DYNAMICS OF CHANGES IN SOME HEMATOLOGICAL PARAMETERS OF EXPERIMENTAL MARSHALLAGIOSIS IN KARAKUL LAMBS

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Annotation: The article investigates the impact and consequences of marshallagiosis, a type of helminth infection common in sheep, on various hematological indices (erythrocytes, leukocytes, platelets, hemoglobin, ESR, leukogram).

Keywords: Karakul lambs, erythrocytes, leukocytes, platelets, hemoglobin, ESR, leukogram, preimaginal, postimaginal stage, helminthosis, marshallagiosis.

Objective: To identify the effect of marshallagiosis on certain hematological indices of Karakul lambs's blood.

Relevance of the topic: It is known that ensuring the population with high-quality and safe meat, milk, wool, and other livestock products is one of the pressing issues in our country's agricultural policy. Livestock, including sheep, goats, and small ruminants, are widely used as sources of meat products, hides, and wool in national economy. Developing the livestock sector in line with modern requirements involves addressing various issues, including preventive measures against livestock diseases. Studies have shown that various diseases affecting livestock lead to a decrease in livestock products by 35-40%.

Specifically, due to the high adaptability and acclimatization characteristics of sheep, which are the subject of this study, rational use of extreme mountainous conditions of the inhabited areas provides the opportunity to improve the social and economic situation of the population living in these regions. In this context, considering the high productivity of sheep in providing quality meat, wool, and valuable skins, it is important to develop practical recommendations aimed at improving their feeding in mountainous and pasture

conditions, enhancing their immune resistance, early detection, and prevention of parasitic diseases. Therefore, the development and implementation of practical recommendations in this area are of great importance today.

Materials and methods of research: Experiments were conducted on sheep at the "Qarnab" factory type. For experimental studies on the investigation of experimental marshallagiosis, nematodiriosis, and xabertiosis, 20 heads of sheep aged 3-4 months were selected and divided into 2 groups.

All sheep used in the experiment were selected in a healthy condition, not harmed by natural helminths, and housed in conditions free from other parasitic and non-parasitic diseases. Initially, all control and experimental sheep's clinical, hematological, and biochemical indices were identified twice, and then the sheep selected for the experiment were infused with soft cultures of invasive strongylate larvae (marshallagia) directly into the rumen using a rubber catheter. In this case, 5000 samples of invasive larvae were used for each organism. The invasive larvae of strongylate collected from donors served as infectious material for the sheep. The collection and cultivation of marshallagia, nematodirus, and xabertial larvae and invasive larvae were generally approved according to the method of "helminthology" by Fulleborn.

Throughout the entire experiment, the general physiological indices of the experimental and control sheep were identified in the second phase after 2 months and in the late afternoon; body temperature (through the rectal), heart rate (through the anterior artery), and respiratory rate (by widening and shortening the nasal tip) were determined. All experimental animals were monitored for 70-75 days (after invasion damage) and were fully inspected for helminthology according to the academic K.I. Skryabin method.

The results obtained were thoroughly analyzed, and the physiological, clinical, and biological changes of all control and experimental group sheep were described. Blood was taken from the jugular vein of all control and experimental sheep before damage from invasion, and initial indicators were identified. The following indicators were then analyzed after invasion damage - 5, 15, 35, 55, 70- days.

Hematological indicators; blood shape elements: erythrocytes, platelets, leukocyte number, hemoglobin index - worked with the laser automatic hematological analyzer operating on the Goryaev method (Mendray BC-5000b China GOST-20790-93), and the erythrocyte sedimentation rate (ECHT) was determined by the Panchenkov-Nevidov apparatus.

Research Results: It is known that parasitic infections have multiple detrimental effects on the animal organism, encompassing not only mechanical and toxic but also immunopathological impacts. Parasitic infections compromise immunity in affected animals, increasing susceptibility to parasitic and other diseases. Morphological and biochemical blood tests play a crucial role in understanding the pathogenesis of any disease. Therefore, based on the results of morphological and biochemical blood indices, it is possible to assess the functional activity of the body systems of diseased animals.

According to the data presented in Table 1, prior to parasite infection, the average red blood cell count in the experimental sheep's blood was approximately 7.9±0.5 million cells per milliliter. Following infection with marshallagia, on the first day of the study, the number of erythrocytes in the blood started to decrease, reaching 7.38±0.46 million cells by the second day and 6.49±0.39 million cells by the fifth day. The most significant decrease in erythrocyte count was observed around days 10-15 of the infection, where it dropped to approximately 4.25±0.5 and 5.29±0.37 million cells, respectively. From days 25 to 35 of the infection period, the number of red blood cells increased again, but this indicator remained relatively lower compared to initial and control levels. The results obtained on days 45, 55, and 70 of experimental damage showed a normalization of red blood cell counts in the blood ($P \leq 0.01$).

At the beginning of marshallagia infection, the overall hemoglobin level in the sheep's body also significantly decreased. For example, on day 5 of the infection, it decreased to 15.45±0.52 g/L compared to the initial and control levels. During the tissue-feeding phase of marshallagia development (day 10 of infection), there was a sharp decline in hemoglobin levels in the blood, reaching 71.8±0.11 g/L, and by day 15, with the emergence of preimaginal marshallagia larvae, this indicator dropped to 67.7±0.21 g/L

(P≤0.01). Hemoglobin levels slightly increased during the imaginal development phase of marshallagia, but they remained lower compared to initial and control levels.

The parallel decrease in erythrocyte count and hemoglobin level in the blood indicates the development of anemia in sheep affected by marshallagiosis. One characteristic sign of marshallagia is the accelerated erythrocyte sedimentation rate (ESR). ESR is considered one of the most important physiological characteristics of blood and is due to the hydrophilicity of erythrocytes' surface in their suspended state in plasma, as well as their negative charge, allowing them to repel each other. If the shaped elements have a negative charge, their electrostatic repulsion is reduced, resulting in the absorption of positively charged molecules such as fibrinogen, gamma globulins, and paraproteins onto their surfaces. Such erythrocytes can adhere to each other, forming "rouleaux" on their surfaces. The formation of "rouleaux" can lead to capillary blockage and impaired blood circulation in tissues and organs. ESR mainly increases with dehydration, infectious diseases, oncological diseases, as well as sharp decreases in the number of erythrocytes in the blood (anemia) are observed.

Table 1

Experimental blood indices of sheep affected by marshallagiosis (n=5)

Research period	Groups	Up to the time of infection	Days after infection				
			5	15	35	55	70
erythrocytes, mln/mm^3	research	7,9±0,5	6,49±0,39	5,29±0,37	6,79±0,25	11,2±0,6*	10,82±1,1
	control	7,7±0,5	7,8±0,4	7,7±0,3	9,1±0,4	7,7±0,5	9,0±0,6
hemoglobin, g/l	research	122,02±0,42	106±0,09**	67,7±0,21**	79,3±0,21	70,1±1,0*	70,4±1,2**
	control	120,9±0,8**	116,05±0,6	111,95±0,5	108,6±0,8	112,3±0,5	109,1±0,5
ECHT, mm/hour	research	7,8±0,85	20,4±1,67*	12,7±1,33	24,5±1,05	7,50±0,8*	10,8±0,4
	control	9,0±0,8	9,8±0,65	9,3±0,81	9,1±0,6	9,0±0,8	9,1±0,3
Leukocytes, thousand/mm3	research	7,65±0,55	9,25±0,52	9,34±0,96	12,65±0,92*	12,0±1,1	13,7±1,1*
	control	9,0±0,4	9,6±0,5	9,0±0,6	9,0±0,8	9,3±0,8	9,1±0,5
Platelets, x10^9/L	research	303±0,08**	317,1±0,12	312±0,47*	327,23±0,6	317,14±0,4*	317,61±0,33
	control	300±0,07	302,1±0,12	300±0,47	302,23±0,6	303,14±0,4	301,61±0,33

During our research, Erythrocyte Sedimentation Rate (ESR or EChT) increased significantly at almost all stages. For instance, on the second day after infection, ESR slightly accelerated to 9.40±0.50 mm/h, and by days 5 and 10, it reached 20.4±1.67 and 21.25±1.5 mm/h, respectively. In experimental sheep, the maximum acceleration of ESR

was observed on day 25 of infection, reaching 32±1.5 mm/h. Towards the later stages of the research (days 55-70), during the chronic phase of the disease or the post-imaginal phase, ESR gradually decreased again to 7.50±0.8 and 10.8±0.4 mm/h, approaching the control group indicators (Table 1). Apart from that, the crucial role of the blood clotting system was assessed, and the number of platelets also showed characteristic changes, increasing to 322.02±0.3 thousand per ml of blood during the preimaginal phase of the invasion (days 15-20). Subsequently, by days 50-55 of the study, this indicator slightly decreased to 319.77±0.2 thousand, but remained within normal levels observed in control and healthy states. The quantity of leukocytes in the blood of sheep affected by marshallagiosis initially averaged 8.65 thousand per milliliter of blood. A sharp increase in the number of leukocytes was not observed in the first 5-10 days after experimental damage, but leukocytosis (an increase in leukocyte count) was noted from day 25 of the invasion until the end of the research (day 70) (Table 2).

Table 2.

Leukogram of sheep affected by experimental marshallagiosis. Mean ± SD (n=5)

Research time		Groups	Up to the point of infection	Days after infection				
				5	15	35	55	70
Leukocyte differential count	metamyelocytes ,%	research	2,4±0,5	3,6±0,5*	4,2±0,02	4,5±0,9	4,3±3,5**	4,3±0,5
		control	2,3±0,1	2,3±0,8	2,3±0,5	2,3±0,95	2,3±0,1	2,3±0,05
	Age,%	Research	1,0±0,05	1,0±0,1	1,5±0,12	2,0±0,2	101±0,07	1,2±0,1
		control	0,5±0,05	0,48±0,05	0,5±0,8	0,5±0,05	0,49±1,3	0,49±0,9
	band neutrophils,%	research	2,7±0,17	3,7±0,17	4,4±0,3	4,0±0,17	3,9±0,12	3,4±0,2
		control	1,4±0,5	1,3±0,99	1,5±4,5	1,4±0,9	1,5±0,1	1,4±1,5
	segmented neutrophils,%	research	40,9±2,0**	41,3±1,7	41,0±1,6	9,7±1,3**	39,0±1,2	39,0±1,24
		control	38,7±1,52	38,0±5,5	29,5±0,5	35,5±0,5	36,9±0,05	38,4±0,9
	eosinophils %	control	2,7±0,2	4,5±0,3	3,7±0,3	4,0±0,27	3,1±0,17	3,0±0,17
		research	2,6±0,25*	4,5±0,2	5,44±0,5	7,5±0,3*	8,1±0,5	9,6±0,5
	monocytes %	control	3,2±0,1	3,4±0,12	3,0±0,1	3,3±0,2	3,1±0,12	3,7±0,2
		research	3,29±1,2	3,5±2,3	4,0±3,5	5,2±2,9**	5,6±0,2	6,3±1,8
	basophils %	control	0,8±0,01	1,0±0,04	1,5±0,1	1,0±0,1	0,8±0,03	0,87±0,07
		research	1,3±0,15	2,5±3,3	5,1±2,5**	6,1±0,5	6,5±3,5**	6,6±3,2
	lymphocytes %	control	47,7±1,7	45,0±2,0	44,9±1,7	46,0±2,0	49,0±2,0	49,0±1,9
		research	49,7±3,1	55,6±1,2	61,3±0,9	64,4±2,1	65,4±0,5	65,8±0,6

If we analyze the results obtained from the leukogram, during the experiment, an increase in eosinophils and band neutrophils, and a decrease in monocytes and lymphocytes counts were observed, indicating a left shift in the leukogram.

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