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Research article/ Научная статья

Therapeutic efficacy of antimastitis drugs in the treatment of subclinical and clinical forms of dairy cow mastitis

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Abstract. Comparative effectiveness of veterinary antimastitis drugs in the treatment of subclinical and clinical mastitis of dairy cows was studied. During the experiment, two treatment regimens were used. Cows from the 1st and 3rd experimental groups were treated according to the traditional scheme for this farm — intracisternal administration of Mastiet Forte; for the treatment of cows from the 2nd and 4th experimental groups, Mamikur was administered intracisternally. The effectiveness of therapy was assessed by clinical signs, by the number of somatic cells in milk, response to Kenotest and hematological parameters. It was established that the use of Mamikur as a monotherapy for serous-catarhal clinical and subclinical mastitis in cows is well tolerated and gives a positive effect when administered intracisternally in the volume of one dosing syringe three times with an interval of 12 hours.

Keywords: mammary gland of cow, subclinical mastitis, clinical mastitis, Mastiet Forte, Mamikur, somatic cells, hematological parameters of blood, Kenotest

Conflict of interests. The authors declare that they have no conflict of interests. The studied antimastitis drugs were provided for research by the livestock complex. The study was carried out with the aim of improving quality of treatment for cow mastitis on this farm.

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Introduction

Bovine mastitis is widespread and causes significant economic damage to processing industry enterprises, milk producers and human health [1, 2]. Microbial agents, which determine characteristics of mastitis, have the leading role in etiology of the disease. Pathogenic streptococci, staphylococci, *E. coli* and other bacteria resistant to antimicrobial drugs are always found in milk of cows suffering from mastitis [3–9].

This pathology significantly reduces productivity and quality of milk [10, 11]. Hence, the service period increases due to impaired reproductive function, which leads to problems in cattle selection and decrease in resistance to mastitis [12]. Every year, from 10 to 80 % of dairy cows are infected with mastitis. Subclinical form of mastitis accounts for up to 97 % of cases [13, 14].

Measures aimed at preventing this pathology promptly reduce incidence of disease in cows and help reduce economic losses [15]. Treatment with some drugs does not always have a positive result. The task of veterinary specialists is to identify new highly effective methods and means of treating all forms of mastitis in cattle. Sulfonamide drugs, nitrofurans derivatives, and antimicrobial substances (antibiotics) are used as medicines. These drugs can lead to decrease in sensitivity of microflora and cause mastitis. This is the main reason for the search for new highly effective antibacterial agents against this pathology in cattle [16, 17].

The purpose of the study was to study effectiveness of anti-mastitis drugs “Mas-tiet Forte” and “Mamikur” in treatment of subclinical and clinical forms of mastitis in dairy cows.

Materials and methods

The research was carried out at dairy farm of livestock complex in the Moscow region. The object of the research was 42 cows of the black-and-white (Holsteinized) breed with a live weight of 500...550 kg, with a milk yield of 6000...7000 L/year. Of these, 20 heads showed signs of sub-clinical and 12 — clinical serous-catarrhal form of mastitis. The control group was formed from 10 healthy cows. All planned diagnostic measures were carried out on the experimental animals (the farm was free from brucellosis, leukemia and tuberculosis). Milking was conducted using the Lely Astronaut milking system. This is a unique set of equipment for milk quality control Lely MQC (milk quality control system). During milking, milk from each quarter of udder is continuously checked. Blood from the experimental animals was taken for analysis in the morning, before feeding, from tail vein using a vacuum tube.

To conduct the experiment according to the scheme (Table 1), 5 groups of cows were formed.

Table 1

Scheme of the experiment

Animal group	Number of animals	Mastitis form	Drug	Dosage	Frequency	Drug administration		Controlled parameter
						intracis- ternal	subcuta- neous	
Experimental group 1	10	Subclinical	Mastiet Forte	8 g	Every 12 hours until negative Kenotest	+		Clinical trial, hematological analysis, Kenotest, quantitative analysis of somatic cells
Experimental group 2	10	Subclinical	Mamikur	8 g	Every 12 hours until negative Kenotest	+		
Experimental group 3	6	Clinical	Mastiet Forte	8 g	Every 12 hours until clinical signs improve	+		
Experimental group 4	6	Clinical	Mamikur	8 g	Every 12 hours until clinical signs improve	+		
Control group 5	10	Healthy	Physiological solution	7 ml	Twice daily for five days		+	

Cows of the 1st and 3rd experimental groups were treated with “Mastiet Forte” intracisternally into the affected udder lobe in the volume of 1 dosing syringe with an interval of 12 hours until recovery and negative Kenotest.

Cows of the 2nd and 4th experimental groups were treated with “Mamikur” intracisternally into the affected udder lobe in the volume of 1 dosing syringe with an interval of 12 hours until recovery and negative Kenotest.

Cows of the 5th control group (healthy) were injected subcutaneously into the udder area with physiological solution of sodium chloride, 7 ml, twice a day with an interval of 12 hours for five days. Table 2 shows the composition of the tested drugs.

Table 2

Composition of drugs

Drug	Mastiet Forte	Mamikur
Pharmaceutical form	1 syringe dispenser (8 g)	1 syringe dispenser (8 g)
Composition	250 mg of neomycin (sulfate form), 200 mg of tetracycline (hydrochloride form), excipients – 368 mg of magnesium stearate and up to 8 g of liquid paraffin oil, 2000 IU of bacitracin and 10 mg of prednisolone	Dexamegazone (sodium phosphate) – 0.5 mg, neomycin (sulfate) – 100 mg, cloxacillin sodium salt – 250 mg, trypsin – 5 mg, excipients: white paraffin and liquid vaseline
Producer	Intervet International B.V., Netherlands	Laboratorios SYVA s. a. u., Avda. Parroco Pablo Diez, 49–57, 24010 Leon, Spain

To diagnose subclinical mastitis, Kenotest was used in accordance with the instructions (Fig. 1).

2 ml of milk from each quarter of the udder was mixed with 2 ml of Kenotest solution (Fig. 2). After stirring with a stick for 15 s, the reaction was recorded. The viscosity of the jelly was assessed:

- negative reaction — homogeneous liquid (–). No mastitis;
- questionable reaction — traces of jelly formation (\pm). Subclinical mastitis;
- positive reaction — a clearly visible clot (from weak to dense), which can be thrown out of the socket with a stick (+). Clinical form of mastitis.



Fig. 1. Taking a sample of mammary gland secretion for Kenotest

Source: created by the authors

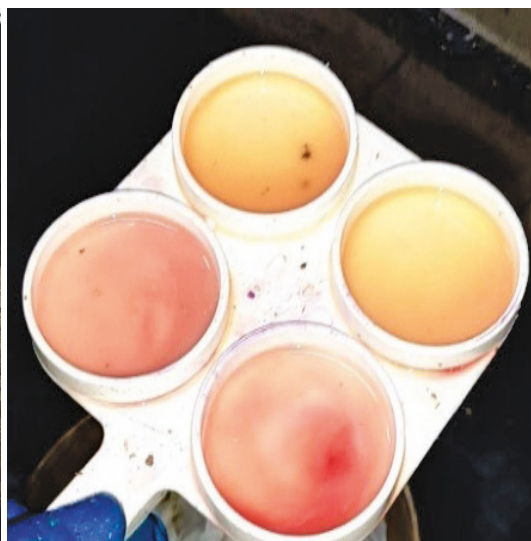


Fig. 2. Tablet for Kenotest

Source: created by the authors

Moreover, number of somatic cells in milk was determined using a viscometric milk analyzer “Somatos-V”, conditional viscosity of milk samples mixed with an aqueous solution of mastoprim was determined by the time of flow through capillary tube. The range of instrument readings is from 90 to 1500 thousand cells in 1 cm³ of milk.

Cows whose somatic cell content after treatment for clinical mastitis was below 500 thousand/1 cm³ were completely recovered; above 500 thousand/1 cm³, the disease became subclinical.

Animals with a number of somatic cells from 500 to 950 thousand/1 cm³ were selected for groups 1 and 2.

The control group 5 included healthy animals with the number of somatic cells in milk less than 500 thousand/1 cm³.

Clinical serous-cattarrhal mastitis was diagnosed based on the results of clinical study using a generally accepted method¹. Using test milking, the degree of dysfunction of mammary gland was determined. Tone of nipple sphincter was measured by milking with force. In particular, in case of impaired milk flow, decrease in amount and change in composition of udder secretion was observed: appearance of milk, color and presence of flakes and clots in it.

Peripheral blood was taken to perform a general clinical analysis. The analysis was carried out on veterinary hematological analyzer PCE-90VET (Japan) before the experiment and after the therapy. Hemoglobin level in animals was determined using Easy Touch GCHb biochemical analyzer (Fig. 3).



Fig. 3. Taking a sample of blood for hematology research

Source: created by the authors

Results and discussion

During a clinical study of animals for mastitis before treatment, on the second day and on the fifth day of therapy, the following clinical signs of general condition of cow and mammary gland were revealed, described in Table 3.

¹ Studentsov A.P., Shipilov V.S., Nikitin V.Ya., Petrov A.M., Dyulger G.P., Khramtsov V.V., Preobrazhensky O.N. *Obstetrics, gynecology and biotechnology of animal reproduction*. M.: Kolos publ., 2011.

Table 3

Clinical signs of mastitis in cows in the experimental groups before using the drug, on the second day and on the fifth day of treatment with anti-mastitis drugs

Indicator	Group 1 (Mastiet Forte) (n=10)		Group 2 (Mamikur) (n=10)		Group 3 (Mastiet Forte) (n=6)		Group 4 (Mamikur) (n=6)		Group 5 (Control) (n=10)			
	before using the drug	2nd day	5th day	before using the drug	2nd day	5th day	before using the drug	2nd day	5th day	before using the drug	2nd day	5th day
	Dynamics the applied treatment (days)											
Depression	3	1	3	4	0	2	6	6	4	1	0	0
Hyperaemia	0	0	0	0	0	0	6	6	3	0	0	0
Compacted udder structure	0	0	0	0	0	0	6	4	4	1	0	0
Edema	3	1	2	4	0	0	6	6	4	0	0	0
Soreness	0	0	0	0	0	0	6	3	3	1	0	0
Increased temperature of udder	0	0	0	0	0	0	6	4	2	0	0	0
Kenotest reaction	10	5	5	10	2	0	6	6	6	1	0	0

Note: the table shows the number of animals in the groups with pronounced clinical signs of mastitis before treatment and during the therapy.

At the beginning of the experiment, in cows of all experimental groups during a clinical study, a slight depression of general condition and swelling of udder was observed. In the 3rd and 4th experimental groups, redness, soreness and thickening were observed in the lower third of udder and at the base of nipples. During milking, the release of aqueous liquid with a large number of clots and casein flakes was noted. All experimental groups had a positive reaction to Kenotest.

Clinical examination of animals on the second day of treatment revealed clinical signs described in Table 3.

On the second day of treatment, when carrying out a reaction to Kenotest in the 2nd experimental group with subclinical form of mastitis, where anti-mastitis drug Mamikur was used, a negative result was achieved in 80 % of cases of sick animals, which is 30 % higher than in the 1st experimental group where Mastiet Forte was used. In this group, recovery occurred in 50 % of cases.

Treatment in the 3rd and 4th experimental groups with clinical mastitis continued, since no significant changes were observed over two days.

Clinical examination of animals on the fifth day of treatment revealed clinical signs described in Table 3. Based on the data presented, the most pronounced therapeutic effect was observed in the 4th experimental group, where Mamikur was used. As a result of a five-day course of therapy, recovery occurred in 90 % of cases, which is 10 % higher than in the 3rd experimental group, where Mastiet Forte was used. A positive reaction to Kenotest was observed in 2 animals from the 3rd group and 1 animal from the 4th group.

Upon completion of treatment measures, somatic cells in milk were counted using viscometric analyzer (Fig. 4, Table 4).



Fig. 4. Somatic Cell Viscometry

Source: created by the authors

Somatic cell count in milk samples from cows with subclinical and clinical forms of mastitis

Indicator	Group 1 (n=10)		Group 2 (n=10)		Group 3 (n=6)		Group 4 (n=6)		Group 5 (n=10)	
	before	after	before	after	before	after	before	after	before	after
Somatic Cell Count ths/ cm ³	770.14± ±73.0	654.8± ±97.66	732.77± ±74.25	436.0± ±56.34	761.2± ±75.2	628.6± ±66.8	758.66± ±73.96	429.83± ±99.83	320.4± ±99.83	334.83± ±55.3

From the results obtained (See Table 4) it is clear that the number of somatic cells in cows with subclinical and clinical mastitis before treatment was higher than normal (more than 500 cells, ths/cm³) in all experimental groups.

After therapy in the 1st and 2nd experimental groups, this indicator significantly decreased compared to the beginning of the experiment, but only in the 2nd group, after using Mamikur, the indicator returned to normal and amounted to 436.0 ± 56.34.

When treating the clinical form of mastitis in the 3rd and 4th experimental groups, the most pronounced therapeutic effect was observed in the 4th group, where Mamikur was used. The indicator significantly decreased to normal and amounted to 429.83±99.83.

The results of general clinical blood test of cows with subclinical and clinical forms of mastitis before and after treatment with anti-mastitis drugs are given in Table 5.

As Table 5 shows, before the experiment, hematological parameters of the 1st and 2nd experimental groups did not have significant differences. In four animals from the 1st experimental group, slight leukocytosis was observed (14.2; 12.8; 16.4 and 12.5×10⁹/L), which slightly increased the average leukocyte count for the group. The average erythrocyte sedimentation rate in group 1 also exceeded the norm (the difference is not significant). A slight decrease in hemoglobin and red blood cells was observed in all experimental animals.

Analysis of hematological parameters at the end of the experiment did not reveal significant changes in blood parameters. As a positive point, we can note the normalization of the number of leukocytes in blood of four animals from the 1st experimental group.

During conducting a hematological study, a higher erythrocyte sedimentation rate was observed in sick animals of the 3rd and 4th groups at the beginning of the experiment. The platelet and white blood cell counts were also elevated. In the leukogram of sick animals, a greater number of neutrophils and a smaller number of lymphocytes were noted compared to the control. Nevertheless, all these indicators, except for ESR, were within the physiological norm.

In animals of these two groups, a slight decrease in hemoglobin and erythrocytes was observed.

Table 5

Results of general clinical blood test of cows with subclinical and clinical mastitis before and after anti-mastitis treatment

Indicators	Norm	Group 1 (n=10)		Group 2 (n=10)		Group 3 (n=6)		Group 4 (n=6)		Group 5 (n=10)	
		before	after	before	after	before	after	before	after	before	after
HGB, g/L	90...120	84.36±6.2	77.46±9.1	84.27±5.1	83.63±7.43	83.25±8.2	81.59±4.1	82.21±8.1	81.11±7.2	83.59±12.9	83.59±10.5
RBC, ×10 ¹² /L	5...7.5	4.62±3.4	4.45±1.9	5.10±3.2	4.76±2.5	5.39±1.6	5.30±1.3	5.13±1.5	5.03±1.4	5.46±1.23	5.55±1.16
ESR, mm/h	0.5...1.5	6.3±2.5	4.7±3.5	4.7±3.3	2.3±1.6	6.2±1.5	3.6±1.3	4.4±1.6	3.3±1.3	2.48±2.33	1.84±1.55
PLT, ×10 ⁹ /L	260...700	472.2±48.5	406.4±60.5	376.3±61.4	419±70.1	330.7±62.5	338.5±60.6	387.5±61.7	377.5±82.1	270.0±58.8	278.0±61.4
WBC, ×10 ⁹ /L	4.5...12.0	11.3±1.14	10.4±1.13	11.8±2.13	8.6±1.23	11.27±1.53	9.25±1.35	9.74±1.15	8.67±1.39	7.95±1.41	7.62±0.62
EOS	3...8	1.55±0.7	2.29±1.18	2.61±1.09	2.38±1.15	3.18±1.11	2.29±1.34	2.43±1.06	2.17±0.78	2.12±1.8	1.76±0.5
BAS	0...2	0	0	0	0	0	0	0	0		
MYELO	—	0	0	0	0	0	0	0	0		
METAMYELOCYTE	0...1	0	0	0	0	0	0	0	0		
BAND	2...5	8.61±1.4	5.15±3.3	6.34±3.1	4.4±1.2	6.78±2.5	5.59±1.1	6.36±2.6	5.32±3.5	3.21±1.2	3.3±1.1
SEGS	20...35	35.7±6.2	31.5±7.6	32.7±2.5	31.4±5.8	36.3±10.1	29.7±3.7	32.6±4.5	26.3±6.1	30.5±3.5	35.0±4.11
MON	2...7	3.3±2.4	2.5±1.4	3.1±1.7	4.2±1.6	4.7±2.3	4.4±1.5	3.3±1.8	3.1±1.5	3.2±0.85	3.0±1.29
LYM	40...75	50.3±10.4	58.2±5.9	53.7±4.3	55.9±7.5	49.3±4.6	59.7±6.1	56.1±7.5	61.9±7.1	60.1±4.42	56.6±4.26

Conclusion

Studies have shown that the veterinary drug “Mamikur”, which belongs to the combined antibacterial drugs, is well tolerated by lactating cows and has a therapeutic effect in subclinical and clinical serous-catarrhal forms of mastitis, which is confirmed by negative Kenotest, normalization of somatic cells in milk and the results of clinical examination of animals.

The use of Mamikura in treatment of subclinical mastitis in form of intracisternal administration in the volume of one dispenser syringe three times with an interval of 12 hours gave a pronounced therapeutic effect on the second day of treatment in the 2nd experimental group and normalized the number of somatic cells in milk samples of sick animals. The effectiveness of the drug was 30 % higher than in the 1st experimental group, where Mastiet Forte was used.

Therapy of serous-catarrhal mastitis with “Mamikur” in the form of intracisternal administration in the volume of one dispenser syringe three times with an interval of 12 hours led to a pronounced therapeutic effect on the fifth day of treatment in the 4th experimental group. The effectiveness of the drug was 10 % higher than in the 3rd experimental group, where Mastiet Forte was used.

Drug “Mamikur” can be recommended for use in veterinary in the treatment of mastitis in cows.

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Терапевтическая эффективность противомаститных препаратов в лечении субклинической и клинической форм мастита дойных коров

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Аннотация. Приведены результаты изучения эффективности ветеринарных противомаститных препаратов в сравнительном аспекте при лечении субклинического и клинического маститов дойных коров. В ходе опыта были применены две схемы лечения. Коров 1-й и 3-й опытных групп лечили по традиционной для данного хозяйства схеме: интрацистернальное введение препарата «Мастигет Форте», а для

лечения коров 2-й и 4-й опытных групп интрацистернально вводили Мамикур. Эффективность терапии оценивали по клиническим признакам, количеству соматических клеток в молоке, реакции на Кенотест и гематологическим показателям. Установлено, что применение препарата «Мамикур» в качестве монотерапии серозно-катарального клинического и субклинического маститов у коров хорошо переносится и дает положительный эффект при интрацистернальном введении в объеме одного шприца-дозатора трехкратно с интервалом 12 часов.

Ключевые слова: молочная железа коровы, субклинический мастит, клинический мастит, Маститет Форте, Мамикур, соматические клетки, гематологические показатели, Кенотест

Заявление о конфликте интересов: Авторы заявляют об отсутствии конфликта интересов. Приведены результаты изучения противовоспалительных препаратов, используемых и предоставленных для научно-исследовательской работы животноводческим комплексом, на базе которого она выполнялась. Исследование проводили с целью улучшения качества терапии маститов коров в данном хозяйстве.

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