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Changes in morphological blood parameters in cows with catarrhal-purulent mastitis

Sigirlarda kataral-yiringli mastitda qonning morfologik ko'rsatkichlaridagi o'zgarishlar**Изменения морфологических показателей крови у коров при катарально-гнойном мастите****Rustam Ismoil o'g'li BOBOMURODOV¹**¹ Scientific-Research Institute of Veterinary, Samarkand, Uzbekistan**ARTICLE INFO****ARTICLE TYPE**

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AUTHOR, TITLE AND ABSTRACT METADATA (EN / UZ / RU)**ENGLISH****Rustam Ismoil o'g'li BOBOMURODOV¹**¹ Scientific-Research Institute of Veterinary, Samarkand, Uzbekistan

Abstract. This study investigated changes in morphological blood parameters in cows with catarrhal-purulent mastitis. The study was conducted in four livestock farms located in Narpay and Pastdargom districts of Samarkand Region. Fifteen cows diagnosed with catarrhal-purulent mastitis were selected for the study. Hematological examinations were performed on the day of disease diagnosis and on the 5th and 10th days of the disease. The results showed a significant increase in the number of leukocytes and segmented neutrophils on the 5th day of the disease, followed by a decrease in these parameters by the 10th day. The number of erythrocytes and hemoglobin levels gradually increased throughout the study period. The obtained results indicate that morphological blood parameters in cows with catarrhal-purulent mastitis may serve as important diagnostic criteria for assessing the course of the disease and the body's response to the inflammatory process.

Keywords: catarrhal-purulent mastitis; mammary gland; blood; erythrocytes; hemoglobin; leukocytes; platelets; neutrophils; lymphocytes; leukocyte formula; hematological parameters

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Annotatsiya. Ushbu tadqiqotda sigirlarda kataral-yiringli mastit kechishida qonning morfologik ko'rsatkichlaridagi o'zgarishlar o'rganildi. Tadqiqotlar Samarqand viloyatining Narpay va Pastdarg'om tumanlaridagi to'rtta chorvachilik xo'jaligida olib borildi. Kataral-yiringli mastit bilan kasallangan 15 bosh sigir tanlab olinib, gematologik tekshiruvlar kasallik aniqlangan kuni, 5- va 10-kunlarda o'tkazildi. Tadqiqot natijalarida kasallikning 5-kunida leykotsitlar va segment yadroli neytrofillar miqdorining sezilarli oshishi, 10-kunga kelib esa ushbu ko'rsatkichlarning kamayishi aniqlandi. Eritrotsitlar va gemoglobin miqdori tadqiqot davrida bosqichma-bosqich oshib bordi. Olingan natijalar kataral-yiringli mastitda qonning morfologik ko'rsatkichlari kasallikning kechishi va organizmning yallig'lanish jarayoniga javob reaksiyasini baholashda muhim diagnostik mezon bo'lishi mumkinligini ko'rsatdi.

Kalit so'zlar: kataral-yiringli mastit; sut bezi; qon; eritrotsit; gemoglobin; leykotsit; trombosit; neytrofil; limfotsit; leykotsitar formula; gematologik ko'rsatkichlar

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Аннотация. В данном исследовании изучены изменения морфологических показателей крови у коров при катарально-гнойном мастите. Исследования проводились в четырех животноводческих хозяйствах Нарпайского и Пастдаргомского районов Самаркандской

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области. Для исследования были отобраны 15 коров, больных катарально-гнойным маститом. Гематологические исследования проводили в день установления заболевания, а также на 5-е и 10-е сутки. Результаты исследований показали, что на 5-е сутки заболевания отмечалось значительное увеличение количества лейкоцитов и сегментоядерных нейтрофилов, тогда как к 10-м суткам наблюдалось снижение данных показателей. Количество эритроцитов и уровень гемоглобина в течение исследуемого периода постепенно увеличивались. Полученные результаты свидетельствуют о том, что морфологические показатели крови при катарально-гнойном мастите могут служить важными диагностическими критериями для оценки течения заболевания и ответной реакции организма на воспалительный процесс.

Ключевые слова: катарально-гнойный мастит; молочная железа; кровь; эритроциты; гемоглобин; лейкоциты; тромбоциты; нейтрофилы; лимфоциты; лейкоцитарная формула; гематологические показатели

1. KIRISH

Introduction

Kirish. Mastit sut yo'nalishidagi sigirlarda keng tarqalgan kasalliklardan biri bo'lib, sut bezining yallig'lanishi bilan kechadi va hayvon organizmining umumiy fiziologik holatiga salbiy ta'sir ko'rsatadi. Kasallikning klinik shakllari orasida kataral-yiringli mastit sut bezida yallig'lanish jarayonining kuchayishi, sutning fizik xususiyatlarining o'zgarishi va yiringli eksudat hosil bo'lishi bilan tavsiflanadi [1,2]. Bunday holatlarda mahalliy patologik jarayon bilan bir qatorda organizmning umumiy himoya mexanizmlarida ham o'ziga hos o'zgarishlar yuzaga keladi. Mastit rivojlanishida sut bezining mahalliy himoya tizimi, tug'ma immunitet mexanizmlari hamda qonning hujayraviy elementlari muhim ahamiyatga ega. Ayniqsa, neytrofillarning qon tomiridan yallig'lanish o'chog'iga migratsiyasi mastitga qarshi himoyaning dastlabki bosqichlaridan biri hisoblanadi. Sut beziga mikroorganizmlar yoki boshqa yallig'lantiruvchi omillar ta'sir etganda, qon oqimidagi leykotsitlar, xususan, neytrofillar yallig'lanish o'chog'iga jalb qilinadi [7,8]. Shu sababli mastitda qondagi leykotsitlar miqdori va leykotsitar formula tarkibidagi o'zgarishlar organizmning yallig'lanish jarayoniga javobini baholashda muhim ko'rsatkichlardan hisoblanadi. Mastitda somatik hujayralar, sut tarkibidagi fermentlar va boshqa laborator ko'rsatkichlardan tashqari qonning morfologik tarkibini o'rganish ham kasallikning umumiy organizmga ta'sirini baholash imkonini beradi. Pyo'rala ma'lumotlariga ko'ra, mastitda yallig'lanish jarayonining kuchayishi bilan immun hujayralarning faolligi va ularning sut beziga migratsiyasi ortadi[4,5].

Qonning morfologik ko'rsatkichlari orasida eritrotsitlar, gemoglobin, leykotsitlar, trombotsitlar hamda leykotsitar formula alohida diagnostik ahamiyatga ega. Xususan, leykotsitlar sonining ortishi organizmida yallig'lanish jarayoni faollashganligini ko'rsatishi mumkin. Leykotsitar formuladagi neytrofillar nisbati esa bakterial yallig'lanish jarayonlarining rivojlanish darajasini baholashda muhim ahamiyat kasb etadi. Shu bilan birga, kataral-yiringli mastitda qonning morfologik ko'rsatkichlari kasallikning turli bosqichlarida qanday o'zgarishi, ayniqsa davolash jarayonining dastlabki kunlarida leykotsitar formula qanday dinamikaga ega bo'lishi amaliy veterinariya nuqtayi nazaridan muhim masalalardan biridir. Kasallik davomida qon tarkibidagi o'zgarishlarni aniqlash hamda bu o'zgarishlarning yuzaga kelishini ilmiy jihatdan asoslash muhim vazifalardan biridir.

Tadqiqotning maqsadi: Sigirlar organizmida kataral-yiringli mastit jarayoni kechishida qonning asosiy morfologik ko'rsatkichlari, jumladan eritrotsitlar, gemoglobin, trombotsitlar, leykotsitlar va leykotsitar formula elementlarining dinamik o'zgarishlarini o'rganish hamda ushbu ko'rsatkichlarning kasallik jarayonini baholashdagi diagnostik ahamiyatini aniqlash.

2. MATERIAL VA METODLAR

Materials and methods

Material va metodlar: Tadqiqotlar Samarqand viloyatining Narpay tumanidagi "Tohir Yusuf chorvasi", "Agro gold spring" hamda Pastdarg'om tumanidagi "Xujaobod chorvasi" va "Xosil-Uboydulla-Bobur UAU" chorvachilik xo'jaliklarida olib borildi. Tadqiqot obyekti sifatida kataral-yiringli mastit bilan kasallangan sigirlar tanlab olindi. Tajribaga hayvonlarni tanlashda o'xshash juftliklar tamoyilidan foydalanilib, jami 15 bosh sigir ajratildi. Hayvonlarda mastit tashxisi klinik tekshiruvlar, sut bezining holatini baholash va laborator diagnostika natijalari asosida belgilandi. Tajribaga olingan sigirlarning umumiy klinik holati, sut bezidagi patologik o'zgarishlar hamda sutning fizik xususiyatlari hisobga olindi.

Gematologik tekshiruvlar hayvonlardan olingan qon namunalari amalga oshirildi. Qon namunalari gematologik analizator yordamida tekshirilib, quyidagi morfologik ko'rsatkichlar aniqlandi: eritrotsitlar soni, gemoglobin miqdori, trombotsitlar soni, leykotsitlar soni, eozinofillar, limfotsitlar, monotsitlar, tayoqcha yadroli neytrofillar, segment yadroli neytrofillar. Gematologik tekshiruvlar uch marotaba: tajriba boshida, ya'ni kataral-yiringli mastit aniqlangan vaqtda, 5-kuni va 10-kuni amalga oshirilib olingan natijalar tegishli o'rtacha qiymatlar ko'rinishida ifodalandi.

3. NATIJALAR VA ULARNING TAHLILI

Results and discussion

Natijalar va ularning tahlili: Tadqiqotlar davomida kataral-yiringli mastit bilan kasallangan sigirlarda qonning morfologik ko'rsatkichlari kasallikning turli davrlarida bir xil bo'lmagan dinamikaga ega ekanligi aniqlandi. Tadqiqot natijalarining umumlashirilgan ma'lumotlari 1-jadvalda keltirilgan.

Tadqiqot davomida eritrotsit va gemoglobin o'zgarishi natijalariga ko'ra, kataral-yiringli mastit bilan kasallangan sigirlarda eritrotsitlar soni tajriba boshida o'rtacha $4,89 \pm 0,03$ mln/mkl ni tashkil etdi. Kasallikning 5-kunida ushbu ko'rsatkich $5,30 \pm 0,02$ mln/mkl, 10-kunida esa $5,89 \pm 0,05$ mln/mkl gacha oshdi. Demak, tajriba boshiga nisbatan 10-kunda eritrotsitlar soni qariyb 1,0 mln/mkl ga oshgan. Bu o'zgarish kasallik jarayonining keyingi bosqichlarida organizmning umumiy holati va eritropoez jarayonining tiklanishi bilan bog'liq. Eritrotsitlar sonining oshishiga parallel ravishda gemoglobin miqdorida ham o'sish kuzatildi. Tajriba boshida gemoglobin miqdori $90,55 \pm 2,8$ g/l bo'lgan bo'lsa, 5-kunda $102,1 \pm 2,1$ g/l, 10-kunda esa $117,75 \pm 1,7$ g/l ni tashkil etdi. Shunday qilib, 10-kunga kelib gemoglobin miqdori dastlabki ko'rsatkichga nisbatan taxminan 27,2 g/l ga oshdi. Eritrotsitlar va gemoglobin miqdorining birgalikda oshib borishi hayvonlarning umumiy holati yaxshilanib, yallig'lanish jarayonining pasayishi bilan bog'liq bo'lishi mumkin.

1-jadval

Kataral-yiringli mastit bilan kasallangan sigirlarda qonning morfologik ko'rsatkichlari dinamikasi / **Table 1.** Dynamics of morphological blood parameters in cows with catarrhal-purulent mastitis

Ko'rsatkichlar	Me'yorda	Tajriba boshida	5-kunida	10-kunida
Eritrotsitlar, mln/mkl	5–7,5	4,89±0,03	5,30±0,02	5,89±0,05
Gemoglobin, g/l	90–140	90,55±2,8	102,1±2,1	117,75±1,7
Trombotsitlar, ming/mkl	100–650	377,5±4,4	385,8±3,4	394,3±3,0
Leykotsitlar, ming/mkl	4,5–12	9,18±0,04	13,75±0,05	8,43±0,06
Eozinofillar, %	3–10	2,7±0,5	3,8±0,4	5,0±0,3
Monotsitlar, %	4–10	4,6±0,5	5,3±0,6	6,8±0,5
Limfotsitlar, %	40–77	38,0±0,7	48,8±0,6	56,3±0,5
Tayoqcha yadroli neytrofillar, %	2–5	6,6±0,5	4,2±0,4	2,8±0,2
Segment yadroli neytrofillar, %	10–30	15,2±0,4	27,0±0,6	16,8±0,2

Tadqiqotning eng muhim natijalaridan biri kataral-yiringli mastitda leykotsitlar miqdorining kasallik bosqichlariga qarab keskin o'zgarishi bo'ldi. Tajriba boshida qondagi leykotsitlar miqdori o'rtacha 9,18±0,04 ming/mkl ni tashkil etgan bo'lsa, kasallikning 5-kunida ushbu ko'rsatkich 13,75±0,05 ming/mkl gacha oshib, dastlabki ko'rsatkichga nisbatan sezilarli yuqori bo'ldi. 10-kunga kelib esa leykotsitlar miqdori 8,43±0,06 ming/mkl gacha kamaydi. Kasallikning 5-kunida leykotsitozning kuchayishi organizmning yallig'lanish jarayoniga faol immun javob berayotganligini ko'rsatadi. 10-kunga kelib leykotsitlar miqdorining kamayishi esa yallig'lanish jarayonining susayishi va organizmning homeostatik holatga qaytishi bilan izohlanishi mumkin.

Leykotsitar formulani o'rganish jarayonida ayniqsa neytrofillar tarkibida sezilarli o'zgarishlar qayd etildi. Segment yadroli neytrofillar tajriba boshida o'rtacha 15,2 foizni tashkil etgan bo'lsa, 5-kunda 27,0 foizgacha oshdi. 10-kunga kelib esa ushbu ko'rsatkich 16,8 foizgacha kamaydi. Segment yadroli neytrofillarning 5-kunda keskin oshishi kataral-yiringli mastitda yallig'lanish jarayonining faollashishi va neytrofillarning organizmning yallig'lanish o'chog'iga jalb etilishi bilan bog'liq bo'lishi mumkin. Neytrofillar tug'ma immunitetning muhim hujayralari bo'lib, bakterial yallig'lanish o'chog'ida fagotsitoz jarayonida faol ishtirok etadi. Tayoqcha yadroli neytrofillar esa aksincha, tajriba boshida 6,6 foizni tashkil etgan bo'lsa, 5-kunda 4,2%, 10-kunda esa 2,8 foizgacha kamaydi.

Tajriba davomida limfotsitlar miqdorida ham bosqichma-bosqich oshish kuzatildi. Tajriba boshida limfotsitlar 38,0%, 5-kunda 48,8%, 10-kunda esa 56,3 foizni tashkil etdi. Monotsitlar miqdori ham tajriba boshida o'rtacha 4,6 foizdan 5-kunda 5,3%, 10-kunda esa 6,8 foizgacha oshdi. Monotsitlar yallig'lanish jarayonlarida fagotsitoz, hujayra qoldiqlarini tozalash va immun javobni boshqarishda ishtirok etadi. Eozinofillar tajriba boshida 2,7 foizni tashkil etgan bo'lsa, 5-kunda 3,8%, 10-kunda 5,0% gacha oshganligi qayd etildi. Ushbu o'zgarishlar mastitning bevosita asosiy ko'rsatkichi bo'lmasa-da, umumiy leykotsitar javob tarkibidagi o'zgarishlarni ko'rsatadi. Trombotsitlar sonida tajriba davomida keskin o'zgarishlar kuzatilmadi. Tajriba boshida ularning miqdori o'rtacha 377,5±4,4 ming/mkl, 5-kunda 385,8±3,4 ming/mkl, 10-kunda esa 394,3±3,0 ming/mkl ni tashkil etdi. Shunday qilib, trombotsitlar miqdori tajriba davomida biroz oshgan bo'lsa-da, ushbu o'zgarishlar leykotsitlar va neytrofillarda kuzatilgan o'zgarishlar kabi yaqqol bo'lmadi. Bu esa kataral-yiringli mastitda qonning morfologik javobida eng katta o'zgarishlar asosan leykotsitar bo'g'inda yuzaga kelganligini ko'rsatadi.

Tadqiqotlarning umumlashtirilgan holda olingan natijalar kataral-yiringli mastitda qonning morfologik ko'rsatkichlari,

ayniqsa leykotsitlar soni, segment va tayoqcha yadroli neytrofillar nisbati, kasallikning yallig'lanish faolligini va uning dinamikasini baholashda qo'shimcha diagnostik mezon sifatida foydalanish mumkinligini ko'rsatmoqda.

4. XULOSA

Conclusion

Xulosa: Samarqand viloyatining turli chorvachilik xo'jaliklarida kataral-yiringli mastit bilan kasallangan 15 bosh sigirda qonning morfologik ko'rsatkichlarini o'rganish natijasida kasallikning kechishi davomida gematologik ko'rsatkichlarda muayyan dinamik o'zgarishlar yuzaga kelishi aniqlandi. Tadqiqot davomida eritrotsitlar soni va gemoglobin miqdorining tajriba boshidan 10-kungacha izchil oshishi, trombotsitlar miqdorida esa nisbatan kam o'zgarishlar kuzatildi. Eng yaqqol o'zgarishlar leykotsitlar va leykotsitar formulada qayd etilib, leykotsitlar miqdori 5-kunda 13,75 ming/mkl gacha oshgan va 10-kunda 8,43 ming/mkl gacha kamaygan, segment yadroli neytrofillar esa mos ravishda 15,2% dan 27,0% gacha ko'payib, keyinchalik 16,8% gacha pasaygan. Shu bilan birga, tayoqcha yadroli neytrofillar miqdorining 6,6% dan 2,8% gacha kamayishi kuzatildi. Olingan natijalar kataral-yiringli mastitda qonning morfologik ko'rsatkichlari, ayniqsa leykotsitlar va neytrofillar tarkibidagi o'zgarishlar organizmning yallig'lanish jarayoniga javob reaksiyasini aks ettirishini ko'rsatadi. Mazkur ko'rsatkichlardan kasallikning kechishini baholash va davolash jarayonini nazorat qilishda qo'shimcha gematologik mezon sifatida foydalanish mumkin.

DECLARATIONS

Declarations

Author contributions CRediT

Conceptualization; Methodology; Investigation; Data curation; Writing – original draft; Writing – review & editing. All authors have read and agreed to the published version of the manuscript.

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Ethics approval

Not applicable. This study did not involve humans, animals or other regulated materials.

Informed consent

All authors have read and approved the final version of the manuscript and have given their consent to its submission and publication. The study involved no human participants and no personal data.

Data availability statement

All data supporting the findings of this study are presented in the article and are available from the corresponding author upon reasonable request.

Conflict of interest

The authors declare no conflict of interest.

Generative AI disclosure

Generative AI was used only partially. The authors used Claude (Anthropic, Opus 5) for language editing, formatting of the reference list and preparation of the English and Russian metadata. No text, data, figures or conclusions were generated by AI. The authors reviewed and verified all output and take full responsibility for the content of the publication.

EXTENDED SUMMARY IN ENGLISH

Kengaytirilgan inglizcha xulosa / Расширенный реферат на английском языке

Mandatory for all articles whose full text is not in English. Length 600–1000 words. It must be independently readable: a reader who does not know the language of the full text should understand the problem, the method, the numerical results and the contribution without consulting the main text. Do not copy the 250-word abstract.

Purpose and research problem

Mastitis is one of the most widespread diseases of dairy cows: it proceeds as an inflammation of the mammary gland and has an adverse effect on the general physiological state of the animal. Among its clinical forms, catarrhal-purulent mastitis is characterised by an intensified inflammatory process, a change in the physical properties of the milk and the formation of purulent exudate, and in such cases specific changes arise not only locally but also in the general defence mechanisms of the organism. Migration of neutrophils from the bloodstream to the focus of inflammation is one of the earliest stages of defence against mastitis, so that the leukocyte count and the leukocyte formula are important indicators of the response of the organism to the inflammatory process. What remained insufficiently defined was how the morphological blood parameters change across the successive stages of catarrhal-purulent mastitis, and in particular what dynamics the leukocyte formula shows during the first days of treatment. The aim of the study was therefore to investigate the dynamic changes in erythrocytes, haemoglobin, platelets, leukocytes and the elements of the leukocyte formula in cows with catarrhal-purulent mastitis and to determine the diagnostic value of these indicators.

Materials and methods

The investigations were carried out on four livestock farms — “Tohir Yusuf chorvasi” and “Agro gold spring” in Narpay district and “Xujaobod chorvasi” and “Xosil-Uboydulla-Bobur UAU” in Pastdargom district of Samarkand region. Cows with catarrhal-purulent mastitis were selected as the object of study; animals were chosen on the principle of analogous pairs and a total of 15 head were allocated. The diagnosis was established on the basis of clinical examination, assessment of the state of the mammary gland and laboratory diagnostics, and the general clinical condition of the animals, the pathological changes in the udder and the physical properties of the milk were taken into account. Blood samples were examined on a haematological analyser, and the erythrocyte count, haemoglobin concentration, platelet count, leukocyte count, eosinophils, lymphocytes, monocytes, band neutrophils and segmented neutrophils were determined. Haematological examination was performed three times — at the start of the experiment when catarrhal-purulent mastitis was diagnosed, and on the 5th and 10th days — and the results were expressed as the corresponding mean values.

Results and discussion

The morphological blood parameters proved to have a non-uniform dynamic across the periods of the disease; the generalised data are given in Table 1. The erythrocyte count averaged 4.89 ± 0.03 million/ μ l at the start of the experiment, rose to 5.30 ± 0.02 million/ μ l on the 5th day and to 5.89 ± 0.05 million/ μ l on the 10th, an increase of

almost 1.0 million/ μ l relative to the start. Haemoglobin rose in parallel, from 90.55 ± 2.8 g/l to 102.1 ± 2.1 g/l on the 5th day and 117.75 ± 1.7 g/l on the 10th, an increase of about 27.2 g/l. The most important result concerned the leukocytes: from 9.18 ± 0.04 thousand/ μ l at the start the count rose sharply to 13.75 ± 0.05 thousand/ μ l on the 5th day and then fell to 8.43 ± 0.06 thousand/ μ l by the 10th, the leukocytosis of the 5th day reflecting an active immune response and the subsequent decline the attenuation of inflammation and the return of the organism to homeostasis. In the leukocyte formula the segmented neutrophils rose from a mean of 15.2 % to 27.0 % on the 5th day and fell to 16.8 % by the 10th, while the band neutrophils moved in the opposite direction, from 6.6 % to 4.2 % and then 2.8 %. Lymphocytes increased steadily from 38.0 % to 48.8 % and 56.3 %, monocytes from 4.6 % to 5.3 % and 6.8 %, and eosinophils from 2.7 % to 3.8 % and 5.0 %. Platelets showed no sharp changes, rising only from 377.5 ± 4.4 to 385.8 ± 3.4 and 394.3 ± 3.0 thousand/ μ l, which shows that the principal morphological response in catarrhal-purulent mastitis occurs in the leukocyte compartment.

Conclusion and contribution

The study of morphological blood parameters in 15 cows with catarrhal-purulent mastitis on farms of Samarkand region showed that definite dynamic changes occur in the haematological indicators over the course of the disease. The erythrocyte count and haemoglobin concentration rose consistently from the start of the experiment to the 10th day, whereas platelets changed comparatively little. The most pronounced changes were recorded in the leukocytes and the leukocyte formula: the leukocyte count rose to 13.75 thousand/ μ l on the 5th day and fell to 8.43 thousand/ μ l on the 10th, the segmented neutrophils rose from 15.2 % to 27.0 % and then fell to 16.8 %, and the band neutrophils fell from 6.6 % to 2.8 %. These changes reflect the response of the organism to the inflammatory process, and the indicators can be used as a supplementary haematological criterion for assessing the course of the disease and monitoring treatment. The contribution of the work is to provide a quantitative, time-resolved haematological profile of catarrhal-purulent mastitis under the production conditions of Samarkand region.

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