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/2024.151

Effectiveness of Antimicrobial Preparations for the Sanitation of the Udder of Dairy Cows

Gulnur Tanbayeva[1*], Bakhyt Barakhov[2], Orynbay Tagayev[3], Zhaxylyk Myrzabekov[2], Primkul Ibragimov[2], Gulmira Alpysbayeva[2], Murat Kalmagambetov[4] and Dinara Darbekovna Narbayeva[2]

[1]Kostanay Regional University named after A. Baitursynov, Kostanay, Republic of Kazakhstan
[2]Kazakh National Agrarian Research University, Almaty, Republic of Kazakhstan
[3]West Kazakhstan Agrarian-Technical University named after Zhangir khan, Uralsk, Republic of Kazakhstan
[4]Scientific Research Institute of Animal Husbandry and Feed Production, Almaty, Republic of Kazakhstan
***Corresponding author:** gulnurtanbayeva@mail.ru

Article History: 23-407 Received: 19-Jan-24 Revised: 27-Feb-24 Accepted: 28-Feb-24

ABSTRACT

Subclinical mastitis prevention in dairy cows necessitates the use of effective pre- and post-milking udder preparations. Many imported post-milking udder treatments have proven ineffective and costly, prompting the exploration of composite preparations based on chemical compounds. This study aims to assess the bactericidal properties of Promixan, a preparation based on Anavidin and its impact on subclinical mastitis prevention and milk quality under production conditions. The experimental study took place at two Republic of Kazakhstan farms. Three groups of cows, comprising those with subclinical mastitis (for disease treatment) and healthy cows (for disease prevention), were selected. To evaluate the bactericidal efficacy of post-milking udder treatments, microbial concentration dynamics were observed every two hours until the subsequent milking. Promixan exhibited 98.1 and 96.7% effectiveness in preventing subclinical mastitis in healthy cows at the Adal Agro-Industrial Complex farm and E.S. Aidarbayev farm, respectively, after 4 hours of exposure. In the group of sick cows, it demonstrated effectiveness rates of 95.3 and 94.3%, respectively. These results indicate that Promixan matches or surpasses the bactericidal properties of analogs. When used on sick cows, Promixan outperformed Blockade and Vet Clean I-Film by 2.1 and 2.2%, respectively, indicating its comparable effectiveness. Experimental studies revealed that Promixan's bactericidal properties surpassed those of Blockade and Vet Clean I-Film by 3.4 and 3.3%, respectively. Promixan effectively forms a bacteriological protective film on cow udder teats, preventing microbial penetration into the skin, and proves to be a viable alternative to existing treatments for subclinical mastitis prevention in dairy cows under production conditions.

Key words: Sanitary treatment, Subclinical mastitis, Bacteriological protection, Udder teat, Mastitis prevention, Bacterial contamination.

INTRODUCTION

The most important problem of dairy farming in the Republic of Kazakhstan is mastitis in cows, characterized by widespread prevalence, massive character, and huge economic damage (Mukhamadieva et al. 2022; Abdalhamed et al. 2023). The total damage caused by diseases consists of a decrease in milk productivity by 50% and milk quality by 10% and an increase in loss of offspring by 10%, treatment costs by 15%, and premature culling of animals by 15%. According to some researchers, the incidence of this disease among cows averages 20-40% and is mainly due to the lack of comfortable conditions for keeping cows on farms (Tagaev 2010; Tanbayeva et al. 2016; Myrzabekov et al. 2020; Reshetnikova and Krylova 2023; Sattarova et al. 2023). In addition, farm owners do not have a systematic approach to solving this problem (Barakhov et al. 2019; Ledo et al. 2021).

Currently, regardless of the keeping conditions and the milking equipment, it is impossible to improve the quality of milk without the use of a complex of means that ensure high-quality treatment of the skin and udder teats before and after milking (Andrew et al. 2021). Improper udder care can provoke the development of lacteous gland inflammation and cracked skin on the teats. Effective pre-milking udder treatment is an affordable method of

Cite This Article as: Tanbayeva G, Barakhov B, Tagayev O, Myrzabekov Z, Ibragimov P, Alpysbayeva G, Kalmagambetov M and Narbayeva DD, 2024. Effectiveness of antimicrobial preparations for the sanitation of the udder of dairy cows. International Journal of Veterinary Science 13(5): 647-654. https://doi.org/10.47278/journal.ijvs/2024.151

reducing the accumulation of microbial and mechanical contaminants in milk (Kumari et al. 2018; Smulski et al. 2020). According to researchers, the content of bacteria on the skin of the teats varies greatly. Depending on their mechanical contamination, it ranges from 5 thousand to 1 million colony-forming units (CFU) from 1 ml of wash sample and depends on the keeping conditions of the animals (Bogush et al. 2013; Molineri et al. 2021).

Special attention should be paid to the treatment of the udder after milking. It is important to perform it immediately after milking since the teat canal remains open from 30 minutes to 1 hour, and it is necessary to ensure its protection from contamination by pathogenic microflora until the next milking (Komarov 2016). Products for udder treatment after milking should provide protection against pathogenic microorganisms, form an active ultra-thin protective film, prevent the entrance of bacteria into the teat canal, enhance local protective mechanisms and stimulate the regeneration of small wounds and cracks (Narbayeva et al. 2016; Korotkiy et al. 2023). Thus, the use of preparations requires careful wiping of the udder teats with a clean towel after sanitary treatment to exclude the ingress of any disinfectant residue into the milk (Beishova et al. 2019; Filatova et al. 2021; Issabekov et al. 2022).

During machine milking, sanitary treatment of udder teats with disinfectants before and after milking can significantly reduce the incidence of lacteous gland diseases in cows and improve the sanitary quality of milk (Kolchina et al. 2012; Thompson-Crispi et al. 2014).

In recent years, the requirements for the sanitary quality of produced milk have increased. The quality of milk and its safety depend on various factors and are determined by a variety of indicators (Blowey and Edmondson 2010; de Jong et al. 2018; Babich et al. 2022; Aitpayeva et al. 2024). The most important sanitary indicators are the degree of purity, bacterial contamination, the number of somatic cells, and the presence of subclinical mastitis (Karpenko 2015; Javed et al. 2021; Beishova et al. 2023). Preparations for sanitary treatment directly affect the degree of cleanliness of the udder and teats. The cleanliness of the udder and teats is a fundamental factor in obtaining high-quality milk. In addition, it is a prophylaxis against various types of mastitis (Cook and Reinemann 2007).

Considering the urgent problems, the purpose of our work was to evaluate the effectiveness of the developed preparation Promixan based on Anavidin for the treatment of udder teats after milking and to determine the dynamics of teat contamination by microorganisms before the next milking and their impact on milk quality.

To achieve this purpose, we planned the following stages of the study:

1. Determination of the dynamics of the concentration of microorganisms after sanitary treatment of the udder teats.
2. Determination of the udder teat cleanliness level and a sanitary assessment.
3. Comparative evaluation of the effectiveness of the therapeutic effect of various preparations used for sanitary treatment.
4. Determination of the impact of udder sanitation measures on the quality of produced milk.

MATERIALS AND METHODS

The experiments and the methods used for research on laboratory animals complied with the requirements of biological safety and ethical principles of experimentation on animals set out in the European Convention for the Protection of Vertebrates Used for Experimental and Other Scientific Purposes (Strasbourg 1987) (Conclusion of the Bioethics Commission of the Kazakh National Agrarian Research University dated October 7, 2021).

The scientific research was conducted at the bases of the Kazakh National Agrarian Research University (Faculty of Veterinary Medicine, Department of Veterinary and Sanitary Expertise and Hygiene), Scientific Research Institute of Animal Husbandry and Feed Production, E.S. Aidarbayev farm, and Adal Agro-Industrial Complex located in the Almaty region, Enbekshikazakh district in 2020-2021.

In the selected two farms, three groups (180 heads each) were formed from cows aged 4-8 years: one experimental group and two control groups. The animals in the experimental groups were treated with Promixan (Tanbaeva et al. 2018). In the 1st control group, we used Vet Clean I-Film (E.S. Aidarbayev farm) and Blockade (Adal AIC), and in the 2nd control group, the udder teats were not treated and were washed only with warm water. All study groups consisted of two subgroups: cows with subclinical mastitis (90 heads) and healthy cows (90 heads).

To evaluate the significance of differences observed in the results, the Mann-Whitney U test was utilized across various comparisons. The Mann-Whitney U test was selected due to its applicability to independent samples where the normal distribution assumption cannot be verified. It is particularly useful in agricultural and veterinary studies where sample sizes may be limited and data distributions unknown. This non-parametric test compares the medians between two independent groups to determine if one group tends to have higher values than the other, without assuming a normal distribution of the data. A p-value of less than 0.05 was considered indicative of a statistically significant difference between groups, highlighting the effectiveness of certain treatments over others or affirming the lack of significant difference where applicable.

Antimicrobial agents used in the experimental studies

Promixan is a liquid solution based on Anavidin (20%) for the sanitary treatment of cows' udders after milking, which includes such active ingredients as glycerin, methyluracil, and polyvinyl alcohol. The product protects the skin of the udder teats in the intervals between milking and prevents the active pathogen from entering the milk due to the formation of a bactericidal film on the skin. It is produced by the Kazakh National Agrarian Research University (Kazakhstan).

Blockade is a preparation in the form of a solution intended for antiseptic treatment of cow udder teats after milking to prevent the occurrence and transfer of mastitis. The preparation contains free (molecular) iodine as an active substance. It is produced by DeLaval (Sweden).

Vet Clean I-Film is an antibacterial and antiseptic agent for udder treatment after milking. It is a complex solution for skin care (moisturizing, softening, and wound

healing components). The composition includes functional additives, iodine-polymer complex, and deionized water. It is produced by InterHimmet (Russia).

Dynamics of the concentration of microorganisms after sanitary treatment of the udder teats

All animal groups were monitored daily. The duration of the experiment was 30 days. Every 2 hours, wash samples were taken with sterile cotton swabs from the surface of the udder teats to determine the bacteriological contamination. Milking was carried out 3 times a day, every 8 hours. The liquid of the wash samples in the amount of 1ml was sown into a nutrient medium and placed in a thermostat, and after the expiration of time, the number of colonies grown was recorded. Milk samples were collected in special sterile containers intended for biological fluid.

Assessment of udder cleanliness

Udder hygiene indicators were assessed during milk sampling in the milking parlor using the previously described method (Schreiner and Ruegg 2002). The udders of the studied animals were compared with control animals, and scores were given based on the following categories:

1) completely free from dirt or with very little dirt
2) slightly dirty
3) mostly covered with dirt
4) completely covered with dirt, caked dirt.

Scores were recorded (based on the results of a bacteriological study and the number of somatic cells) and determined by one person throughout the study.

Evaluation of the effectiveness of medicinal preparations

During the test, the areas of the studied surfaces were seeded with selective pathogenic microorganisms. Medicinal preparations were applied to the seeded surfaces for a certain exposure time, after which the residual microbiological contamination was checked. The number of pathogenic microorganisms extracted from the test surfaces (exposed to medicinal preparations) was compared with the number of pathogenic microorganisms extracted from the corresponding control surface sample (with the results of other preparations). A successful comparative evaluation allowed us to consider medicinal preparations suitable for use.

The determination of the number of somatic cells was carried out using the Somatos B device, manufactured by KOSTIP (Russia). According to the principle of operation of the analyzer, the specified volumetric quantities of milk and an aqueous solution of a sulfanol-based preparation Mastoprim (Sibagropribor Military-Industrial Complex, Russia) are mixed, and then the conditional viscosity of the mixed samples is determined according to the leakage times of their identical parts by volume through the capillary. The analyzer measures the outflow times of the same weight (calibration weight) parts of the samples, using a tensoelectric weighing device (TWD). Using the CombiFoss FT+ milk analyzer by Foss (Denmark) (includes the milk composition analyzer MilkosanFT+, the somatic cell analyzer FossomaticFT+, a common conveyor, and a computer), the indicators of fat, protein, density and nonfat milk solids (NFMS) in milk were established.

The animals were constantly monitored for a month and control milking for latent mastitis was carried out using a Promastit express diagnostic kit (Barakhov et al. 2017) every 14 days. In case of a positive result of the mastitis test, repeated testing was carried out after 24 hours and with a repeated positive result, latent mastitis was diagnosed.

Promastit is an express diagnostic kit designed to determine the number of somatic cells in milk and diagnose mastitis in cows. The preparation contains anionic surfactants, preservatives, color indicators, and purified water. It is produced by the Kazakh National Agrarian Research University (Kazakhstan).

Descriptive statistical analysis was performed using SPSS for Windows 13.0 by SPSS Inc (USA). The χ^2 test was used to analyze the prevalence of the difference between the dilutions of the medium (Kimura et al. 2004).

RESULTS

Dynamics of the concentration of microorganisms after sanitary treatment of the udder teats

The results of the work on determining the dynamics of the concentration of microorganisms after the sanitary treatment of the udder of dairy cows are shown in Table 1.

In the experimental group, the udders of cows were treated with Promixan. After a 2-hour exposure, bacterial contamination at the Adal AIC reached $3.6\pm2.1x10^5$ CFU/ml (55.7% lower), and after 4 hours of exposure, it decreased to $1.2\pm0.4x10^4$ CFU/ml. Thus, the effectiveness equaled 98.1%. After a 6-hour exposure, a small increase in microorganisms was observed, and after an 8-hour exposure, the increase was $5.2\pm1.8x10^4$ CFU/ml.

When cows with subclinical mastitis were treated with Promixan, after 4 hours of exposure, bacterial contamination was $3.9\pm1.3x10^4$ CFU/ml, and the effectiveness was 95.3%. In subsequent exposures, the number of microorganisms increased.

When the udders of cows were treated with the same preparation at the E.S. Aidarbayev farm, after 4 hours of exposure, positive results were obtained equaling $2.3\pm0.7x10^4$ CFU/ml, and the effectiveness of the preparation increased, reaching 96.7%. When the udders of cows with subclinical mastitis were treated with the preparation, the number of microorganisms was $4.6\pm2.2x10^4$ CFU/ml, and the effectiveness was 94.3%.

In the 1st control group, the udders of cows were treated with Blockade. After a 4-hour exposure, bacterial contamination at the Adal AIC reached $2.1\pm0.8x10^4$ CFU/ml, with an effectiveness of 96.5%. In the case of treatment of the udders of cows with subclinical mastitis, after 4 hours of exposure, the number of microorganisms was $5.1\pm1.9x10^4$ CFU /ml, and the effectiveness was 93.2%.

With the treatment of the udders of healthy cows with Vet Clean I-Film at the E.S. Aidarbayev farm, after a 4-hour exposure, positive results were obtained ($3.4\pm2.2x10^4$ CFU/ml), and after the treatment of the udders of cows with subclinical mastitis, the number of microorganisms was $6.7\pm3.8x10^4$ CFU/ml. The effectiveness of the preparations was 95.0 and 92.1%, respectively.

In the 2nd control group, where the cow teats were not treated with any preparation at the Adal AIC after 4 hours of exposure, the number of microorganisms was $1.8\pm 4.2x10^5$ CFU/ml, and the effectiveness was 77.2%.

Table 1: Dynamics of the concentration of microorganisms after sanitary treatment of udder teats

No.	Preparations	Animal group	Total number of microorganisms, CFU/ml	Bacteriological sampling after udder treatment, hour			
				2	4	6	8
			Adal AIC				
1	Promixan (experimental)	healthy	$6.5\pm3.4x10^5$	$3.1\pm2.1x10^5$	$1.2\pm0.4x10^4$	$3.0\pm1.1x10^4$	$5.2\pm1.8x10^4$
		sick*	$8.4\pm3.4x10^5$	$4.0\pm2.0x10^5$	$3.9\pm1.3x10^4$	$5.5\pm1.9x10^4$	$6.4\pm2.2x10^4$
2	Blockade (1st control)	healthy	$6.2\pm3.3x10^5$	$3.1\pm2.4x10^5$	$2.1\pm0.8x10^4$	$4.2\pm1.4x10^4$	$7.0\pm1.8x10^4$
		sick*	$7.6\pm3.0x10^5$	$3.8\pm2.2x10^5$	$5.1\pm1.9x10^4$	$7.4\pm2.0x10^4$	$9.6\pm2.6x10^4$
3	No treatment (2nd control)	healthy	$8.3\pm3.3x10^5$	$5.4\pm2.8x10^5$	$1.8\pm4.2x10^5$	$2.5\pm2.0x10^5$	$6.9\pm2.0x10^5$
		sick*	$9.5\pm3.4x10^5$	$5.8\pm2.8x10^5$	$3.3\pm2.0x10^5$	$6.5\pm3.1x10^5$	$8.1\pm3.0x10^5$
			E.S. Aidarbayev farm				
1	Promixan (experimental)	healthy	$7.1\pm3.7x10^5$	$3.0\pm2.1x10^5$	$2.3\pm0.7x10^4$	$4.4\pm2.1x10^4$	$6.0\pm2.0x10^4$
		sick*	$8.2\pm3.5x10^5$	$4.8\pm2.6x10^5$	$4.6\pm2.2x10^4$	$7.1\pm3.2x10^4$	$9.2\pm3.8x10^4$
2	Vet Clean I-Film (1st control)	healthy	$6.8\pm3.2x10^5$	$2.8\pm3.5x10^5$	$3.4\pm2.2x10^4$	$5.7\pm2.4x10^4$	$9.5\pm1.8x10^4$
		sick*	$8.5\pm3.8x10^5$	$4.4\pm2.8x10^5$	$6.7\pm3.8x10^4$	$8.0\pm3.7x10^4$	$9.1\pm3.6x10^4$
3	No treatment (2nd control)	healthy	$8.0\pm3.1x10^5$	$4.2\pm2.5x10^5$	$2.1\pm3.0x10^5$	$3.7\pm2.6x10^5$	$7.4\pm3.2x10^5$
		sick*	$9.1\pm3.3x10^5$	$4.9\pm2.6x10^5$	$5.6\pm3.4x10^5$	$6.8\pm3.0x10^5$	$8.4\pm3.7x10^5$

*dairy cows with subclinical mastitis

After treatment of the udders of cows with subclinical mastitis, after 4 hours of exposure, the number of microorganisms was $3.3\pm2.0x10^5$ CFU/ml and the effectiveness was 64.6%

At the E.S. Aidarbayev farm, microbial contamination of udder teats in healthy cows decreased to 73.4%, and in sick cows, to 62.6%.

According to the experimental data, the natural resistance of animals is not enough to resist udder diseases and promote the production of high-quality milk. There is a need for preventive measures for cow udder treatment,

As a result, the greatest effectiveness of Promixan was 98.1%, which is 1.6% higher than that of Blockade, 3.1% higher than Vet Clean I-Film, and 20.9% higher compared to the group where the udder teats were not treated with any preparations.

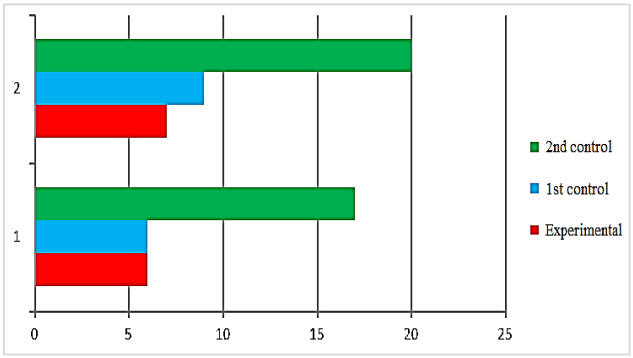

Fig. 1: Cleanliness level of udders and teats of dairy cows.
Between Promixan and Blockade: U statistic=6.0; P-value=0.096
Between Promixan and No treatment: U statistic=10.0; P-value=0.027.

Udder teat cleanliness and a sanitary assessment

The results of determining the degree of udder cleanliness are shown in Table 2.

As our results show, after the sanitary treatment of the udder before the next milking, bacterial contamination increases significantly. When treated with the tested preparations in the experimental group and the 1st control group, the degree of cleanliness of the teats showed the 2nd category, and in the 2nd control group, the degree of cleanliness of the teats showed the 3rd category, which greatly increases the risk of mastitis spread.

In general, the 3rd and 4th category cows had a high probability of subclinical mastitis, so special attention should be paid to the sanitary treatment of the udder after milking the cows. Based on the digital data, a comparative analysis diagram was constructed (Fig. 1).

According to Fig. 1, the degree of cleanliness of the udder teats of the 2nd control group was slightly higher compared to other groups.

Comparative evaluation of the effectiveness of the therapeutic effect of preparations used in sanitary treatment

The results of the work on determining the therapeutic efficacy of antimicrobial agents are shown in Table 3. For Table 3, evaluating the therapeutic effectiveness of Promixan compared to Blockade and no treatment for healthy cows at the Adal AIC farm, the Mann-Whitney U test provided the following results:

These results suggest that there is a statistically significant difference in the therapeutic effectiveness of Promixan compared to no treatment ($p<0.05$), indicating that Promixan is more effective. However, the comparison between Promixan and Blockade did not reach statistical significance at the 0.05 threshold ($p=0.096$), suggesting no clear difference in effectiveness between these two treatments under the simplified analysis conditions.

According to our results, at both farms, Promixan showed a positive effect, and its effectiveness was not inferior to foreign analogs. However, the results at the E.S. Aidarbayev farm were much lower than at the Adal AIC. This is explained by the level of cow keeping (principles of the manure removal system, increased productivity of the zone of automatic drinking fountains, litter contamination, etc.), as well as the degree of cleanliness of the teats and udders of dairy cows.

Based on the numerical data of Table 3, Fig. 2 was compiled.

According to Fig. 2, the effectiveness of Promixan was slightly higher than that of the analogs. Thus, it was proved that with timely disinfection of udder teats after milking, the incidence of cows with subclinical mastitis is significantly reduced.

Impact of udder sanitation measures on the quality of milk

The results concerning the effect of antimicrobial agents for udder treatment on milk quality are shown in Table 4.

Table 2: Assessment of the level of udder teat cleanliness in dairy cows

Degree of cleanliness	Adal AIC			E.S. Aidarbayev farm		
	Animal group (average values)					
	Experimental	1st control	2nd control	Experimental	1st control	2nd control
CATEGORY 1 Clean, no dirt	-	-	-	-	-	-
CATEGORY 2 Slightly contaminated, 2-10% of the surface	5-7 (6)	5-7 (6)	-	6-8 (7)	8-10 (9)	-
CATEGORY 3 Average degree of contamination, 10-30% of the surface	-	-	15-20 (17)	-	-	17-22 (20)
CATEGORY 4 Heavy contamination, > 30% of the surface	-	-	-	-	-	-

Note: "-" means the absence of cleanliness degree.

Table 3: Results of evaluation of therapeutic effectiveness of the preparations

No.	Preparations	Animal group	Number of heads	Number of cases (subclinical mastitis)	Therapeutic effect, %
			Adal AIC		
1	Promixan	Healthy cows	15	2	86.7
	(experimental)	Sick cows	15	4	73.4
2	Blockade	Healthy cows	15	3	80.0
	(1st control)	Sick cows	15	4	73.4
3	No treatment	Healthy cows	15	5	66.7
	(2nd control)	Sick cows	15	7	53.4
			E.S. Aidarbayev farm		
1	Promixan	Healthy cows	15	3	80.0
	(experimental)	Sick cows	15	5	66.7
2	Vet Clean I-Film	Healthy cows	15	4	73.4
	(1st control)	Sick cows	15	5	66.7
3	No treatment	Healthy cows	15	6	60.0
	(2nd control)	Sick cows	15	8	46.7

Table 4: The effect of preparations for the treatment of teats on the quality of milk

Indicators	Animal group (average values)					
	Experimental		1st control		2nd control	
	Beginning of the experiment	End of the experiment	Beginning of the experiment	End of the experiment	Beginning of the experiment	End of the experiment
			Adal AIC			
Mass fraction of fat, %	2.89±0.8	3.70±1.2	2.91±1.0	3.62±1.2	2.88±0.8	2.92±1.0
Mass fraction of protein, %	3.00±0.02	3.16±0.04	3.00±0.02	3.18±0.06	3.01±0.02	3.00±0.02
Density, kg/m^3	29.8±0.4	30.4±0.5	29.2±0.5	30.2±0.2	29.6±0.4	29.8±0.3
NFMS	8.0±0.14	8.5±0.18	8.1±0.12	8.5±0.18	8.0±0.14	8.0±0.14
Somatic cells, thousand/ml	715±8.6	355±6.9	723±8.7	380±7.4	718±8.6	606±7.5
			E.S. Aidarbayev farm			
Mass fraction of fat, %	2.90±1.2	3.75±1.5	2.95±1.2	3.72±1.4	2.91±1.2	3.00±1.3
Mass fraction of protein, %	3.01±0.03	3.20±0.04	3.00±0.02	3.18±0.04	3.00±0.02	2.99±0.01
Density, kg/m^3	28.8±0.1	30.0±0.2	29.0±0.2	30.3±0.3	28.6±0.1	29.4±0.2
NFMS	7.9±0.10	8.2±0.14	8.0±0.12	8.4±0.16	8.0±0.12	8.1±0.13
Somatic cells, thousand/ml	722±8.4	292±4.8	716±8.2	306±6.4	706±8.0	615±7.2

Note: M±m is the error of the arithmetic mean.

In the experimental group, the fat content of milk at the Adal AIC increased from 2.89±0.8 to 3.70±1.2%, and at the E.S. Aidarbayev farm, from 2.90±1.2 to 3.75±1.5%.

In the 1st control group, at the Adal AIC, the fat content of milk at the beginning of the experiment was 2.91±1.0%, and at the end of the experiment, it increased to 3.62±1.2%. At the E.S. Aidarbayev farm, the fat content of milk increased from 2.95±1.2 to 3.72±1.4%.

In the 2nd control group, at the Adal AIC, the fat content of milk at the beginning of the experiment was 2.88±0.8% and at the end of the experiment, there was a slight increase to 2.92±1.0%. The same situation was observed at the E.S. Aidarbayev farm (2.91±1.2:3.00±1.3%).

One of the important indicators of milk quality is the number of somatic cells. In the experimental group, at the Adal AIC, the number of somatic cells was 715±8.6 thousand/ml, and by the end of the experiment, it decreased to 355±6.9 thousand/ml, while at the E.S. Aidarbayev farm, the number of somatic cells decreased from 722± 8.4 to 292±4.8 thousand/ml.

In the 1st control group, at both farms by the end of the experiment, the number of somatic cells was normal (at the Adal AIC, 380±7.4 thousand/ml and at the E.S. Aidarbayev farm, 306±6.4 thousand/ml).

In the 2nd control group, at the Adal AIC at the beginning of the experiment, somatic cells were in the range of 718±8.6 thousand /ml, and at the end of the experiment, 606±7.5 thousand/ml, which is higher than normal. The same pattern was observed at the E.S. Aidarbayev farm (706±8.0:615±7.2 thousand/ml). Milk with such reduced quality indicators is unsuitable for processing enterprises.

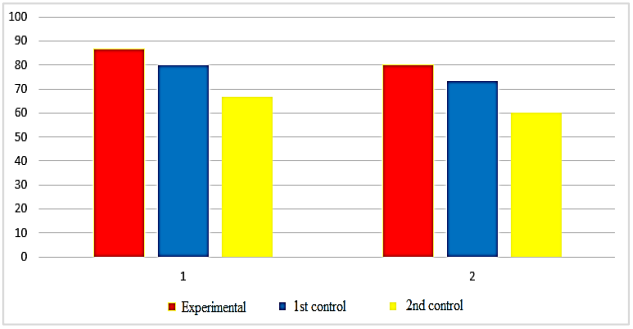

Fig. 2: Therapeutic effectiveness of teat treatment preparations after milking.

DISCUSSION

As a result of the conducted studies comparing the effectiveness of Promixan with Blockade and Vet Clean I-Film, we found that this preparation was 2.2% more effective and is not inferior to analogs. After milking, during 4 hours of exposure, with the use of Promixan, the degree of contamination of the udder and teats with microorganisms was reduced by 98.1%. According to the bactericidal properties, the effectiveness of Promixan on average ranged from 94.3 to 98.1%, and it affected all types of microorganisms. In studies conducted in this field, the average effectiveness of the used preparations increased to 80.3-88.8% (Narbayeva et al. 2016). In works by some scientists, no effect was found to reduce the number of Candida yeast fungi (Mišeikienė et al. 2015).

The results of the use of Promixan in the experimental group in terms of bactericidal properties are not inferior to the results of modern preparations Blockade and Vet Clean I-Film. An improvement in the quality of the obtained milk was established and ensured, together with the prevention of subclinical mastitis. In our studies, the level of cleanliness of the udder and skin increased to 17-20%, while the results of other scientists' research in this field show that it ranges from 22-30%, which creates the possibility of mastitis (Schreiner and Ruegg 2003; de Pinho Manzi et al. 2012).

When comparing the therapeutic effectiveness of the results of preparations used in the prevention of subclinical mastitis, the therapeutic effectiveness of Promixan was 13.3%, which is 6.7% higher than Blockade and 13.3% higher than Vet Clean I-Film. The efficacy of Promixan, developed with our participation, averaged 86.7%. Compared with research by many scientists (90-90.4%), it was possible to verify that there was no significant difference (Reshetka and Koba 2015; Tanbayeva et al. 2016).

In the experimental group, as a result of the sanitary treatment of milk of dairy cows with Promixan, the composition of the resulting milk had significantly better indicators compared to the other preparations. We found that the fat content of milk samples from dairy cows with subclinical mastitis in the experimental group decreased to 2.88±0.8% before the study and increased to 3.7±1.2% by the end of the study. In other studies, there was an increased compliance from 2.89±0.7 to 4.2±1.6% (Bagri et al. 2018). We found that the number of somatic cells in milk decreased from 722±8.4 to 292±4.8 thousand/ml and improved by up to 2.4 times. In other works in this field, the number of somatic cells decreased from 603.23±29.6 to 494.57±57.6 thousand/ml and improved by only 1.2 times (Zelenko and Kobozev 2003).

Conclusions

As a result of determining the effectiveness of Promixan in the prevention of microbial contamination of the udder teats of cows with subclinical mastitis after milking, a high bactericidal index was established compared with the control preparations. The maximum effectiveness of the preparation was achieved with an exposure of 4 hours.

When assessing the degree of cleanliness of the teats and udders of dairy cows of the experimental and the 1st control group, in both farms, the indicators corresponded to the 2nd category, and in the 2nd control group (not treated with preparations), the dairy cows belonged to the 3rd category, which means an increased possibility of mastitis for cows.

The therapeutic effectiveness of the developed preparation Promixan was 3.4% higher than Blockade, 3.3% higher than Vet Clean I-Film, and 20-46.7% higher compared to no treatment. Besides, the quality of the milk had significantly improved after the sanitary treatment of the udder with the developed preparation.

Based on our results in production conditions, it can be concluded that the developed preparation can be used at livestock facilities.

REFERENCES

Abdalhamed AM, Zeedan GSG and Hafez AAN, 2023. Rapid On-Site Detection of Major Mastitis Pathogens in Ruminants Using a Colorimetric Loop-Mediated Isothermal Amplification Assay. International Journal of Veterinary Science 13(2): 186-194. https://doi.org/10.47278/journal.ijvs/2023.081

Aitpayeva Z, Tagayev O, Smagulov D, Sidikhov B and Barakhov B, 2024. Veterinary sanitary assessment of mutton after application of antihelminth feed additive with albendazole. Brazilian Journal of Biology 84.

Andrew R, Chusi T and Mwembezi GP, 2021. Milking hygiene and handling practices among smallholder dairy farmers in Zanzibar. European Journal of Agriculture and Food Sciences 3(6): 82-88. http://dx.doi.org/10.24018/ejfood.2021.3.6.422

Babich EA, Aryngaziev BS, Ovchinnikova LY and Ovchinnikov AA, 2022. Features of growth and development in heifers of Holstein and Black-and-White breeds. OnLine Journal of Biological Sciences 22(4): 529-538. https://doi.org/10.3844/ojbsci.2022.529.538

Bagri DK, Pandey RK, Bagri GK, Kumari R and Bagdi DL, 2018. Effect of subclinical mastitis on milk composition in lactating cows. Journal of Entomology and Zoology Studies 6(5): 231-236.

Barakhov BB, Myrzabekov ZhB, Alpysbaeva GE and Alikhanov KD, 2019. Dinamika pokazatelei mikroklimata v raznykh zonakh korovnikakh v zavisimosti ot sezona goda [Dynamics of microclimate indicators in different zones of the cowshed depending on the season of the year]. Nauchnyi zhurnal Issledovanie, rezultaty 4(84): 56-64.

Barakhov BB, Myrzabekov ZhB, Tagaev OO and Tanbaeva GA, 2017. Patent na poleznuyu model "Indikator dlya diagnostiki mastita u korov" [Patent for utility model "Indicator for diagnosing mastitis in cows"] No.2328 dated 26.04.2017.

Beishova I, Nurgaliyev B, Belaya A, Chuzhebayeva G, Ulyanov V, Ulyanova T, Kovalchuk A, Dushayeva L, Murzabayev K, Taipova A, Zholdasbekova A and Isabaev A, 2023. Marking of genetic resistance to chlamydia, brucellosis and mastitis in Holstein cows by using polymorphic variants of LTF, MBL1 and TLR9 genes. American Journal of Animal and Veterinary Sciences 18(2): 89-97. http://dx.doi.org/10.3844/ajavsp.2023.89.97

Beishova IS, Kovalchuk AM, Poddudinskaya TV, Ulyanov VA and Alikhanov KD, 2019. Identification of phytopathogenic bacteria of genus pseudomonas using the real-time PCR method. Ecology, Environment and Conservation Paper 25(4): 1661-1666.

Blowey R and Edmondson P, 2010. Mastitis Control in Dairy Herds, 2nd Ed. CAB International, Cambridge, MA, USA, pp: 274.

Bogush A, Ivashkevich O and Ivanov V, 2013. Skvoz takoe "sito" ne proiti mastitu [Mastitis cannot pass through such a "sieve"]. Belorusskoe selskoe khozyaistvo 6: 88-90.

Cook NB and Reinemann DJ, 2007. A Tool Box for Assessing Cow, Udder and Teat Hygiene. In: Proceedings of the 46th Annual Meeting of the National Mastitis Council. National Mastitis Council, San Antonio, Texas, USA, pp: 21-24.

de Jong A, El Garch F, Simjee S, Moyaert H, Rose M, Youala M, Siegwart E and VetPath Study Group, 2018. Monitoring of antimicrobial susceptibility of udder pathogens recovered from cases of clinical mastitis in dairy cows across Europe: VetPath results. Veterinary Microbiology 213: 73-81. https://doi.org/10.1016/j.vetmic.2017.11.021

de Pinho Manzi M, Nóbrega DB, Faccioli PY, Troncarelli MZ, Menozzi BD and Langoni H, 2012. Relationship between teat-end condition, udder cleanliness and bovine subclinical mastitis. Research in Veterinary Science 93(1): 430-434. http://dx.doi.org/10.1016/j.rvsc.2011.05.010

Filatova AV, Bibaeva YuV, Kozlov SV, Nistratova MV and Avdeenko VS, 2021. Functional state of the udder of cows after the treatment of the udder nipples with hygiene products during milking. BIO Web of Conferences 36: 06035. http://dx.doi.org/10.1051/bioconf/20213606035

Issabekov SS, Syrym NS, Sambetbayev AA, Alikhanov KD and Yespembetov BA, 2022. Prospects of bacteriophage collections in disinfectant applications. Veterinary World 15(1): 220-231. http://dx.doi.org/10.14202/vetworld.2022.220-231

Javed MU, Ijaz M, Fatima Z, Anjum AA, Aqib AI, Ali MM, Rehman A, Ahmed A and Ghaffar A, 2021. Frequency and antimicrobial susceptibility of methicillin and vancomycin-resistant staphylococcus aureus from bovine milk. Pakistan Veterinary Journal 41(4): 463-468. http://pvj.com.pk/pdf-files/41_4/463-468.pdf

Karpenko N, 2015. Kachestvennaya obrabotka vymeni – Potentsialnaya pribyl [High-quality udder treatment means potential profit]. Veterinarnoe delo 12: 19-21.

Kimura T, Yokoyama A, Kohno N, Nakamura H and Eboshida A, 2004. SPSS 13.0 Brief Guide. SPSS Inc., Chicago, IL, USA.

Kolchina AF, Barkova AS and Elesin AV, 2012. Kontrol Sostoyaniya Soskov Vymeni Korov pri Mashinnom Doenii [Monitoring the Condition of Cows' Udder Teats during Machine Milking]. In: Sovremennye Problemy Veterinarnogo Akusherstva i Biotekhnologii Vosproizvedeniya Zhivotnykh: Materialy Mezhdunarodnoy Nauchno-Prakticheskoy Konferentsii, Posvyashchennoy 85-letiyu so Dnya Rozhdeniya Voronezhskoy Shkoly Veterinarnykh Akusherov [Modern Problems of Veterinary Obstetrics and Biotechnology of Animal Reproduction: Materials of the International Research and Practice Conference Dedicated to the 85th Anniversary of G.A. Cheremisov and the 50th Anniversary of the Creation of the Voronezh School of Veterinary Obstetrics]. Istoki, Voronezh, Russia, pp: 256-261.

Komarov VYU, 2016. Veterinarno-sanitarnoe i zoogigienicheskoe obosnovanie izyskaniya i primeneniya novykh sredstv i sposobov diagnostiki, terapii i profilaktiki mastita u korov [Veterinary, sanitary and zoohygienic justification for the search and use of new means and methods for diagnosing, treating and preventing mastitis in cows]: a Dr. Vet. Sci. dissertation. Orel State Agrarian University, Orel, Russia, pp: 157.

Korotkiy VP, Zaitsev VV, Bogolyubova NV, Zaitseva LM and Ryzhov VA, 2023. The effect of a pine tree energy supplement on methane release by lactating cows. Research Journal of Pharmacy and Technology 16(4): 1627-1632. http://dx.doi.org/10.52711/0974-360X.2023.00266

Kumari T, Bhakat C and Choudhary RK, 2018. A review on subclinical mastitis in dairy cattle. International Journal of Pure and Applied Bioscience 6(2): 1291-1299.

Ledo J, Hettinga KA, Bijman J, Kussaga J and Luning PA, 2021. A tailored food safety and hygiene training approach for dairy farmers in an emerging dairy chain. Food Control 124: 107918. http://dx.doi.org/10.1016/j.foodcont.2021.107918

Mišeikienė R, Rudejevienė J and Gerulis G, 2015. Effect of pre-milking antiseptic treatment on the bacterial contamination of cow teats' skin. Bulgarian Journal of Veterinary Medicine 18(2): 159-66. http://dx.doi.org/10.15547/bjvm.833

Molineri AI, Camussone C, Zbrun MV, Archilla GS, Cristiani M, Neder V, Calvinho L and Signorini M, 2021. Antimicrobial resistance of Staphylococcus aureus isolated from bovine mastitis: Systematic review and meta-analysis. Preventive Veterinary Medicine 188: 105261. https://doi.org/10.1016/j.prevetmed.2021.105261

Mukhamadieva N, Julanov M, Zainettinova D, Stefanik V, Nurzhumanova Z, Mukataev A and Suychinov A, 2022. Prevalence, Diagnosis and Improving the Effectiveness of Therapy of Mastitis in Cows of Dairy Farms in East Kazakhstan. Veterinary Sciences 9(8): 398. https://doi.org/10.3390/vetsci9080398

Myrzabekov ZhB, Alpysbaeva GE, Barakhov BB and Maldybaeva AA, 2020. Vliyanie uslovii soderzhaniya vosproizvodstvennuyu sposobnost molochnykh korov [The influence of housing conditions on the reproductive ability of dairy cows]. Issledovanie, rezultaty 2(86): 12-19.

Narbayeva D, Myrzabekov Z, Ratnikova I, Gavrilova N, Barakhov B and Tanbayeva G, 2016. Comparative assessment of the feasibility of some probiotic cultures as a means for sanitization of cows. Biology and Medicine 8(7): 1000345.

Reshetka MB and Koba IS, 2015. Profilaktika mastitov u doinykh korov na promyshlennykh fermakh [Prevention of mastitis in dairy cows on industrial farms]. Vestnik Altaiskogo Gosudarstvennogo Agrarnogo Universiteta 10(132): 58-62.

Reshetnikova T and Krylova T, 2023. Serological and hematological studies of the blood of calves in the experimental use of the medication Triazavirin. Advancements in Life Sciences 10(2): 265-269.

Sattarova R, Shynybaev K, Bakiyeva F, Strochkov V, Boranbayeva K, Zhanserkenova O, Kassymbekova S, Ibadullayeva A and Khamzina A, 2023. Metagenomic analysis and identification of epizootic strains of the causative agent of infectious bovine keratoconjunctivitis in Kazakhstan. International Journal of Veterinary Science 12(6): 822-831. https://doi.org/10.47278/journal.ijvs/2023.071

Schreiner DA and Ruegg PL, 2002. Effects of tail docking on milk quality and cow cleanliness. Journal of Dairy Science 85(10): 2503-2511. http://dx.doi.org/10.3168/jds.S0022-0302(02)74333-6

Schreiner DA and Ruegg PL, 2003. Relationship between udder and leg hygiene scores and subclinical mastitis. Journal of Dairy Science 86(11): 3460-3465. http://dx.doi.org/10.3168/jds.S0022-0302(03)73950-2

Smulski S, Gehrke M, Libera K, Cieslak A, Huang H, Patra AK and Szumacher-Strabel M, 2020. Effects of various mastitis treatments on the reproductive performance of cows. BMC Veterinary Research 16: 99. https://bmcvetres.biomedcentral.com/articles/10.1186/s12917-020-02305-7

Tagaev OO, 2010. Puti sovershenstvovaniya veterinarno-sanitarnykh meropriyatii na obektakh veterinarnogo nadzora [Ways to improve veterinary and sanitary measures at veterinary supervision facilities]: a Dr. Vet. Sci. dissertation. Almaty, Republic of Kazakhstan, pp: 363.

Tanbaeva GA, Myrzabekov ZHB, Tagaev OO, Kospakov ZH, Tokaeva MO, Barakhov BB and Narbaeva DD, 2018. Patent na izobretenie "Sredstvo dlya sanitarnoi obrabotki vymeni korov" [Patent for the invention "Product for sanitizing the cow udder"] No. 32739 dated 19.03.2018.

Tanbayeva G, Myrzabekov ZH, Tagayev O, Barakhov B and Tokayeva M, 2016. Diagnostics of subclinical mastitis in dairy cows. International Journal of Animal and Veterinary Sciences 10(3): 81756.

Tanbayeva G, Myrzabekov ZH, Tagayev O, Ratnikova I, Gavrilova N, Barakhov B and Narbayeva D, 2016. The results of the application of a probiotic as a therapeutic and prophylactic agent in the early form of mastitis in dairy cows. Biosciences Biotechnology Research Asia 13(3): 1579-1584. http://dx.doi.org/10.13005/bbra/2302

Thompson-Crispi KA, Atalla H, Miglior F and Mallard BA, 2014. Bovine mastitis: Frontiers in immunogenetics. Frontiers in Immunology 5: 493. https://doi.org/10.3389/fimmu.2014.00493

Zelenko EN and Kobozev VI, 2003. Vliyanie Obrabotki Kozhi Vymeni Korov Razlichnymi Dezinfitsiruyushchimi Preparatami na Kachestvo Moloka [The Effect of Treating Cow Udder Skin with Various Disinfectants on Milk Quality]. In: Issledovaniya Molodykh Uchenykh v Reshenii Problem Zhivotnovodstva: Materialy III Mezhdunarodnoi Nauchno-Prakticheskoi Konferentsii [Research by Young Scientists in Solving Livestock Problems: Materials of the 3rd International Research and Practice Conference], Vitebsk, Belarus, May 30, 2003. Vitebsk State Academy of Veterinary Medicine, Vitebsk, Republic of Belarus, pp: 106-108.