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BLOOD CHARACTERISTICS IN SHEEP WITH VARIOUS FORMS OF DERMATITIS

Annotation. This study provides a comprehensive analysis of hematological and biochemical blood parameters in sheep with dermatitis of varying severity and etiology.

The data obtained demonstrate a clear relationship between the severity of skin lesions and changes in blood composition. Hematological parameters indicate a decrease in hematocrit and hemoglobin levels with increasing severity of dermatitis, which may indicate a violation of erythropoiesis or suppression of bone marrow function in conditions of inflammation and chronic intoxication. At the same time, there is an increase in erythrocyte sedimentation rate (ESR), leukocyte count, neutrophils, and eosinophils, reflecting activation of the immune response and the presence of a systemic inflammatory process. Signs of thrombocytopenia have been identified in severe cases of the disease, which is associated with the redistribution of blood elements and toxic effects.

Biochemical blood analysis shows a tendency toward increased levels of bilirubin, liver enzymes (ALT, AST), creatinine, and alkaline phosphatase as dermatitis progresses, indicating the involvement of the liver and kidneys in the pathological process and the development of toxic damage. An increase in total protein and globulins indicates enhanced synthesis of acute phase proteins and activation of the immune system.

Thus, changes in hematological and biochemical blood parameters serve as important diagnostic and prognostic markers of the severity of dermatitis in sheep. Their comprehensive study allows assessing the general condition of the animals, identifying pathophysiological disorders, and contributes to the selection of adequate therapeutic measures. The results of the study emphasize the importance of blood monitoring in skin diseases of sheep of various etiologies.

Keywords: *dermatitis, hematological parameters, skin inflammation, leukocytes, hemoglobin, pathology, diagnostics, biochemical parameters.*

Introduction

Sheep health in Kazakhstan plays an essential role in the overall agricultural productivity and socio-economic stability of the country. The importance of sheep farming is deeply rooted in the cultural and economic framework of Kazakhstan, where sheep not only provide meat and wool but also serve as a crucial source of livelihood for many rural communities. The interplay of local breeds, such as the Baisary fat-tailed sheep, which are genetically suited to the country's harsh climatic conditions, underscores the significance of maintaining robust health standards in sheep rearing. This adaptability allows for the sustenance of sheep populations amidst environmental challenges, making it crucial to prioritize their health.

Veterinary care is vital for ensuring sheep health, as various diseases pose significant threats to livestock production. Infectious diseases such as sheep pox, which is a notifiable disease due to its rapid spread and economic impact, demand comprehensive veterinary strategies to manage and mitigate outbreaks effectively Abdolla (2023). Furthermore, endemic diseases like echinococcosis are prevalent in sheep populations across Kazakhstan, with a prevalence of approximately 30% to 50%, highlighting the necessity for continuous health monitoring and management practices to safeguard animal welfare and productivity (Abdybekova et al., 2015).

Additionally, advancements in veterinary medicine, such as genetic characterizations of indigenous breeds, are contributing to a deeper understanding of the specific health needs of sheep in Kazakhstan (Dossybayev et al., 2019). Monitoring nutrition during critical periods, such as late pregnancy, is essential to optimizing health outcomes and ensuring the welfare of both ewes and their offspring (Phillips et al., 2014). Researchers emphasize the role of effective pain management and welfare assessments in enhancing sheep health, encouraging veterinary practitioners to develop comprehensive health management plans that consider both disease prevention and the overall well-being of the flock (Lizarraga & Chambers, 2012).

Ensuring optimal sheep health in Kazakhstan requires a multifaceted approach involving veterinary intervention, disease management, and adherence to nutritional standards. Strategies that integrate traditional knowledge with modern veterinary practices will be vital to enhancing sheep health, thereby supporting the resilience of rural communities that rely on this vital livestock sector.

Skin diseases of various etiologies are one of the main causes of reduced sheep productivity. The most common are invasive dermatitis (sarcoptosis, malophagosis, syphunculosis), especially in the autumn-winter period, which is due to the deterioration of zoohygienic conditions of keeping. At the same time, these diseases often occur in an associated form, complicating diagnosis and treatment. Changes caused by skin lesions affect hematological and biochemical parameters, which can be used as diagnostic criteria for the severity of the pathological process.

The aim of the study is to identify general patterns of changes in hematological and biochemical blood parameters in sheep with various forms of dermatitis.

Materials and methods of research

The study was conducted on clinically examined sheep aged 1–1.5 years in the Abay region. All animals were kept under the same feeding and housing conditions. Selection was based on uniformity in age, sex, breed, and weight.

Experimental groups were formed based on the severity of skin lesions: Group 1 (n=5): initial stage of dermatitis (primary signs, mild course); Group 2 (n=5): moderate dermatitis; Group 3 (n=5): generalized dermatitis (intense lesions, severe course); Group 4 (control, n=5): clinically healthy sheep (similar in all parameters).

Body temperature, heart rate, respiratory rate, rumen activity, as well as general condition and behavior were recorded in all animals.

Blood was taken on an empty stomach from the jugular vein under aseptic conditions for hematological (total erythrocytes, leukocytes, hemoglobin, hematocrit, leukocyte formula) and biochemical analysis (total protein, albumin, globulins, urea, creatinine, ALT, AST, calcium, phosphorus, etc.).

Biochemical blood parameters were studied using a Stat Fax 4500 analyzer (Awareness Technology, USA), and hematological parameters were studied using a URIT-2900 Vet Plus hematology analyzer. The Stat Fax 4500 analyzer is designed for 12 mm diameter tubes and allows dynamic processing of colorimetric samples. The URIT-2900 Vet Plus automatically determines the number of animal blood cells, including WBC, RBC, PLT, and HGB, using electrical resistance and photometric methods.

Clinical manifestations of skin lesions were confirmed by laboratory methods: microscopy of scrapings and identification of parasites (sarcoptids, lice, hair lice), with a diagnosis based on the classification of dermatitis (invasive, non-contagious, infectious).

The results obtained were processed using variational statistics methods with standard software packages. Differences were considered statistically significant at $P < 0.05$.

Results

A veterinary clinical examination of sheep with varying degrees of skin damage revealed a certain correlation between the severity of dermatitis and changes in physiological parameters. The most pronounced deviations were observed in animals with generalized dermatitis.

Thus, in sheep of this group, the following was observed: an increase in body temperature by an average of 0.5°C compared to normal; an increase in respiratory rate by an average of 6 breaths per minute; an increase in pulse rate by 15–18 beats per minute.

In animals with mild and moderate dermatitis, these indicators did not exceed physiological norms. In some cases, values close to the upper limit of normal physiological fluctuations were recorded, but no statistically significant differences compared to the control group were found ($p > 0.05$).

Table 1 presents the results of hematological analysis of blood samples from sheep with varying degrees of dermatitis of non-parasitic etiology. Analysis of the data obtained indicates a correlation between the severity of skin lesions and changes in the morphological composition of blood.

Table 1 - Hematological parameters of sheep with dermatitis of varying severity

Indicator	Normal Range	Mild Form	Moderate Form	Generalized Form
Hematocrit, %	25–37	22.3 ± 2.2	20.1 ± 2.0	18.7 ± 1.9
Hemoglobin, g/L	112–160	88.6 ± 8.9	81.3 ± 8.1	76.5 ± 7.7
Erythrocytes, $\times 10^{12}/\text{L}$	10.5–17.0	13.7 ± 1.4	10.1 ± 1.0	8.6 ± 0.9
Erythrocyte Sedimentation Rate (ESR), mm/h	1–2	3.2 ± 0.3	4.8 ± 0.5	7.5 ± 0.8
Leukocytes, $\times 10^9/\text{L}$	4.0–12.0	8.1 ± 0.8	13.9 ± 1.4	17.5 ± 1.8
Band Neutrophils, %	4–20	13.5 ± 1.4	18.2 ± 1.8	15.4 ± 1.5
Segmented Neutrophils, %	25–45	31.2 ± 3.1	24.6 ± 2.5	19.3 ± 1.9
Eosinophils, %	0–6	2.7 ± 0.3	4.9 ± 0.5	7.6 ± 0.8
Lymphocytes, %	50–70	28.3 ± 2.8	39.7 ± 4.0	56.2 ± 5.6
Platelets, $\times 10^9/\text{L}$	300–500	164.5 ± 16.5	192.8 ± 19.3	221.1 ± 22.1

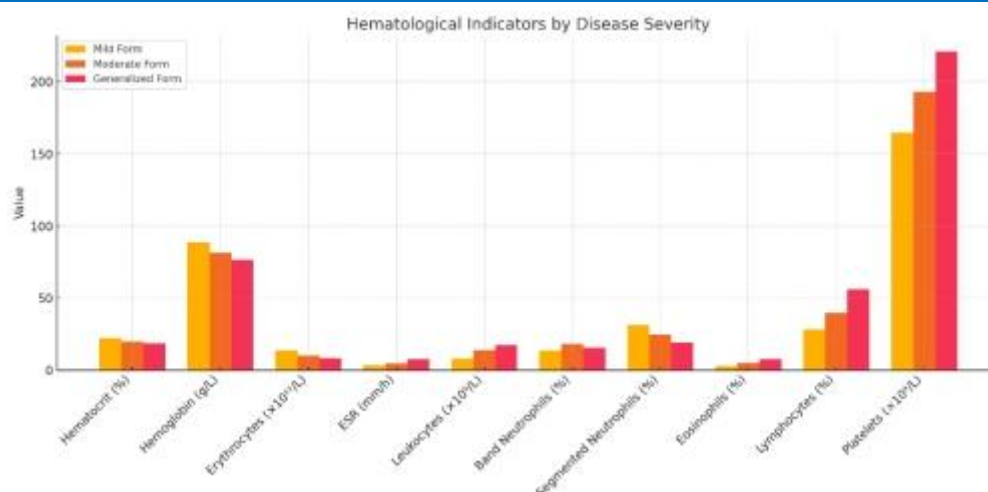


Figure 2 – Hematological indicators by Disease Severity

Analysis of the data presented in Table 1 reveals a clear correlation between the severity of dermatitis and changes in key hematological parameters.

Thus, there is a tendency toward a decrease in hematocrit and hemoglobin concentration as the severity of the pathological process increases. This may indicate a violation of erythropoiesis or general suppression of bone marrow function against the background of an inflammatory reaction and chronic intoxication of the body.

At the same time, indicators such as ESR, leukocyte count, neutrophils, and eosinophils show a sustained upward trend, which is especially pronounced in the generalized form of dermatitis. Such dynamics indicate the presence of a systemic inflammatory process and activation of the immune response.

Special attention should be paid to the detection of signs of thrombocytopenia in animals with severe dermatitis, which may be associated with chronic intoxication and redistribution of blood elements in conditions of inflammation.

An increase in ESR and eosinophil levels further confirms the presence of inflammatory processes and, possibly, allergic reactions in the animal's body.

Thus, the results obtained confirm that the intensity of skin lesions in dermatitis of various etiologies in sheep directly correlates with the severity of hematological changes, which can be used as a diagnostic criterion for the severity of the disease and assessment of the general condition of the organism.

Table 2 — Biochemical blood parameters in sheep with dermatitis of various etiologies

Indicator	Normal Range	Mild Form	Moderate Form	Generalized Form
Bilirubin, $\mu\text{mol/L}$	1.6–4.2	3.8 ± 0.4	5.3 ± 0.5	8.7 ± 0.9
AST (Aspartate Aminotransferase), U/L	up to 100	61.2 ± 6.1	123.4 ± 12.3	161.9 ± 16.2
ALT (Alanine Aminotransferase), U/L	up to 45.0	43.1 ± 4.3	59.8 ± 6.0	70.6 ± 7.1
Urea, mmol/L	4.2–6.2	5.4 ± 0.5	7.3 ± 0.7	8.9 ± 0.9
Creatinine, $\mu\text{mol/L}$	60–135	142.7 ± 14.3	201.3 ± 20.1	259.8 ± 26.0
Total Protein, g/L	60–75	72.6 ± 7.3	77.9 ± 7.8	88.2 ± 8.8
Albumin, g/L	22.8–34.9	32.8 ± 3.3	34.6 ± 3.5	37.5 ± 3.8
Globulins, g/L	37.3–42.2	39.8 ± 4.0	43.3 ± 4.3	50.2 ± 5.0
Alkaline Phosphatase, U/L	up to 290	283.4 ± 28.3	325.7 ± 32.6	511.6 ± 51.2

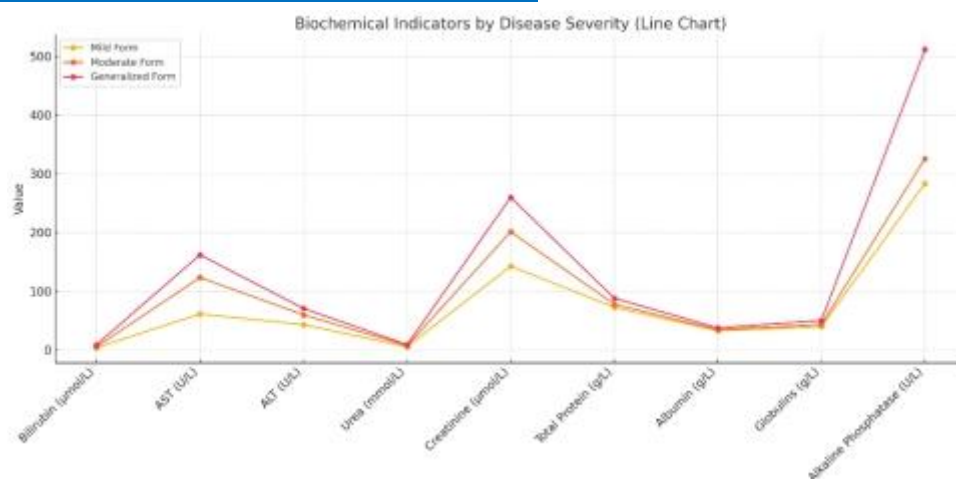


Figure 1 – Diometrical indicators by Disease Severity

Table 2 presents the results of biochemical blood analysis of sheep with varying degrees of skin damage caused by non-parasitic etiology. Analysis of the results shows a clear trend toward an increase in most biochemical parameters as the intensity of the pathological process increases.

Increased concentrations of bilirubin, AST and ALT enzyme activity, creatinine and alkaline phosphatase levels indicate the development of toxic liver damage, which is probably associated with general intoxication of the body due to an inflammatory reaction and tissue breakdown in the area of skin lesions. This indicates the involvement of the liver and kidneys in the pathological process in generalized forms of dermatitis.

An increase in total protein, especially due to globulins, may reflect activation of the immune system and increased synthesis of acute phase proteins.

Thus, the biochemical profile of blood in sheep with non-parasitic dermatitis allows these indicators to be used as diagnostic and prognostic criteria reflecting the severity of the pathological condition.

Discussion

The study of hematological and biochemical blood parameters in sheep with dermatitis of various etiologies is important for assessing the general state of health and identifying pathophysiological changes caused by this disease. Dermatitis in sheep can develop under the influence of various factors - infectious agents, parasites, allergens, and unfavorable external conditions, each of which has a specific effect on blood parameters. Changes in hematological and biochemical markers serve as key indicators of the physiological state of animals and allow the identification of disorders associated with skin pathology.

Hematological studies of sheep with parasitic dermatitis demonstrate dynamics similar to those observed in non-parasitic dermatitis. As the degree of skin damage increases, there is a tendency toward a decrease in hematocrit and hemoglobin levels, indicating a disruption of erythropoiesis and the development of anemia characteristic of chronic inflammatory and intoxication processes. At the same time, there is an increase in erythrocyte sedimentation rate (ESR), as well as in the number of leukocytes, neutrophils, and eosinophils, which is especially pronounced in generalized forms of the disease, indicating an active systemic inflammatory response. An increase in eosinophils reflects the allergic and parasitic nature of the processes, confirming the importance of the immune response in the pathogenesis of dermatitis of parasitic etiology. Thrombocytopenia and delayed erythropoiesis in severe forms of the disease are likely associated with the toxic effects of parasite waste products and tissue breakdown, leading to intoxication of the body (Bagamaev et al., 2018; Akbaev et al., 2015; Agarkova et al., 2019).

Biochemical studies of blood from sheep with parasitic dermatitis revealed a sustained increase in bilirubin, aspartate aminotransferase (AST), alanine aminotransferase (ALT), creatinine, and alkaline phosphatase levels as the intensity of the invasion increased. These changes indicate toxic damage to the liver and other internal organs caused by a general inflammatory process and intoxication with the products of decay of the affected tissues and parasite metabolites. The increase in the activity of these

enzymes indicates damage to hepatocytes and metabolic disorders (Kumar et al., 2015; Sajid et al., 2023).

A comparison of hematological and biochemical data in dermatitis of various and parasitic etiologies shows significant similarities in the pathophysiological reactions of the body. This confirms the hypothesis that skin lesions of different origins activate universal mechanisms of inflammation and intoxication, which must be taken into account in the diagnosis and treatment of skin diseases in sheep (Bagamaev et al., 2019; Agarkova & Chernobai, 2021).

Thus, a comprehensive analysis of hematological and biochemical blood parameters plays a key role in the diagnosis of dermatitis in sheep, allowing the severity and nature of the pathological process to be assessed. The data obtained serve as an important basis for selecting effective therapeutic and preventive measures, as well as contributing to the improvement of animal husbandry practices and the welfare of sheep.

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ДЕРМАТИТТІҢ ӘРТҮРЛІ ТҮРЛЕРІ БАР ҚОЙЛАРДЫҢ ҚАН КӨРСЕТКІШТЕРІ

Аннотация: Бұл жұмыста әртүрлі этиологиясы мен ауырлық дәрежесіндегі дерматиттерге шалдыққан қойлардың қанының гематологиялық және биохимиялық көрсеткіштеріне кешенді талдау жүргізілді. Алынған деректер тері зақымдану деңгейі мен қан құрамындағы өзгерістер арасында айқын байланыс бар екенін көрсетеді. Гематологиялық көрсеткіштер дерматиттің ауырлығы артқан сайын гематокрит пен гемоглобин деңгейінің төмендейтінін көрсетеді, бұл эритропоэздің бұзылуына немесе қабыну мен созылмалы интоксикация жағдайында сүйек кемігінің функциясының тежелуіне байланысты болуы мүмкін. Сонымен қатар, эритроциттердің шөгу жылдамдығы (СОЭ), лейкоциттер, нейтрофилдер мен эозинофилдер санының артқаны байқалады, бұл иммундық жауаптың белсенуі мен жүйелі қабыну процесінің бар екенін білдіреді. Ауру ауыр өткен жағдайда тромбоцитопения белгілері анықталды, бұл қан элементтерінің қайта бөлінуі мен уытты әсерге байланысты.

Қанның биохимиялық талдауы дерматиттің өршуіне қарай билирубин, бауыр ферменттері (АЛТ, АСТ), креатинин және сілтілік фосфатаза деңгейінің артатын үрдісін көрсетеді, бұл бауыр мен бүйректің патологиялық процеске тартылып, уытты зақымдану дамып жатқанын білдіреді. Жалпы белок пен глобулиндердің жоғарылауы қабынудың жедел фазасына тән белоктардың синтезінің күшеюі мен иммундық жүйенің белсендірілуін көрсетеді.

Осылайша, қойларда дерматиттердің ауырлығын бағалауда гематологиялық және биохимиялық көрсеткіштердің өзгерістері маңызды диагностикалық және болжамдық маркерлер болып табылады. Бұл көрсеткіштерді кешенді зерттеу жануарлар организмінің жалпы жағдайын бағалауға, патофизиологиялық ауытқуларды анықтауға және тиімді емдеу шараларын таңдауға мүмкіндік береді. Зерттеу нәтижелері әртүрлі этиологиядағы қойлардың тері ауруларында қан көрсеткіштерін бақылаудың маңыздылығын атап көрсетеді.

Түйінді сөздер: дерматит, гематологиялық көрсеткіштер, тері қабынуы, лейкоциттер, гемоглобин, патология, диагностика, биохимиялық көрсеткіштер.

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Аннотация: В данной работе проведён комплексный анализ гематологических и биохимических показателей крови овец с дерматитами различной степени тяжести и этиологии. Полученные данные демонстрируют чёткую зависимость между выраженностью кожных поражений и изменениями в составе крови. Гематологические показатели свидетельствуют о снижении уровня гематокрита и гемоглобина при увеличении тяжести дерматита, что может указывать на нарушение эритропоэза или угнетение костномозговой функции в условиях воспаления и хронической интоксикации. Одновременно отмечается повышение скорости оседания эритроцитов (СОЭ), количества лейкоцитов, нейтрофилов и эозинофилов, отражающее активацию иммунного ответа и наличие системного воспалительного процесса.

Выявлены признаки тромбоцитопении при тяжёлом течении заболевания, что связано с перераспределением кровяных элементов и токсическим воздействием.

Биохимический анализ крови показывает тенденцию к увеличению уровней билирубина, ферментов печени (АЛТ, АСТ), креатинина и щелочной фосфатазы по мере прогрессирования дерматита, что свидетельствует о вовлечении печени и почек в патологический процесс и развитии токсического поражения. Повышение общего белка и глобулинов указывает на усиление синтеза белков острой фазы воспаления и активацию иммунитета.

Таким образом, изменения в гематологических и биохимических параметрах крови служат важными диагностическими и прогностическими маркерами тяжести дерматитов у овец. Их комплексное изучение позволяет оценить общее состояние организма животных, выявить патофизиологические нарушения и способствует выбору адекватных лечебных мероприятий. Результаты исследования подчёркивают значимость мониторинга крови при кожных заболеваниях овец различной этиологии.

Ключевые слова: дерматит, гематологические показатели, воспаление кожи, лейкоциты, гемоглобин, патология, диагностика, биохимические показатели.

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EPIZOOTIC SITUATION ANTHRAX IN EAST KAZAKHSTAN REGION

Abstract: Anthrax remains one of the most dangerous zoonotic infections affecting livestock and humans worldwide. The pathogen [Bacillus anthracis](#) is characterized by exceptional environmental persistence due to its ability to form spores that can remain viable in soil for several decades. Kazakhstan is historically endemic for anthrax, and the East Kazakhstan Region is among the areas with the highest concentration of burial sites of animals that died from the disease. This expanded manuscript provides a comprehensive analysis of the epizootic situation of anthrax in the region by