P-ISSN: 2304-3075; E-ISSN: 2305-4360
International Journal of Veterinary Science
www.ijvets.com; editor@ijvets.com

Research Article https://doi.org/10.47278/journal.ijvs/2025.113

Evaluation of Blood Parameter Changes on Treatment Efficacy in Cows with Purulent-Catarrhal Endometritis in Farms of West Kazakhstan Region

Dosmukan Gabdullin [1], Mardan Julanov [2], Orynbay Tagayev [1], Dinara Zainettinova [3], Bakytkanym Kadraliyeva [1], Faruza Zakirova [1], Aigerim Kozhayeva [3], Bekzhassar Sidikhov [1], Adilbek Zholdasbekov [4], Balaussa Yertleuova [1]* and Zukhra Aitpayeva [1]*

[1]Non-profit JSC Zhangir Khan West Kazakhstan Agrarian and Technical University, Uralsk, Kazakhstan
[2]Kazakh National Agrarian Research University, Almaty, Kazakhstan
[3]Non-profit JSC Shakarim University, Semey, Kazakhstan
[4]West West Kazakhstan Innovation and Technological University, Uralsk, Kazakhstan
***Corresponding author:** aliba.87@mail.ru (BY); zulya08_@mail.ru (ZA)

Article History: 25-157 Received: 26-Jun-25 Revised: 19-Aug-25 Accepted: 20-Aug-25 Online First: 10-Oct-25

ABSTRACT

The objective of this study was to evaluate hematological and biochemical parameter changes during treatment of purulent-catarrhal endometritis in cows and correlate with clinical outcomes. The study was conducted from 2018-2023 on 27 Black Pied cows (3-6 years old, milk yield 5000-6000kg/lactation). Diagnosis was confirmed clinically, by ultrasound (DRAMINSKI 4Vet Slim) and laboratory tests (Abacus Vet 5.5200 hematology analyzer, ChemWell biochemistry analyzer). Animals were divided into 3 groups: Groups I-II received experimental protocols with antibiotics, phytopreparations and laser therapy (STP-9), Group III served as control (conventional treatment). Blood parameters (WBC, RBC, HGB, total protein, iron etc.) were monitored on days 1, 3 and 7 of treatment. Experimental groups showed parameter normalization: hemoglobin increased to 112g/L, leukocytes decreased to 12.3×10⁹/L. The control group maintained signs of inflammation (leukocytosis 14.6×10⁹/L). The combined therapy protocol demonstrated optimal results. The developed treatment protocol effectively restores hematological and biochemical parameters, confirming its superiority over conventional methods. Blood parameter monitoring serves as a key criterion for evaluating treatment efficacy and recovery prognosis.

Key words: Dairy cattle, Purulent-catarrhal Endometritis, Hematology, Biochemistry, Treatment protocol.

INTRODUCTION

Current approaches to managing obstetric and gynecological pathologies in cows involve various treatment protocols combining antibacterial, anti-inflammatory medications, and agents enhancing nonspecific resistance. Notably, prolonged use of antimicrobials, particularly antibiotics, leads to resistant bacterial strains that may become pathogenic to humans (Kulpiisova 2024).

Endometritis represents one of the most prevalent diseases in dairy cattle, adversely affecting herd reproductive performance and causing significant economic losses to farms, with substantial implications for Kazakhstan's agricultural and food sectors (Kamalieva et al. 2020). Reproductive challenges and high calf mortality rates pose serious threats to livestock production (Kulpiisova 2024; Vorobyov et al. 2025). Furthermore, veterinary treatment costs and additional disease management resources substantially increase farmers' expenses. Researches indicate varying prevalence rates of bovine reproductive disorders across regions (Zaitsev et al. 2024). In northern Kazakhstan, imported cattle showed endometritis incidence of 27.7% and uterine subinvolution at 17.5%, with these pathologies predominantly occurring postpartum (Jakupov et al. 2013).

The purulent-catarrhal form of endometritis predominates in farms. Uzintleuova et al. (2020) reported acute endometritis prevalence at 23.3% and subclinical cases at 8% in 2020. In beef cattle of West Kazakhstan Region, endometritis affected 35% of animals, with ovarian dysfunction (33.75%), ovarian cysts

Cite This Article as: Gabdullin D, Julanov M, Tagayev O, Zainettinova D, Kadraliyeva B, Zakirova F, Kozhayeva A, Sidikhov B, Zholdasbekov A, Yertleuova B and Aitpayeva Z, 2026. Evaluation of blood parameter changes on treatment efficacy in cows with purulent-catarrhal endometritis in farms of West Kazakhstan Region. International Journal of Veterinary Science 15(1): 225-232. https://doi.org/10.47278/journal.ijvs/2025.113

(21.3%), and chronic uterine subinvolution (10%) (Bozymov et al. 2015). International and domestic studies report postpartum uterine disease incidence ranging from 8% to over 40% (Beishova et al. 2024). Potter and Guitian (2010) found Holstein-Friesian cows in UK farms had 27% endometritis prevalence. Parmar (2021) documented 25% incidence in Indian cattle, while Knyazeva et al. (Add country) reported 20.6-45% variation in Udmurtia, noting predisposing factors including environmental (climate, housing, nutrition, treatment efficacy) and intrinsic factors (host resistance, genetics, parturition characteristics) (Bozymov et al. 2015).

Postpartum endometritis etiology involves α- and β-hemolytic streptococci (including *S. aureus*), staphylococci, *E. coli*, *Fusobacterium spp.*, and *Bacteroides spp.* (Földi et al. 2006; Gnezdilova et al. 2024), with additional isolates including *Arcanobacterium pyogenes* and *Trueperella pyogenes* (Mateus et al. 2002).

Multiple treatment approaches exist for bovine endometritis. The fundamental principle involves reducing pathogenic bacteria while enhancing uterine defense mechanisms and endometrial regeneration to restore fertility, with preference for etiotropic therapy (Darmenova et al. 2022). Comprehensive treatment combines local etiotropic therapy using long-acting antimicrobials ensuring complete uterine sanitation between estrous cycles, uterotonics to improve contractility, and agents promoting endometrial repair and immunobiological reactivity.

Numerous international and domestic studies have addressed endometritis treatment and prevention. The widespread occurrence of purulent-catarrhal endometritis necessitates further clinical research to develop novel therapeutic and preventive approaches, which determined our study's focus.

Jakupov et al. (2013) demonstrated that combined therapy incorporating immunomodulators and antibacterial agents significantly improved treatment efficacy for purulent-catarrhal endometritis, enhancing both clinical parameters and overall immune status. These findings are supported by other studies investigating comprehensive postpartum endometritis treatments, including antibacterial drugs and uterine microbiota improvement (Jakupov et al. 2013; 2016; Gnezdilova et al. 2025).

However, the risk of antibiotic-resistant bacteria development requires careful consideration, as highlighted in international studies discussing bacterial resistance and alternative treatments like probiotics and phytopreparations (Jakupov and Karabayeva 2017; Il et al. 2024). Multiple researchers have explored using local antiseptics and colloidal silver-based preparations for uterine infections, potentially offering effective alternatives to conventional antibiotic therapy (Asatbayeva et al. 2019). Therefore, based on literature recommendations, an integrated approach incorporating modern antiseptic and immunocorrective agents becomes crucial in bovine endometritis treatment.

The aim of this study is to evaluate the influence of hematological and biochemical parameter dynamics on treatment efficacy in cows with purulent-catarrhal endometritis in West Kazakhstan region farms, and to establish correlations between these parameter changes and clinical outcomes of therapeutic protocols, aiming to optimize treatment methods and enhance their effectiveness in regional agricultural conditions.

MATERIALS AND METHODS

Study location and duration: Field experiments were performed at AQAS Agricultural Firm in Terekti District, West Kazakhstan Region from 2018-2023.

Animal characteristics: The study involved 27 Black Pied cows (3-6 years old, milk yield 5000-6000kg/lactation) diagnosed with postpartum purulent-catarrhal endometritis. Diagnosis was confirmed through comprehensive rectal and ultrasound examinations. Animals were divided into three groups (n=9 each): Group I received experimental antibiotic-probiotic therapy; Group II received combined phytopreparate treatment; Group III served as control (conventional therapy).

Study procedures: Reproductive health screening was performed using standard obstetric-gynecological examination methods. Endometritis diagnosis combined clinical and laboratory findings. Treatment efficacy was evaluated through regular clinical monitoring, recovery time of reproductive function, days to estrus resumption post-treatment and conception rates during first and second estrous cycles.

Blood samples were collected from the jugular vein before morning feeding/milking using sterile syringes. Samples were stored at 2-4°C and analyzed within 3-4hours. Hematological parameters (WBC, RBC, HGB, PLT) and biochemical markers were assessed on treatment days 1, 3, and 7.

Blood samples for biochemical analysis were collected at three time points: pre-treatment, during treatment, and post-recovery. Biochemical studies were performed using the Abacus Vet 5 hematology analyzer (Diatron, Austria) and the Chem Well biochemical analyzer (USA) to measure the following parameters: total protein, glucose, iron, creatinine, and cholesterol.

Treatment protocols: These comprehensive analyses were critically important as they enabled assessment of animal health status, therapeutic protocol adjustment, disease outcome prediction, and evaluation of pharmaceutical effects on cattle.

Three treatment protocols were compared for efficacy in managing postpartum purulent-catarrhal endometritis at AQAS Agricultural Firm, West Kazakhstan Region (Table 1).

The first treatment protocol involved intramuscular administration of the anti-inflammatory drug *Aynil* 10% at a dose of 3mL per 100kg body weight during the first two days. To eliminate pathogenic microflora, *Ceftimag* was administered intramuscularly at 1mL per 100kg body weight every 24 hours for five consecutive days. Additionally, *Endometromag-Green* was infused intrauterinely using a Jané syringe over a 5-day period with varying doses: 150mL on day 1, followed by 50mL on days 2 and 3, and 20mL on days 4 and 5. To restore

Table 1: Treatment protocols for cows with purulent-catarrhal endometritis

Treatment Name	Dosage	Administration Route	Treatment Days						
			1	2	3	4	5	6	7
Group I									
Aynil 10%	3mL/100kg	Intramuscular	+	+	-	-	-	-	-
Ceftimag	1mL/100kg	Intramuscular	+	+	+	+	+	-	-
Endometromag-Green	290mL/head	Intrauterine	150	50	50	20	20	-	-
Vitamin E	5mL/head	Intramuscular	+	-	-	-	+	-	-
Vetom 1.1	50mg/kg	Oral with feed	+	+	+	+	+	+	-
Low-intensity laser irradiation (STP-9)	5minutes	Uterine region	+	+	+	+	+		
Group II									
Novocaine 1% + Rivanol 0.1% + Oxytocin 50IU + Penicillin 500,000IU	100mL	Intra-aortic	+	-	+	-	+	-	+
Onion peel infusion		Intrauterine	+	-	+	-	-	+	-
Garlic extract tampon soaked in 5% suspension in Tetravit	1–2 tampons	Intravaginal at the mouth of the cervix	+	-	+	-	-	-	-
ASD-2 fraction with 0.5% novocaine	10mL per site (20mL total)	Subcutaneous	+	-	+	-	+	-	+
Low-intensity laser irradiation (STP-9)	5minutes	Uterine region	+	+	+	+	+		
Group III (Control)									
Nitox-200	1mL/10kg	Intramuscular	+	-	-	+	-	-	+
Furacilin solution 1:5000	400mL	Intrauterine	150	-	150	-	100	-	-
Neofur	1–3units	Intrauterine	+	+	+	-	-	-	-
Uterine massage	3–5minutes	Rectal	+	+	+	+	+	+	+

natural resistance during prolonged antibiotic therapy, the probiotic *Vetom 1.1* was administer ed daily following antibiotic treatment. Vitamin E was supplemented at 5mL per animal on days 1 and 5 to accelerate regeneration of the damaged endometrium. Adjuvant therapy included 5-minute daily sessions of low-intensity laser irradiation using the *STP-9* device for 5 days, which provided thermal effects on uterine cells and deeper tissues while restoring metabolic processes, exerting anti-inflammatory action, and enhancing tissue regeneration.

The second treatment protocol combined several approaches: pathogenetic therapy (novocaine and ASD fraction 2), etiotropic therapy (0.1% ethacridine lactate Rivanol with 500,000IU penicillin G sodium), and symptomatic therapy (oxytocin). In addition, phyto-preparations were used (a 5% onion peel infusion and tampons soaked in a 5% garlic suspension with Tetravit), together with low-intensity laser irradiation of the uterine region. The onion peel infusion was prepared by weighing 25g of peel, rinsing with running water, steeping in 500mL of boiled water in a thermos for 5 hours, followed by filtration through a sieve and cooling to body temperature before gravity-fed intrauterine administration, which was performed three times on days 1, 3, and 6 using the 5% infusion. Complementary treatment included placement of Tetravit-soaked garlic suspension tampons near the cervical os for 12-hour periods on days 1 and 3. The garlic suspension was prepared by blending 5g of peeled garlic cloves with 95mL of Tetravit, with the resulting suspension transferred to a jar containing tampon balls for 24-hour soaking before application using vulval speculum and forceps. Subcutaneous injections of 5% ASD fraction 2 mixed with 0.5% novocaine were administered in 10mL aliquots to each side of the cervical region (total 20mL) at 48-hour intervals for four treatments. The intra-aortic therapeutic cocktail, consisting of 1% novocaine, 0.1% ethacridine lactate, 50 IU oxytocin, and 500,000 IU penicillin, was administered four times at 48-hour intervals.

The treatment course for Group II animals continued for 7 days, with daily clinical monitoring of their condition throughout this period.

The control group received conventional therapy routinely practiced at the study farm, consisting of the antibacterial drug *Nitox 200* (active ingredient: oxytetracycline). Following administration, therapeutic concentrations of oxytetracycline were maintained in blood serum for 60-72 hours. Uterine lavage was performed using a 1:5000 dilution of furacilin solution to reduce bacterial contamination, supplemented by intrauterine administration of *Neofur*, a broad-spectrum antimicrobial agent. Adjuvant therapy included uterine massage to stimulate tone enhancement and facilitate exudate removal.

Equipment: Obstetric and gynecological examinations were performed using the DRAMINSKI 4Vet Slim veterinary ultrasound scanner (Poland). Hematological analysis was conducted with the Abacus Vet 5.5200 veterinary analyzer (Diatron, Austria), while biochemical parameters were measured using the ChemWell analyzer (Awareness Technology, USA). Additional therapeutic interventions included laser therapy delivered by the STP-9 device (Russia).

Statistical analysis: For statistical processing of the results, SPSS version 26.0 (IBM, USA) and Microsoft Excel software were used. Data analysis was performed using analysis of variance (ANOVA). The results are presented as mean values with standard deviation (Mean±SD).

RESULTS

According to a number of researchers, some of the predisposing factors for postpartum endometritis in cows include deficiencies in housing and feeding conditions for pregnant and newly calved cows, retained placenta, trauma to the mucous membranes of the birth canal during parturition, non-compliance with aseptic and antiseptic rules during obstetric assistance, and weakened immunity (Zhaxalykov et al. 2024). All these negative changes create favorable conditions for the growth and

development of pathogenic microflora in the reproductive tract of cows.

Treating cows with postpartum endometritis is a complex and multifaceted task. In veterinary practice, when dealing with large herds, it is common to group cows with the same diagnoses and administer treatment collectively. At the same time, measures are taken to improve housing and feeding conditions for the cows.

In endometritis, hematological changes such as leukocytosis are observed, indicating the presence of an inflammatory process. A shift in the leukocyte formula toward an increased total white blood cell count may also occur. In chronic cases, prolonged inflammation and blood loss can lead to anemia. These changes reflect the systemic response of the body to the inflammatory process in the uterus.

The hematological and biochemical blood parameters of cows suffering from acute purulent-catarrhal endometritis, recorded at the beginning, middle, and end of treatment, are presented in Tables 2 and 3. As can be seen in Table 2, before the start of treatment, hematological data indicated a low red blood cell count in Groups I and II (3.17±0.2×10¹²/L and 3.32±0.2×10¹²/L, respectively), as well as hemoglobin levels (82.10±0.4g/L and 83.33±0.3g/L), similar to the control group (2.81±0.1×10¹²/L and 83.33±0.3g/L).

Simultaneously, elevated leukocyte levels were observed in cows of the first and second groups (16.91±0.4×10⁹/L and 17.81±0.4×10⁹/L) and the control group (17.50±0.5×10⁹/L), indicating a severe infection and inflammatory process. Meanwhile, platelet counts remained within the physiological range with minor variations (324.80±0.4×10⁹/L, 326.01±0.3×10⁹/L, and 322.41±0.5×10⁹/L), suggesting normal blood coagulation and confirming that the decrease in red blood cells and hemoglobin in the experimental and control groups was not associated with blood loss.

The low red blood cell count in cows with endometritis was attributed to insufficient production of new erythrocytes at the required rate, leading to anemia.

By the third day of treatment, red blood cell and hemoglobin levels showed an upward trend, approaching physiological norms in the first and second groups (4.33±0.2×10¹²/L and 95.13±0.3g/L; 4.69±0.2×10¹²/L and 98.11±0.2g/L) as well as in the control group (3.91±0.2×10¹²/L and 90.00±0.2g/L).

At the same time, a decrease in leukocyte levels was noted in both experimental groups (14.64±0.3×10⁹/L and 13.61±0.4×10⁹/L), while in the control group, the values remained elevated (16.29±0.5×10⁹/L), exceeding the physiological norm. The high leukocyte count indicated a persistent inflammatory process in the genital tract of the cows. Platelet levels showed a slight downward trend but remained within normal limits.

By the end of the treatment course, these parameters normalized. The red blood cell and hemoglobin levels in cows treated with our developed protocol reached 5.64±0.3×10¹²/L and 105.83±0.4g/L, and 5.98±0.2×10¹²/L and 112.01±0.4g/L, respectively. In the control group, although the red blood cell count normalized (4.79±0.2×10¹²/L), hemoglobin levels remained below physiological values (94.19±0.2 g/L).

Table 2: Hematological Blood Parameters in Cows with Acute Purulent-Catarrhal Endometritis at "AKAS" Agro-Firm LLP (n=27)

Parameters	Normal Range	Before Treatment			Day 3 of Treatment			Day 7 of Treatment		
		Group I	Group II	Control	Group I	Group II	Control	Group I	Group II	Control
RBC (×10¹²/L)	5.0-7.5	3.17±0.2b	3.32±0.2b	2.81±0.1a	4.33±0.2b	4.69±0.2c	3.91±0.2a	5.64±0.3b	5.98±0.2c	4.79±0.2a
Hb (g/L)	99-129	82.10±0.4a	83,33±0.3b	84.68±0.3c	95.13±0.3a	98.11±0.2c	90.00±0.2a	105.83±0.4b	112.01±0.4c	94.19±0.2a
WBC (×10⁹/L)	4.5-12	16.91±0.4a	17.81±0.4b	17.50±0.5b	14.64±0.3b	13.61±0.4a	16.29±0.5c	13.03±0.2b	12.30±0.2a	14.61±0.2c
PLT (×10⁹/L)	100-450	324.80±0.4b	326.01±0.3c	322.41±0.5a	287.04±0.5b	286.23±0.4a	293.76±0.5c	170.44±0.5b	160.33±0.5c	179.34±0.4c

RBC: Red blood cells, Hb: Hemoglobin, WBC: White blood cells, PLT: Platelets. Different superscript letters in the same row indicate statistically significant differences between groups at the same time point (P<0.05).

Table 3: Biochemical Blood Analysis of Cows with Acute Purulent-Catarrhal Endometritis at "AKAS" Agro-Firm LLP (n=27)

Parameters	Normal Range	Before Treatment			Day 3 of Treatment			Day 7 of Treatment		
		Group I	Group II	Control	Group I	Group II	Control	Group I	Group II	Control
Total protein (g/L)	62-82	95.94±2.34a	95.83±0.4a	96.69±2.37a	87.22±2.02b	84.82±0.40a	90.84±1.70c	70.07±1.58a	73.6±0.4b	83.68±0.98c
Glucose (mmol/L)	2.3-4.1	2.78±0.78a	2.56±0.04a	2.86±0.80a	2.72±0.47a	2.90±0.07a	3.09±0.42a	3.09±0.28a	3.44±0.09b	2.83±0.35a
Iron (µmol/L)	18-20	10.14±0.24b	10.83±0.18c	9.83±0.20a	14.06±0.39b	15.57±0.12c	12.28±0.41a	18.03±0.21b	18.32±0.13b	14.64±0.42a
Cholesterol (mmol/L)	4.5-6.0	2.51±0.23a	2.33±0.08a	2.68±0.23b	3.90±0.06b	4.26±0.09c	3.29±0.15a	4.21±0.16b	4.47±0.10	3.82±0.13a
Creatinine (µmol/L)	56-162	160.60±1.9b	160.96±0.5b	158.26±1.0a	128.60±2.39a	126.83±0.47a	150.73±1.04b	98.74±0.49a	99.92±0.30 b	137.88±1.28c

Different superscript letters in the same row indicate statistically significant differences between groups at the same time point (P<0.05).

At the same time, a decrease in leukocyte levels was observed in both experimental groups (14.64±0.3×10⁹/L and 13.61±0.4×10⁹/L), whereas in the control group, the values remained elevated (16.29±0.5×10⁹/L), exceeding the physiological norm. The high leukocyte count in the blood indicated a persistent inflammatory process in the cows' genital tract. Platelet levels showed a downward trend but remained within the physiological range.

By the end of the treatment course, these parameters normalized. Specifically, red blood cell and hemoglobin levels in the animals treated with our developed protocol reached 5.64±0.3×10¹²/L and 105.83±0.4g/L, and 5.98±0.2×10¹²/L and 112.01±0.4g/L, respectively. In the control group, although the red blood cell count normalized (4.79±0.2×10¹²/L), hemoglobin levels remained below physiological values (94.19±0.2g/L).

Leukocyte levels in the first and second experimental groups decreased to physiological ranges (13.03±0.2× 10⁹/L and 12.30±0.2×10⁹/L). In the control group, this parameter remained elevated (14.61±0.2×10⁹/L), indicating ongoing inflammation. Meanwhile, platelet levels in both groups declined but stayed within normal limits.

Special attention was given to changes in protein, enzyme, and other biochemical markers, which provided a comprehensive assessment of the animals' physiological state during disease progression and treatment. In cows with endometritis, an increase in total protein is often observed, likely due to inflammation. Glucose levels may decrease due to metabolic disturbances, particularly in prolonged inflammation. Reduced serum iron levels may signal developing anemia, while fluctuations in cholesterol and creatinine could reflect lipid metabolism

disorders and impaired kidney function in chronic inflammation.

The combined analysis of these parameters provided a holistic understanding of the cows' physiological status and the efficacy of the applied therapy (Table 3).

As can be seen in Table 3, pre-treatment biochemical data revealed low iron (10.14±0.24µmol/L and 10.83± 0.18µmol/L) and cholesterol levels (2.51±0.23mmol/L and 2.33±0.08mmol/L) in both experimental and control groups (9.83±0.20µmol/L and 2.68±0.23mmol/L, respectively). The reduced iron and cholesterol concentrations were likely associated with inflammatory processes in the reproductive organs. Concurrently, elevated creatinine (160.60±1.9µmol/L and 160.96± 0.5µmol/L) and total protein levels (95.94±2.34g/L and 95.83±0.4g/L) were noted in the first and second experimental groups, as well as in the control group (158.26±1.0µmol/L and 96.69±2.37g/L). The increased total protein suggested infection and systemic inflammation. Glucose levels, however, remained physiologically normal across all groups (2.78±0.78 mmol/L, 2.56±0.04mmol/L in experimental groups; 2.86± 0.80mmol/L in controls).

Biochemical analysis of the diseased animals revealed elevated total protein and creatinine, likely linked to endometrial inflammation complicated by bacterial infection. The rise in blood protein may reflect the body's defensive response, increased antibody production and fever. Additionally, post-calving cows were in the milking phase, which could exacerbate fluid loss, and their diets lacked adequate carbohydrate balance, essential during this period.

By the third day of treatment, iron and cholesterol levels showed an upward trend, reaching physiological norms in the first group (14.06±0.39µmol/L and 3.90±0.06mmol/L), the second group (15.57±0.12µmol/L and 4.26±0.09mmol/L), and the control group (12.28± 0.41µmol/L and 3.29±0.15mmol/L). This indicates a recovery trend, most pronounced in the experimental groups.

Simultaneously, a reduction in total protein and creatinine levels was observed across all groups. In the experimental groups, total protein measured 70.07± 1.58g/L and 98.74±0.49µmol/L in the first group, and 73.6±0.41g/L and 99.92±0.30µmol/L in the second group, while the control group showed 83.68±0.98g/L and 137.88±1.28µmol/L. Despite this decline, these values remained above physiological norms.

By the end of the treatment course, biochemical parameters normalized. Iron and cholesterol levels in the experimental groups reached 18.03±0.21µmol/L, 18.32±0.13µmol/L and 5.30±0.16mmol/L, 5.14±0.10 mmol/L, respectively. In the control group, iron (14.64± 0.42µmol/L) and cholesterol (3.82±0.13mmol/L) levels remained suboptimal. Total protein and creatinine in the experimental groups decreased to physiological ranges (70.07±1.58g/L, 73.6±0.41g/L and 98.74±0.49µmol/L, 99.92±0.30µmol/L), whereas the control group maintained mildly elevated levels (83.68±0.98g/L and 137.88±1.28µmol/L). Glucose levels remained within normal limits in all groups throughout the study.

The findings demonstrate a positive correlation between improvements in hematological/biochemical parameters and clinical recovery in cows treated under the three protocols. The second treatment protocol yielded the best outcomes, with the most significant normalization of both hematological and biochemical markers (Fig. 1).

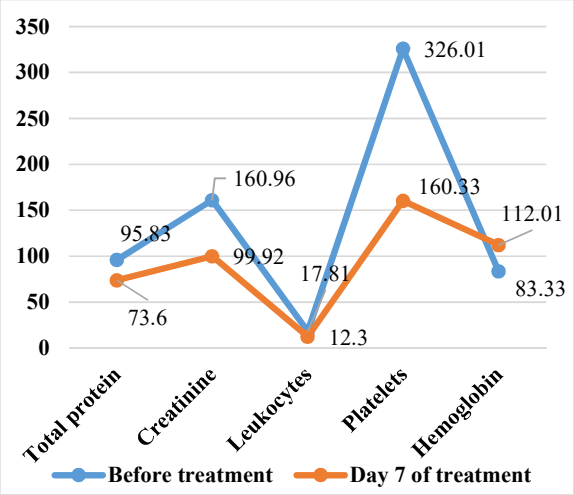

Fig. 1: Correlation between changes in biochemical and hematological parameters under Treatment Protocol II.

Post-therapy, the experimental groups exhibited marked improvements in erythrocyte and hemoglobin levels, reflecting restored hematopoiesis and resolution of inflammation-associated anemia. Hemoglobin increased from 83.33g/L to 112.01g/L, while leukocyte counts declined from 17.81×10⁹/L to 12.3×10⁹/L, indicating reduced inflammatory activity. In contrast, control group values remained elevated, confirming persistent inflammation.

Treatment efficacy was further evidenced by the normalization of iron, cholesterol, total protein, and creatinine levels. Total protein decreased from 95.83g/L to 73.6g/L, and creatinine from 160.96µmol/L to 99.92µmol/L, underscoring systemic recovery. Control group parameters, however, failed to stabilize within normal ranges.

In conclusion, the implemented treatment protocol positively influenced the animals' overall health. All monitored parameters—total protein, glucose, iron, cholesterol, and creatinine – normalized post-treatment. Thus, the tested protocol is viable for managing acute purulent-catarrhal endometritis in cows.

Our developed treatment protocol demonstrated significant improvement in biochemical and hematological parameters in cows suffering from purulent-catarrhal endometritis. The experimental group showed markedly superior results compared to controls, with increases of 9.8% in total protein, 33.2% in glucose, 20.2% in iron, 49.3% in cholesterol, 25.12% in creatinine, 14% in erythrocytes, 23.3% in hemoglobin, 14.6% in leukocytes, and 6.5% in platelets - all values remaining within physiological ranges, confirming the treatment's positive effect.

DISCUSSION

Blood parameter dynamics proved crucial for monitoring recovery progress. The experimental groups

showed favorable trends through increased erythrocyte and hemoglobin levels coupled with decreased leukocyte counts, indicating resolution of anemia and inflammatory processes. These changes represent important prognostic markers for clinical improvement. In contrast, the control group maintained abnormal blood parameters reflecting persistent inflammation and poorer recovery prospects.

Serial monitoring of hematological parameters provides reliable indicators of recovery in cows with endometritis, reflecting both amelioration of anemia and subsiding inflammation. This assertion is supported by reviews emphasizing the value of such blood markers in diagnosing and prognosticating bovine uterine disorders (Várhidi et al. 2024). Corroborative evidence arrives from molecular-genetic studies demonstrating differential gene expression of immune and antioxidant markers in endometritis-affected Holstein cattle, suggesting that transcriptomic profiling can enhance prognostic accuracy alongside hematologic measures (Al-Sharif et al. 2023). Additionally, ultrasonographic evaluations using power Doppler techniques have revealed altered uterine vascular perfusion associated with endometritis, which may correlate with persistent hematological anomalies in untreated cases (Ghasemzadeh-nava et al. 2025). Conversely, our control group's persistently aberrant blood indices align with reports that delayed normalization of hematologic and vascular parameters portends poor recovery. Altogether, these findings reinforce the utility of combining hematological surveillance with molecular and imaging diagnostics to monitor treatment response and predict outcomes in bovine endometritis.

The study establishes hematological and biochemical parameter dynamics as reliable indicators of treatment efficacy and recovery prognosis. The speed at which blood parameters normalize directly correlates with favorable clinical outcomes, providing veterinarians with valuable biomarkers for monitoring therapeutic success. These findings support the protocol's effectiveness in managing purulent-catarrhal endometritis while highlighting the importance of systematic blood parameter analysis in assessing bovine reproductive health.

Hematological and biochemical parameter dynamics have proven to be reliable indicators of treatment efficacy and recovery prognosis in bovine purulent-catarrhal endometritis. The rate of normalization of blood parameters is directly associated with favorable clinical outcomes, providing veterinarians with objective biomarkers to monitor therapeutic success (Khalil et al. 2023). Adjunct studies demonstrate that effective treatment protocols correspond with decreased proinflammatory cytokines (e.g., TNF-α, IL-6) and improved metabolic profiles, including serum enzymes and minerals, which further reinforce clinical assessments (Amer et al. 2024). Moreover, bromelain-based therapies in endometritis cases have been shown to modulate hemato-biochemical parameters underscoring their diagnostic and prognostic utility (Bhaskara Reddy et al. 2024). Collectively, these findings support the effectiveness of our integrative protocol in managing purulent-catarrhal endometritis and highlight the crucial role of systematic hematologic and biochemical monitoring in evaluating treatment success and overall reproductive health.

Comparison of our data with results from other researchers reveals similar trends in hematological parameter dynamics in cows with purulent-catarrhal endometritis (Jakupov et al. 2024). According to Griga et al. (2012) decreased erythrocyte and hemoglobin levels in endometritis cases confirm inflammation-induced anemia and impaired hematopoiesis. However, their studies reported slower recovery of these parameters compared to our experimental group, where improvements were observed as early as day 3 of treatment.

Recent studies confirm that cows with purulent-catarrhal endometritis exhibit hematological alterations consistent with inflammation-induced anemia, including decreased erythrocyte counts and reduced hemoglobin levels. Similar findings were reported in buffaloes with clinical endometritis, where normocytic hypochromic anemia and significant reductions in red blood cells, hemoglobin, and packed cell volume were observed (El-Sayed et al. 2024). In contrast to these observations, our data indicate that hematological recovery in the experimental groups occurred more rapidly, with significant improvement evident by day 3 of treatment. The accelerated normalization of erythrocyte and hemoglobin values suggests that the integrative protocol applied in this study may enhance hematopoietic function and systemic recovery more effectively than conventional therapy.

Similarly, Voitenko (2015) documented elevated leukocyte levels during treatment, indicating persistent inflammation - consistent with our findings where control group leukocytosis reflected ineffective conventional therapy. Notably, our experimental groups demonstrated more pronounced leukocyte reduction, evidencing the proposed protocol's positive immunomodulatory effects. While generally aligned with existing literature, our comprehensive treatment approach yielded faster and more significant hematological recovery.

Comparative analysis confirms the high efficacy of our protocol. As demonstrated by Kuznetsova (2023), traditional methods eventually restore blood parameters but require substantially longer timeframes than our 3-day improvement window. Though previous studies employed antibiotics and lavage, their lack of hematological monitoring limits direct comparability.

Our results correlate with Boyko et al. (2022), Jakupov et al. (2023), Nametov et al. (2023) regarding phytopreparations' immunostimulatory properties and Danilov (2015) research on laser therapy's tissue regeneration benefits. However, our innovative combination of phytotherapy, laser treatment, and conventional methods produced superior synergistic effects.

Conclusion

The study verifies that platelet counts remained stable within physiological ranges, though recovery dynamics were less pronounced in referenced works. Our observed platelet decline while maintaining normal levels indicates restored coagulation function.

The proposed protocol demonstrates superior efficacy, evidenced by accelerated hematological recovery and improved clinical outcomes compared to conventional

treatments. This integrated approach establishes a new standard for managing purulent-catarrhal endometritis, combining rapid parameter normalization with comprehensive physiological restoration. The findings underscore the importance of multimodal therapy in veterinary gynecology and provide a validated framework for optimizing bovine reproductive health management.

DECLARATIONS

Funding: This research received no external funding.

Acknowledgements: The authors sincerely thank the editorial team of the International Journal of Veterinary Science for their valuable guidance and support throughout the review and publication process.

Conflict of interest: The authors declare that there is no conflict of interest regarding the publication of this paper.

Data Availability: Data available upon request from the corresponding authors.

Ethical statement: The study protocol was approved by the Ethics Committee and conducted from 2018 to 2023 at the Laboratory of Biotechnology and Infectious Disease Diagnostics of the Testing Center at Zhangir Khan West Kazakhstan Agrarian-Technical University (Accreditation No. KZ.T.09.0147 dated 01/23/2017 and No. KZ.T.09.E0858 dated 03/15/2022 by the National Accreditation Center, Committee of Technical Regulation and Metrology, Ministry of Trade and Integration of Kazakhstan).

Authors contribution: DG: Conceptualization, methodology, data collection; MJ: Laboratory analysis, statistical evaluation; OT: Clinical trials supervision, interpretation of results; DZ: Data curation, manuscript preparation; BK: Animal handling, field investigations; FZ: Laboratory support, biochemical analysis; AK: Data processing, literature review; BS: Veterinary examinations, sample collection; AZh: Technical assistance, data interpretation; BY, ZA: Supervision, project administration, manuscript drafting.

Generative AI Statement: The authors declare that no Gen AI/DeepSeek was used in the writing/creation of this manuscript.

Publisher's Note: All claims stated in this article are exclusively those of the authors and do not necessarily represent those of their affiliated organizations or those of the publisher, the editors, and the reviewers. Any product that may be evaluated/assessed in this article or claimed by its manufacturer is not guaranteed or endorsed by the publisher/editors.

REFERENCES

Al-Sharif M, Abdo M, Shabrawy OE, El-Naga EMA, Fericean L, Banatean-Dunea I and Ateya A, 2023. Investigating polymorphisms and expression profile of immune, antioxidant, and erythritol-related genes for limiting postparturient endometritis in Holstein cattle. Veterinary Sciences 10(6): 370. https://doi.org/10.3390/vetsci10060370

Amer SS, Ghallab RS, El Dakroury MF and El Amrawi GA, 2024. Advanced clinical trials in treatment of postpartum endometritis in Holstein dairy cows using nano-oxytetracycline, platelet-rich plasma, and conventional oxytetracycline. Matrouh Journal of Veterinary Medicine 4(1). https://doi.org/10.21608/MJVM.2023.245148.1020

Asatbayeva GK, Abdrakhmanov TZh and Konvisher AN, 2019. Comparative evaluation of methods for diagnosing catarrhal endometritis of cows. Selection and Genetic Aspects of Dairy Cattle Development: 166-174.

Beishova I, Belaya A, Kuzhebayeva U, Ulyanova T, Ulyanov V, Beishov R, Ginayatov N, Kovalchuk A, Kharzhau A and Sidarova A, 2024. Association of polymorphic variants of prolactin (PRL) and beta-lactoglobulin (BLG) genes with resistance/susceptibility to mastitis in holstein cows. Brazilian Journal of Biology 84: e284961. https://doi.org/10.1590/1519-6984.284961

Bhaskara Reddy SV, Srinivas M, Chandra Prasad B and Sreenu M, 2024. Therapeutic efficacy of bromelain in treatment of subclinical endometritis in buffaloes: Hemato-biochemical changes. International Journal of Veterinary Sciences and Animal Husbandry 9(2): 123–131.

Boyko TV, Luksha EA, Veretennikova VS and Ogurnoy IV, 2022. Development of injectable dosage form of phytodrug on the basis of hellellow, yarrow, and nettle for the prevention and treatment of postpartum diseases in cows. International Journal of Veterinary Medicine 3: 83-90. https://doi.org/10.52419/issn2072-2419.2022.3.83

Bozymov KK, Nasambaev EG and Sultanova AK, 2015. Experience of using ultrasonography for diagnosing reproductive organ diseases in beef cattle in West Kazakhstan. Bulletin of Bryansk State Agricultural Academy 2(1): 37-41.

Danilov MS, 2015. Pharmacological properties and therapeutic-prophylactic efficacy of herbal preparations and mineral compounds in cow mastitis. Dissertation, Institute of Experimental Veterinary Medicine of Siberia and Far East.

Darmenova AG, Yusupov SR, Kereyev AK, Zukhrabov MG, Sengaliyev YM, Gabdullin DE and Satybaev BG, 2022. The study of cows' uterine tone in normal and pathological postpartum periods. Advances in Animal and Veterinary Sciences 10(5): 1153-1160. https://doi.org/10.17582/journal.aavs/2022/10.5.1153.1160

El-Sayed A, Refaai M and Ateya A, 2024. Doppler ultrasonographic scan, gene expression and serum profile of immune, APPs and antioxidant markers in Egyptian buffalo–cows with clinical endometritis. Scientific Reports 14: 5698. https://doi.org/10.1038/s41598-024-56258-0

Földi J, Kulcsár M, Pecsi A, Huyghe B, De Sa C, Lohuis JACM, Cox P and Huszenicza Gy, 2006. Bacterial complications of postpartum uterine involution in cattle. Animal Reproduction Science 96(3-4): 265-281. https://doi.org/10.1016/j.anireprosci.2006.08.006

Ghasemzadeh-nava H, Masoudifard M, Shafiee-tabar M and Baghbadorani MK, 2025. Evaluation of endometrial vascular flow index and echogenicity following experimental induction of subclinical endometritis in dairy cows. Scientific Reports 15: 16073. https://doi.org/10.1038/s41598-025-98966-1

Gnezdilova L, Kruglova Y, Muradyan Zh and Rozinsky S, 2025. Assessing The ecological impact of betulin-containing feed additives: Insights from biochemical parameters in breeding calves and dairy cows. International Journal of Ecosystems and Ecology Science15 (1): 103-112. https://doi.org/10.31407/ijees15.1

Gnezdilova L, Kruglova Y, Muradyan Zh and Rozinsky S, 2024. Sustainable ecological health of livestock farms, the impact

of a betulin-containing feed additive on clinical and hematological parameters in breeding calves and dairy cows. International Journal of Ecosystems and Ecology Science 14(4): 191-200. https://doi.org/10.31407/ijees14.4

Griga OE, Griga EN and Bozhenov SE, 2012. Determination of hematological, biochemical blood parameters and factors of nonspecific resistance in cows with normal and pathological reproductive organs. Veterinary Pathology 4(42): 48-51.

Il Y, Il D, Zabolotnykh M, Savenkova I, Nurzhanova K, Zhantleuov D, Kozhebayev B, Akhmetova B, Satiyeva K and Kurmangali L, 2024. Changes in blood biochemical parameters in highly productive cows with ketosis. Veterinary World 17(5): 1130–1138. https://doi.org/10.14202/vetworld.2024.1130-1138

Jakupov I, Kuzerbayeva A and Karabayeva ZhZ, 2016. Development of a Color Chart for Differentiating Lochia in Cows with and without Uterine Involution Disorders. Tierarztliche Praxis 6: 368-370. https://doi.org/10.15653/TPG-160691

Jakupov I, Wehrend A, Abultdinova A, Mamytbekova G, Zharkimbaeva Z and Zabrodin A, 2024. Development of a rapid test to determine endometritis of cows after calving. Veterinary World 17(9): 2028-2035. https://doi.org/10.14202/vetworld.2024.2028-2035

Jakupov IT and Karabayeva ZhZ, 2017. Monitoring of reproductive function in dairy cows of different breeds. Bulletin of Shakarim State University of Semey 2(1): 35-41.

Jakupov IT, Yeszhanova GT and Krivets V, 2013. Prevalence and diagnosis of postpartum pathologies in cows. Seifullin Readings – 9: New Vector of Higher Education and Science Development 1(2): 210-212.

Jakupov IT, Yeszhanova GT and Mamytbekova GK, 2023. Biological activity and pharmaco-therapeutic efficiency of Calligonum leucocladum B. dosage forms in the treatment of cow endometritis. Advances in Animal and Veterinary Sciences 11(7): 1200-1208. https://doi.org/10.17582/journal.aavs/2023

Kamalieva Y, Mingaleev D, Ravilov R and Zhanabayev A, 2020. Incidence of non-specific tuberculin reactions in cattle in the Republic of Tatarstan in comparison with bovine tuberculosis epizootic situation. BIO Web of Conferences, 27). https://doi.org/10.1051/bioconf/20202700104

Khalil HM, Waheeb RS, Abd El-Rheem SM and El-Amrawi GA, 2023. Evaluation of medical and economical efficacy of some protocols for treatment of postpartum clinical endometritis in Holstein dairy cows. Alexandria Journal of Veterinary Sciences 79(1): 150–157.

Knyazeva MV, Khamitova EF and Merzlyakova EA, 2014. Analysis of obstetric and gynecological studies of cattle in the Udmurt Republic. Scientific Notes of Kazan State Academy of Veterinary Medicine 219: 192-197.

Kulpiisova A, Jakupov I, Karabayeva Zh and Mamytbekova G, 2024. Utilization of Assisted Reproductive Technologies in Breeding Auliekol Cattle: A Comparative Study. Life 14(9): 1167. https://doi.org/10.3390/life14091167

Kuznetsova EYU, 2023. Study of means for prevention of cow endometritis. In: Experimental Science: Mechanisms, Transformations, Regulation. Agency of international research, Sterlitamak, Russian Federation, pp. 5-8. https://www.elibrary.ru/item.asp?id=53745789

Mateus L, Lopes da Costa L, Bernardo F and Robalo Silva J, 2002. Influence of puerperal uterine infection on uterine involution and postpartum ovarian activity in dairy cows. Reproduction in Domestic Animals 3(1): 31-35. https://doi.org/10.1046/j.1439-0531.2002.00317.x

Nametov A, Yertleuova B, Orynkhanov K, Semenenko MP, Sidikhov B, Murzabayev K, Dushayeva L, Ichshanova A and Marat M, 2023. Evaluation of the antibacterial effect of Artemisia lerchiana compared with various medicines. Brazilian Journal of Biology 83: e272654. https://doi.org/10.1590/1519-6984.277641

Parmar KH, 2021. Endometritis in bovine: A review. Agricultural Reviews 42(3): 342-347. https://doi.org/10.18805/ag.r-2038

Potter TJ, Guitian J, Fishwick J, Gordon PJ and Sheldon IM, 2010. Risk factors for clinical endometritis in postpartum dairy cattle. Turkish Journal of Veterinary and Animal Sciences 74(1): 127-134. https://doi.org/10.1016/j.theriogenology.2010.01.023

Uzintleuova AD, Dzholanova NM and Dzholanov MN, 2020. Prevalence and Etiology of Gynecological Pathologies in Cows. Agrarian Science for Agriculture: Proceedings of the 15th International Scientific and Practical Conference. Barnaul.

Várhidi Z, 2024. Uterine disease in dairy cows: A comprehensive review. Animals 14: 200. https://doi.org/10.3390/ani14010200

Voitenko LG, 2011. The effect of some blood indexes on the onset of bovine puerperal endometritis. Bulletin of the Michurinsk State Agrarian University 1-2: 26. https://www.elibrary.ru/item.asp?id=17093139

Vorobyov N, Selina M and Guselnikova A, 2025. Neural Network Visualization of Stochastic Dependence of Weight Gain Processes on Dairy Productivity of Cows. Journal of Global Innovations in Agricultural Sciences 13: 691-697. https://doi.org/10.22194/JGIAS/13.1599

Zaitsev V, Korotkiy V, Bogolyubova N, Zaitseva L and Ryzhov V, 2024. Prevention of Heat Stress in Lactating Cows. American Journal of Animal and Veterinary Sciences 19(1): 7-12. https://doi.org/10.3844/ajavsp.2024.7.12

Zhaxalykov RA, Bayazitova KN, Polyak AI, Kassymbekova LN, Mustafina R and Zabolotnykh MV, 2024. Veterinary and sanitary assessment of milk quality in black-and-white cows fed with extruded compound feeds in North Kazakhstan. Advancements in Life Sciences 11(4). http://dx.doi.org/10.62940/als.v11i4.3375