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THE MORPHOLOGICAL AND BIOCHEMICAL BLOOD PARAMETERS OF SHEEP AFFECTED BY MASTITIS

Annotation

Mastitis in sheep causes significant harm both to animal health and to the sheep farming economy. Treatment and prevention of mastitis require substantial investment in acquiring medicinal products, antiseptics, veterinary services, and other necessary materials. Morphological and biochemical blood parameters can serve as important indicators for diagnosing mastitis in sheep. The article presents the results of a study on the morphological and biochemical blood parameters of sheep affected by various forms of mastitis. The investigation of morphological and biochemical blood parameters in acute catarrhal, serous, and subclinical forms of mastitis in sheep revealed characteristic changes in blood before and after treatment. In cases of acute catarrhal, serous, and subclinical mastitis, a decrease in the number of erythrocytes and hemoglobin levels, an increase in leukocyte count, a decrease in glucose levels, an increase in total protein, and a decrease in albumin levels were observed. For treatment, Kalankhin preparation was used, which was rubbed into the udder. Additionally, the intracisternal administration of a physiologic saline solution, preheated to 37°C, at a dose of 20 ml with a concentration of 600 mg/L, was performed for three days. After treatment, blood parameters returned to physiological norms, where an increase in the number of erythrocytes and hemoglobin levels, a decrease in leukocyte count, an increase in glucose levels, a decrease in total protein, and an increase in albumin levels were observed. These changes indicate the restoration of metabolism, a reduction in the inflammatory process, and an improvement in metabolic exchange after treatment. Thus, the conducted study showed that acute catarrhal, serous, and subclinical forms of mastitis in sheep lead to shifts in morphological and biochemical blood parameters. After treatment, changes in parameters indicate a positive trend in restoring homeostasis and animal health. The use of environmentally friendly and safe preparations helps increase the effectiveness of treatment and the organism's resistance to diseases.

Ключевые слова: *мастит, кровь, овцы, биохимия, эритроциты, лейкоциты*
Key words: *mastitis, blood, sheep, biochemistry, erythrocytes, leukocytes*

Introduction. Mastitis in sheep is a prevalent inflammatory condition of the mammary gland caused by various pathogenic microorganisms. This condition can significantly reduce milk yields, deteriorate its quality, and lead to substantial economic losses for farmers. The causes of mastitis in sheep can be diverse, including bacterial, viral, and fungal infections. Trauma, stress, improper care, and even genetic factors can also contribute to the development of this disease.Key symptoms of mastitis in sheep include swelling and tenderness of the udder, changes in the color and consistency of milk, elevated body temperature, and general weakness of the animal. Laboratory milk examinations, as well as clinical examinations of the udder, are conducted for mastitis diagnosis. Treatment of mastitis in sheep typically involves the administration of antibiotics, anti-inflammatory drugs, and other medications under the supervision of a veterinarian. It is also important to ensure good housing conditions, proper nutrition, and disease prevention to prevent its recurrence [1, 2, 3].

Mastitis in sheep causes significant harm to both animal health and the livestock economy. Here are several main aspects of the damage caused by this disease. Mastitis reduces sheep productivity by increasing the number of somatic cells in milk, which in turn reduces its quality and quantity. Milk from infected sheep may contain blood, pus, bacteria, and other impurities, rendering it unfit for consumption and industrial processing. Mastitis can lead to reduced sheep fertility due to disruptions in their reproductive function. Treatment and prevention of mastitis require significant expenditures on the acquisition of medications, antiseptics, veterinary services, and other necessary materials [4, 5, 6, 7]. In cases of severe mastitis, when treatment is ineffective, animal culling may be necessary, resulting in direct financial losses for the farmer. Products from animals with mastitis may be rejected by the market due to their low quality, which can negatively impact the farmer's reputation and lead to loss of customers.

Mastitis is one of the most common and serious diseases in sheep, thus studying its morphological and biochemical aspects in blood is essential for early diagnosis and effective treatment of this disease. Mastitis in sheep leads to decreased animal productivity and increased costs for treatment and prevention. Research in the field of morphological and biochemical blood parameters can help optimize approaches to managing sheep health and minimize economic losses. Studying morphological and biochemical changes in blood in mastitis in sheep contributes to the development of diagnostic, treatment, and prevention methods for this disease, which is an important direction in veterinary medicine. Modern trends in scientific research in veterinary medicine and animal husbandry pay special attention to the development of innovative methods for diagnosing and treating diseases in animals, including mastitis in sheep [7, 9, 10]. Thus, research focused on morphological and biochemical blood parameters in mastitis in sheep is highly relevant and important for contemporary veterinary practice and science.

The study of morphological and biochemical blood parameters in mastitis in sheep holds significant importance for the practice of veterinary medicine and animal husbandry. Morphological and biochemical blood parameters can serve as important indicators for diagnosing mastitis in sheep. Investigating these parameters allows the detection of inflammatory processes in the animal's body and determines the severity of the condition. The examination of morphological and biochemical blood parameters enables the assessment of mastitis severity in sheep and determines the necessity of treatment. Elevated levels of certain indicators may indicate the severity of the disease and require immediate intervention by a veterinary specialist [11, 12, 13]. Changes in morphological and biochemical blood parameters can be utilized to monitor the effectiveness of mastitis treatment in sheep. Based on research findings, the response of the animal's body to therapy can be evaluated, and necessary adjustments to the treatment regimen can be made. Research on morphological and biochemical blood parameters can aid in the development of effective preventive measures and control strategies for mastitis in sheep. Understanding the changes occurring in the animal's body during the development of this disease allows the development of prevention strategies and timely intervention. Thus, the study of morphological and biochemical blood parameters in mastitis in sheep is crucial for the diagnosis, treatment, prevention, and control of this disease, contributing to the improvement of animal health and livestock productivity [14, 15].

The aim of this study is to investigate morphological and biochemical blood parameters in sheep with mastitis and after treatment to identify characteristic changes that can be used for early diagnosis, severity assessment, and treatment effectiveness evaluation of this disease.

Materials and methods. The research material was obtained from the experimental farm Akzhaik located in the settlement of Atameken, Taskala district of the West Kazakhstan region. The study was conducted on 45 sheep with catarrhal, serous, and subclinical mastitis, which were divided into three groups in equal numbers. The first group consisted of sheep with catarrhal mastitis, the second with serous mastitis, and the third with subclinical mastitis. Blood samples were taken from all animals before and after treatment for subsequent examination.

For treatment, the drug "Kalankhin" was used, which was rubbed into the udder. Additionally, the active physiological solution drug was administered intracisternally, preheated to 37°C, at a dose of 20 ml with a concentration of 600 mg/l for three days. Morphological blood parameters were measured at the veterinary clinic of the West Kazakhstan Agricultural-Technical University named after Zhangir Khan.

Clinical mastitis is characterized by obvious signs of inflammation of the mammary gland, such as swelling, redness, increased milk temperature, and the presence of purulent or bloody discharge. This type of mastitis is easily diagnosed visually. Subclinical mastitis does not exhibit obvious symptoms but is accompanied by changes in the milk and blood composition of the animal. It is diagnosed through milk and blood analysis [16, 17, 18].

The diagnosis of clinical mastitis in animals involves a series of methods and procedures to determine the presence and nature of inflammation in the mammary gland. The main diagnostic methods included: Clinical examination: The veterinarian conducted a visual examination of the udder and surrounding tissues, as well as evaluated the animal's behavior. Signs of inflammation included swelling, redness, hot udder to the touch, and changes in milk (color, consistency) [13, 20, 21]. Physicochemical milk analysis: Laboratory examination of milk was performed to detect bacteria, somatic cells (the normal content of cells in milk in healthy animals is low), and changes in physicochemical properties (e.g., increased protein content).

The diagnosis of clinical mastitis in animals requires a comprehensive approach and may include the use of various research methods to accurately determine the presence and nature of the inflammatory process in the mammary gland. The diagnosis of subclinical mastitis in animals is more complex because this form of mastitis is not accompanied by obvious clinical signs. For accurate diagnosis and severity assessment of subclinical mastitis, a comprehensive approach was used, including various research methods. Early detection and treatment of subclinical mastitis are important for preventing the transition of the disease to the clinical form and minimizing damage to animals and milk production. We performed the Dimastin test. The Dimastin test (or Dimastin test) is one of the methods for diagnosing subclinical mastitis in sheep [22].

Blood samples were taken from all animals for analysis. Blood samples were taken before the start of treatment and after the completion of treatment to assess the dynamics of changes in parameters. Blood was taken from the jugular vein of the sheep. For the assessment of morphological blood parameters, a complete blood count was performed, including the determination of leukocyte, erythrocyte, and hemoglobin levels. For the study of biochemical blood parameters, an analysis of biochemical components such as total protein, glucose, albumin, and bilirubin was conducted. Blood analysis was performed using a hematological and biochemical blood analyzer. Working with a hematological and biochemical blood analyzer included a series of steps that needed to be performed to obtain accurate and reliable analysis results. Before starting the analysis, blood samples were prepared. Venous blood collected in a tube for analysis was used.

The analyzer was turned on, and the availability of consumables (tubes, reagents) and their suitability were checked. Blood samples were carefully loaded into the appropriate sections of the analyzer. Analysis parameters were adjusted according to the requirements, and the analysis process was started. After the analysis was completed, the apparatus automatically displayed the results on the display. The obtained data were evaluated and recorded. After completing the work, the apparatus was cleaned and disinfected according to the manufacturer's instructions. Sterility and safety rules were also observed when working with blood.

The obtained data were statistically processed using Excel 2016 software to assess the mean arithmetic and mean error of arithmetic. Thus, the study is conducted using a comprehensive

approach, including morphological and biochemical blood analysis, to identify characteristic changes in sheep mastitis and assess their significance for the diagnosis and treatment of this disease.

Results and discussion. The results of the study of morphological and biochemical blood parameters in acute catarrhal mastitis in sheep before and after treatment are presented in Table 1.

After treatment, the number of erythrocytes increased from 6.1 to 7.2, indicating the restoration of the hematopoietic function of the organism after the inflammatory process. The hemoglobin level increased from 71.0 to 97.0 after treatment, which also indicates the restoration of blood condition and improvement of oxygen exchange. The leukocyte count decreased from 8.8 to 6.5 after treatment, indicating a reduction in the inflammatory process in the organism. The glucose level increased from 1.83 to 2.81 after treatment, which may be a result of compensatory reactions of the organism to inflammation and treatment. After treatment, the total protein level decreased from 69.7 to 57.3, indicating an improvement in metabolic processes and a decrease in the inflammatory process. The albumin level increased from 33.78 to 45.29 after treatment, indicating the restoration of liver function and improvement of the overall organism condition.

Table 1 – Results of the study of morphological and biochemical blood parameters in acute catarrhal mastitis in sheep before and after treatment

Indicators	Before treatment	After treatment
Erythrocytes, 10^{12}/l	6,1±0,37	7,2±0,31
Hemoglobin, g/l	71,0±4,5	97,0±5,57
Leukocytes, 10^{9}/l	8,8±0,42	6,5±0,84
Glucose, mmol/l	1,83±0,117	2,81±0,172
Totalprotein, g/l	69,7±2,52	57,3±1,69
Albumin, %	33,78±1,657	45,29±40,62

Thus, the results of the study show that the treatment of acute catarrhal mastitis in sheep leads to an improvement in morphological and biochemical blood parameters, indicating a positive trend in the recovery of animal health.

The results of the study of morphological and biochemical blood parameters in serous mastitis in sheep before and after treatment are presented in Table 2.

After treatment, an increase in the number of erythrocytes from 6.1 to 7.4 and the level of hemoglobin from 78.3 to 98.1 were observed. This indicates the restoration of hematopoietic function and normalization of oxygen exchange after the inflammatory process. The leukocyte count decreased from 7.8 to 6.5 after treatment, indicating a reduction in the inflammatory reaction in the organism. The glucose level increased from 1.78 to 2.71 after treatment, which may be a result of compensatory reactions to inflammation and treatment. After treatment, the total protein level decreased from 73.2 to 61.7, and the albumin level increased from 35.94 to 43.52. This may indicate an improvement in metabolic processes and the restoration of liver function after inflammation.

Table 2 – Results of the study of morphological and biochemical blood parameters in serous mastitis in sheep before and after treatment

Indicators	Before treatment	After treatment
Erythrocytes, 10^{12}/l	6,1±0,29	7,4±0,31
Hemoglobin, g/l	78,3±1,36	98,1±1,92
Leukocytes, 10^{9}/l	7,8±0,22	6,5±0,41
Glucose, mmol/l	1,78±0,123	2,71±0,111
Totalprotein, g/l	73,2±2,56	61,7±3,65
Albumin, %	35,94±0,331	43,52±0,434

Thus, the research findings indicate a positive trend in sheep health recovery after serous mastitis. The reduction in inflammatory response, restoration of hematopoietic function, and improvement in metabolic exchange signify the effectiveness of the administered therapy.

The results of the study of morphological and biochemical blood parameters in subclinical mastitis in sheep before and after treatment are presented in Table 3.

After treatment, a slight increase in the number of erythrocytes from 6.9 to 7.5 and the level of hemoglobin from 80.1 to 99.2 was observed. This may indicate the normalization of hematopoietic function and oxygen exchange post-treatment. The leukocyte count decreased from 7.2 to 6.2 after treatment, indicating a reduction in inflammatory reaction in the udder and mammary gland tissues. The glucose level increased from 1.92 to 2.69 after treatment, which may be a result of stress and compensatory reactions to inflammation and treatment. After treatment, the total protein level slightly increased from 59.3 to 63.1, and the albumin level increased from 39.7 to 41.9. This may suggest an improvement in metabolic processes and restoration of liver function after inflammation.

Table 3 – Results of the study of morphological and biochemical blood parameters in subclinical mastitis in sheep before and after treatment

Indicators	Before treatment	After treatment
Erythrocytes, 10^{12}/l	6,9±0,12	7,5±0,13
Hemoglobin, g/l	80,1±1,39	99,2±1,27
Leukocytes, 10^{9}/l	7,2±0,19	6,2±0,31
Glucose, mmol/l	1,92±0,23	2,69±0,178
Totalprotein, g/l	59,3±2,72	63,1±1,67
Albumin, %	39,7±1,59	41,9±4,12

Thus, the research findings indicate a positive trend in sheep health recovery after subclinical mastitis. The reduction in inflammatory response, normalization of hematopoiesis, and improvement in metabolic exchange signify the effectiveness of the administered therapy.

The results of the study of morphological and biochemical blood parameters in various types of mastitis in sheep before and after treatment allow for the assessment of changes occurring in the animals' organisms in response to the inflammatory process and therapy.

An increase in the number of erythrocytes and hemoglobin levels after treatment indicates the restoration of bone marrow function and adequate oxygen supply to the organism after inflammation. A decrease in leukocyte count after treatment indicates a reduction in the intensity of the inflammatory process and normalization of the immune response. An increase in glucose levels after treatment may result from stress and compensatory reactions of the organism to inflammation and treatment. A decrease in total protein levels after treatment may indicate an improvement in metabolic exchange and a reduction in the organism's need for protein synthesis. An increase in albumin levels indicates an improvement in protein synthesis after inflammation.

Thus, the results demonstrate that the treatment of various types of mastitis in sheep not only contributes to the reduction of the inflammatory process but also restores the organism's basic functions, such as hematopoiesis, immune reactions, metabolic exchange, and protein synthesis.

Conclusion. The study of morphological and biochemical blood parameters in acute catarrhal, serous, and subclinical forms of mastitis in sheep revealed characteristic changes in blood before and after treatment.

In acute catarrhal mastitis, post-treatment showed an increase in the number of erythrocytes and hemoglobin levels, a decrease in leukocyte count, an increase in glucose levels, a decrease in total protein, and an increase in albumin levels. These changes indicate restoration of hematopoietic function, reduction of inflammatory processes, and restoration of metabolic exchange after treatment.

Similarly, in serous mastitis, post-treatment also showed an increase in erythrocyte count and hemoglobin levels, a decrease in leukocyte count, an increase in glucose levels, a decrease in total protein, and an increase in albumin levels. These changes suggest restoration of hematopoietic function, reduction of inflammatory processes, and improvement of metabolic exchange after treatment.

In subclinical mastitis, post-treatment showed a slight increase in the number of erythrocytes and hemoglobin levels, a decrease in leukocyte count, an increase in glucose levels, a slight increase in

total protein, and albumin levels. These changes also indicate normalization of hematopoiesis, reduction of inflammatory processes, and improvement of metabolic exchange after treatment.

Thus, the conducted study demonstrated that the treatment of acute catarrhal, serous, and subclinical forms of mastitis in sheep leads to improvements in morphological and biochemical blood parameters, indicating a positive trend in the recovery of animal health. In the case of mastitis in sheep, many parameters of homeostasis are altered. The use of effective drugs helps to increase the organism's resistance to disease by accumulating its own reserves.

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АННОТАЦИЯ

Мастит у овец причиняет значительный ущерб как здоровью животных, так и экономике овцеводства. Лечение и профилактика мастита требуют значительных затрат на приобретение лекарственных средств, антисептиков, ветеринарных услуг и других необходимых материалов. Морфологические и биохимические показатели крови могут служить важными индикаторами для диагностики мастита у овец. В статье показаны результаты исследования морфологических и биохимических показателей крови овец больных различными видами мастита. Исследование морфологических и биохимических показателей крови при острой катаральной, серозной и субклинической формах мастита у овец показало характерные изменения в крови до и после лечения. При острой катаральной, серозной и субклинической формах мастита наблюдалось уменьшение количества эритроцитов и уровня гемоглобина, увеличение количества лейкоцитов, уменьшение уровня глюкозы, повышения общего белка и уменьшение уровня альбумина. Для лечения использовали препарат каланхин, который втирали в вымя. Также вводили интрацистернально препарат активного физиологического раствора, предварительно нагретый до 37°С, в дозе 20 мл с концентрацией 600 мг/л в течение трех дней. После лечения показатели крови пришли к физиологической норме, где мы наблюдали увеличение количества эритроцитов и уровня гемоглобина, снижение количества лейкоцитов, увеличение уровня глюкозы, снижение общего белка и увеличение уровня альбумина. Эти изменения указывают на восстановление метаболизма, уменьшение воспалительного процесса и улучшение обмена веществ после лечения. Таким образом, проведенное исследование показало, что при острой катаральной, серозной и субклинической форм мастита у овец происходят сдвиг морфологических и биохимических показателей крови. После лечения изменение показателей свидетельствует о положительной динамике восстановления гомеостаза и здоровья животных. Применение экологичных и безопасных препаратов помогает повысить эффективность лечения и устойчивость организма к болезням.

ТҮЙІН

Қойдағы мастит малдың денсаулығына да, қой шаруашылығының экономикасына да айтарлықтай зиян келтіреді. Маститті емдеу және алдын алу дәрі-дәрмектерді, антисептиктерді, ветеринарлық қызметтерді және басқа да қажетті материалдарды сатып алуға айтарлықтай шығындарды талап етеді. Морфологиялық және биохимиялық қан көрсеткіштері қойлардағы маститті диагностикалау үшін маңызды көрсеткіштер ретінде қызмет ете алады. Мақалада маститтің әртүрлі түрлерімен ауыратын қойлардың қанының морфологиялық және биохимиялық көрсеткіштерін зерттеу нәтижелері көрсетілген. Қойлардағы маститтің жіті катаральды, серозды және субклиникалық түрлерінде қанның морфологиялық және биохимиялық көрсеткіштерін зерттеу емдеуге дейін және емдеуден кейінгі қандағы тән өзгерістерді көрсетті. Маститтің жедел катаральды, серозды және субклиникалық түрлерінде эритроциттер саны мен гемоглобин деңгейінің төмендеуі, лейкоциттер санының жоғарылауы, глюкоза деңгейінің төмендеуі, жалпы ақуыздың жоғарылауы және альбумин деңгейінің төмендеуі байқалды. байқалды. Емдеу үшін емшек сүтін ысқылаған Каланкин препараты қолданылған. Алдын ала 37°С дейін қыздырылған белсенді физиологиялық ерітіндінің препараты да үш күн бойы 600 мг/л концентрациямен 20 мл дозада интрацистерналды түрде енгізілді. Емдеуден кейін қан көрсеткіштері физиологиялық нормаларға оралды, онда біз эритроциттер мен гемоглобин деңгейінің жоғарылауын, лейкоциттер санының азаюын, глюкоза деңгейінің жоғарылауын, жалпы ақуыздың төмендеуін және альбуминнің жоғарылауын байқадық. деңгейлері. Бұл өзгерістер емдеуден кейін метаболизмнің қалпына келуін, қабынудың төмендеуін және метаболизмнің жақсаруын көрсетеді. Сонымен, зерттеу қойларда маститтің жедел катаральды, серозды және субклиникалық түрлері кезінде қанның морфологиялық және биохимиялық көрсеткіштерінің ығысуы болатынын көрсетті. Емдеуден кейін көрсеткіштердің өзгеруі гомеостазды және жануарлардың денсаулығын қалпына келтірудің оң динамикасын көрсетеді. Экологиялық таза және қауіпсіз препараттарды қолдану емдеудің тиімділігін және ағзаның ауруларға төзімділігін арттыруға көмектеседі.