivermectin per 1 kg of animal weight).

Blood serum of lambs spontaneously infested with larvae Oestrus ovis served as the material for the study. Blood was drawn in the morning hours before the feeding, before the drug administration and 14 days later, from the jugular vein. Blood sampling was performed from the same animals (5 heads from each group) in two vacutainers, the first one without an anticoagulant for blood serum isolation, the second containing EDTA-K2 to do the clinical blood analysis.

The following were determined in blood serum: the content of total protein, urea, creatinine, glucose and aminotransferases activity (ALT, AST), alkaline phosphatase (ALP); The amount of total bilirubin was determined on the Accent 200 automatic biochemical analyzer (manufactured by the Cormay company, Poland) and using biochemical test systems of Cormay; the content of protein fractions was
determined by the nephelometric method, the amount of potassium was determined with Cormay biochemical test system, sodium was determined by Olvex biochemical test system, serum iron – with biochemical method, hemoglobin – using test system of Lahema company on a semi-automatic biochemical analyzer StatFax 1904 Plus (manufactured by AWARENESS TECHNOLOGY, USA); the number of erythrocytes and ESR - by the methods offered by the Methodological Recommendations of All-Russian Scientific Research Institute of Sheep and Goat breeding.

Statistical results were calculated using Primer of Biostatistics 4.03. For Windows program by the Student criterion method. The digital material was presented in SI units. The changes compared with the controls were considered reliable at the probability \( p \leq 0.05 \).

3. Results and discussion

Biochemical and hematological studies make it possible to judge about changes in organs and tissues in the absence of obvious clinical signs. The obtained data allow to give a full assessment of the sheep body metabolic condition when using the drug Iversan to fight ovine oestrosis.

To assess the metabolic processes in the organism of animals, we studied the indicators of the activity of serum transferases and protein, carbohydrate, and mineral metabolism.

As a result of biochemical studies of blood serum of lambs treated with Iversan, we obtained the following data shown in table 1.

| Table 1. Results of morpho-biochemical studies of the blood of lambs in the treatment of oestrosis with Iversan. |
|-------------------------------------------------------------|
| Indicators                  | Experiment | Control | Reference values |
|-----------------------------|------------|---------|------------------|
| AST, Units/l                | 102.20±1.5 | 98.59±1.3 | 104.60±3.4 | 102.80±2.2 | 49.00-123.0 |
| ALT, Units/l                | 37.80±1.2  | 43.66±0.5 | 37.61±1.7 | 35.30±1.7 | 15.00-44.0 |
| APT, Units/l                | 205.90±4.6 | 203.10±4.2 | 206.20±3.6 | 207.70±2.3 | 61.00-283.0 |
| Urea, mmol/l                | 6.69±0.11  | 7.81±0.09 | 5.82±0.9 | 9.13±2.5 | 3.70-9.43 |
| Glucose, mmol/l             | 2.53±0.08  | 2.77±0.06 | 2.64±0.03 | 2.61±0.02 | 2.40-4.5 |
| Creatinine, mkol/l          | 79.80±2.7  | 94.60±7.0 | 80.60±4.2 | 82.70±5.4 | 76.00-174.0 |
| Total bilirubin, mkol/l     | 1.77±0.19  | 1.78±0.22 | 1.92±0.25 | 1.89±0.19 | 0.70-8.6 |
| Total protein, g/l          | 73.72±1.9  | 76.72±1.8 | 70.81±2.7 | 71.94±1.7 | 61.00-75.0 |
| Albumin, g/l                | 27.39±0.9  | 31.10±0.5 | 29.46±0.4 | 25.35±1.4 | 24.4-37.5 |
| α Globulines, g/l           | 19.18±1.2  | 15.39±1.0 | 17.82±2.1 | 21.02±1.8 | 7.93-15.0 |
| β Globulines, g/l           | 9.48±1.2   | 11.83±1.1 | 9.93±1.7 | 8.66±1.7 | 4.27-15.0 |
| γ Globulines, g/l           | 16.40±2.1  | 18.39±1.6 | 13.60±2.3 | 16.91±1.3 | 12.20-26.25 |
| AG                          | 0.60       | 0.68     | 0.65     | 0.54     | - |
| Serum iron, mkol/l          | 20.40±0.5  | 19.70±0.4 | 20.90±0.7 | 21.30±0.2 | 12.00-27.0 |
| Na, ml mol/l                | 130.30±3.3 | 135.60±3.1 | 130.30±3.3 | 129.70±4.1 | 142.00-160.0 |
| K, ml mol/l                 | 4.58±0.09  | 4.82±0.11 | 4.81±0.07 | 4.37±0.06 | 4.30-6.3 |
| WBC, xl09/l                 | 7.56±0.3   | 6.70±0.2 | 7.62±0.4 | 8.64±0.9 | 5.00-140 |
| RBC, xl09/l                 | 7.74±0.14  | 8.02±0.2 | 7.71±0.21 | 7.69±0.2 | 7.80-13.8 |
| Parameter | Mean ± SD
|----------------|----------------|
| HGB, g/l | 90.00±1.5 93.40±2.7 90.10±1.4 89.80±1.9 90.00-155.0 |
| ESR, mm/h | 0.78±0.06 0.76±0.04 0.81±0.1 0.86±0.08 0.5-11.5 |

Note: *p≤0.05

It was found that the averaged values of the morpho-biochemical parameters in the control group of sheep had an unreliable character over the entire time of the experiment and, after 14 days, varied within the initial data.

The results obtained in the experimental group showed that the biochemical parameters of the blood serum were within the limits of the physiological norm reference values.

When analyzing the results of the enzymatic activity of the serum and blood in experimental animals, it was established that the activity of serum enzymes was within the physiological norm. At the same time, 14 days after administration of the drug, there was an inter-group difference in these indicators. Thus, AST activity in the experimental group decreases in comparison with this indicator at the beginning of the experiment by 3.6% and was lower than its analogue in the control group by 6.1% on day 14. ALP activity changed similarly. Its activity in the experimental group on 14th day was lower than its analogue at the beginning of the experiment by 1.4% and by 2.3% relative to the alkaline phosphatase activity in animals of the control group on 14 days (table 1).

The ALT activity in the experimental group was significantly higher on the 14th day relative to the experiment beginning by 15.5% and by 23.7% relative to this enzyme activity in the control group on the 14th day (table 1).

During the research work, it was found that all indicators of protein metabolism were within the reference values, but a closer analysis revealed inter-group differences.

The analysis of the obtained results showed that the amount of total protein in the blood serum of the experimental animals on the 14th day was higher than the initial analogous indicator by 4.1% and by 6.6% of the analogue in the control group (table 1).

The concentration of the albumin fraction in the test group on day 14 was significantly higher than the initial data by 13.5%, while the analogous indicator on day 14 was 17.6% lower. Changes in the globulin fraction concentration in experimental animals indicate the presence of an inflammatory process at the beginning of experimental work. The amount of this fraction was higher than the reference values, and was numerically equal to 19.18 g/l in the experimental group and 17.82 g/l in the control group. On the 14th day of the experiment, a decrease in the concentration of this fraction by 24.6% was observed in the serum of lambs injected with oral preparation Iversan. In the blood serum of control lambs, an increase in this indicator on the 14th day by 18.0% was established, which indicates the development of an inflammatory process in the body of animals (table 1).

A detailed analysis of protein fractions concentration reveals a redistribution of protein metabolism components in the control group due to a decrease in albumins and an increase in globulins. The consequence of this was the violation of the ratio albumin-globulin factions (albumin-globulin coefficient). A disturbance in the dynamic equilibrium of protein metabolism components in all experimental animals was found. In addition, the albumin-globulin coefficient in the experimental group was 25.9% higher than that in the control group.

The urea amount in the blood serum in the experimental animals on the 14th day was significantly higher by 16.7% than at the beginning of the experiment, but by 16.9% lower than the analogue of the control group on the 14th day. The creatinine concentration in the blood serum of lambs which received Iversan enterally once individually at a dose of 1 ml per 200 kg of live weight (200 μg of ivermectin per 1 kg of live weight) on the 14th day was higher by 14.4% than the creatinine concentration in lambs infested by O. ovis (table 1).

When analyzing the morpho-biochemical blood parameters of experimental animals (table 1), it was found that the amount of glucose, serum iron, and total bilirubin content in the blood serum of lambs for all the time of the experiment had an invalid character and after 14 days of experiment varied within the reference values. At the same time, the concentration of potassium at the lower limit of the reference
values should be noted, and the concentration of sodium in the blood serum of lambs is less than the lower level of reference data, which indicates a violation of the water-salt balance in the body of animals.

Analysis of blood morphological parameters showed that on the 14th day of treatment with Iversan, there was a decrease in leukocytes and ESR number relative to the beginning of the experiment by 12.8% and 2.6%, respectively; an increase in the number of erythrocytes by 3.6% and in the hemoglobin level – by 3.8%. At the same time, in the experimental animals blood on the 14th day there was an increase in the leukocytes number of 13.4%, in ESR – of 6.2% relative to the beginning of experiment, and a decrease in hemoglobin concentration and erythrocytes number of 0.3% is observed (table 1).

4. Conclusion
The conducted laboratory studies are an important part of the research, as they demonstrate the visual signs of the effect of Iversan on the lambs body, reflecting changes in metabolic processes.

The research results demonstrate that the use of Iversan at a dose of 1 ml per 200 kg of body weight of an animal causes a pronounced response of the body, which is manifested in an increase in the content of total protein by 4.1%, albumin fraction by 13.5%, urea by 16.7%, creatinine by 4.4%, a decrease in the number of leukocytes and ESR relative to the beginning of the experiment by 12.8% and 2.6%, respectively.

The drug Iversan can be recommended for the fight against ovine oestrosis.

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