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Reduction of intramammary infections in dairy cow herd by application of mastitis suppression procedures

Abstract

The aim of this study was to reduce the prevalence of mastitis by introduction of effective anti-mastitis measures in a herd of 125 dairy cows. The effectiveness of the relevant measures was monitored by six examinations conducted in two-month intervals during the one-year period. A reduction in the prevalence of mastitis was recorded from 53.6% to 22.9%, i.e. by 26.0%. The prevalence of *Staphylococcus spp*. as the most frequently isolated pathogens of the mammary gland in the examined samples gradually reduced from 33.4% to 18.4%, 14.1%, 10.0%, 7.6%, and 8.1%. In contrast to the dynamics of mastitis, the monthly fluctuations in the values of somatic cell count (SCC) and total bacterial count (TBC) in bulk tank milk samples were irregular. However, a declining dynamics of SCC and TBC was evident during the last three samplings which reflected a reduction in the counts of udder pathogens after the treatment and introduction of mastitis suppression procedures.

Keywords: dairy cows, milk quality, somatic cell count, *Staphylococcus spp*

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Introduction

Despite increasing advances in breeding technologies and veterinary measures nowadays, mastitis is one of three major health problems of dairy cows. The occurrence of mastitis in farms and their individual forms depends on the interaction of several factors such as the health status of dairy cows, stage of lactation, housing hygiene, nutrition and hygienic milking program.[1,2]

Breeding and economic severity of this disease is determined by reducing milk quality and milk production, but also indirect losses such as the premature culling of dairy cows, treatment costs, medicines, disinfectants, and veterinary procedures. The total cost of treating one dairy cow affected by mastitis is in the range of €120-180.[3]

Taponen et al.[4] reported that up to 95% of intramammary infections that occurred in dairy cows are caused by contamination of the mammary gland with bacterial pathogens through the teat canal. Many sources of udder pathogens have been identified in the milking parlor setting.[2] Because the infected mammary gland serves as the main reservoir of pathogenic microflora, keeping the udder clean and milking can shield the healthy cow from an infected cow, hence lowering the infection.[5]

The aim of this study was to reduce mastitis in a herd of 130 dairy cows with the reduction in the incidence of *Staphylococcus spp*. during the annual application of damping procedures.

Materials and methods

Dairy herd and udder examination

The practical part of the study was carried out in dairy cows of Slovak spotted cattle in Eastern Slovakia during one year period 2021. The breeding technology is represented by free box stables covered with straw in two reconstructed stalls connected to the milking parlor with Westfalia tandem 2x8 equipment (Germany). Feeding was ensured by loading with feed wagons. The professional level of the staff as well as the correct observance of hygienic procedures during machine milking was within the limits of the current breeding standard with the application of a wet udder toilet with drying of the teats with disposable towels before milking and dipping them into the post-dip after the end of the milking.

For one year, the etiology and prevalence of mastitis was monitored in six herd examinations of 125 dairy cows at two-month intervals. Individual milk samples for bacteriological examination were taken following the clinical examination of the mammary gland, assessment of the first squirts of milk and California mastitis test (CMT) according to procedures indicated by the NMC.[6]

Sample examination

In addition, SCC, and TBC were evaluated in regular monthly intervals in the monitored dairy cows based on milk yield control by workers from The National Dairy Research Institute (Žilina, Slovakia). Microbiological diagnosis (cultivation and identification) of pathogenic bacteria was performed according to our previous study.[7] Bacteriological examination included culture in 5% blood agar (Figure 1), Medium No. 110 and Baird Parker agar (Oxoid, GB). Commercial kits, such as STAPHYtest 24, STREPTOtest 24, ENTEROtest 24 (Pliva-Lachema, Brno, Czech Republic) were used to identify individual spieces of udder pathogens.

Mastitis suppression procedures

Based on the results of the clinical examination of the udder of dairy cows supplemented by the California mastitis test, laboratory diagnostic of individual milk samples with the determination of the current sensitivity of bacteria to antibiotics and data from the control of milk utility were implemented the following measures:

1) Infected dairy cows were threated during lactation according to actually sensitive to antibiotics
2) Cows with mastitis were separated from healthy cows and individually milked as the last
3) Milk quality and composition was monitored from the treated animals after inclusion in the milking
4) Dairy cows with chronic mastitis or atrophy of secretory tissue in udder quarters after unsuccessful treatment were discarded
5) Milk samples for laboratory diagnosis were taken from all cows after parturition on the 5th day
6) All cows with high SCC (>400 x 10^3) during last three months of lactation were exanimated or treated and dried by applying selected intramammary preparations
7) The milking cups were disinfected with 5% H_2O_2 after changing each group of cows during the milking process
8) The bedding materials was cleaned frequently every time the cows left for the milking parlor
9) Ground limestone was added to the bedding twice a week.

Figure 1 Clinical mastitis with primary culture of milk on 5% blood agar and growth of *S. aureus* after 24 hours.

Results and discussion

The results of six microbiological examinations of milk samples performed at two-month intervals are evaluated in Table 1. The most significant representation of the isolated pathogens was represented by coagulase-negative staphylococci (22.8%) and *S. aureus* (10.6%), which were isolated during all 6 examinations.

According to Vargová et al.[2] Staphylococci are ubiquitous in the dairy cow's environment and *S. aureus* is recognized worldwide as a frequent cause of clinical or subclinical mastitis. Many sources of *S. aureus* have been identified in the skin of the teats, milking units and parlor setting.[8,9] Contamiantion sources of *S. aureus* was discovered by Bogdanovičová et al.[10] in raw milk and milk processing tools (milk filters) from 50 dairy farms (from 2012 till 2014) in the Czech Republic. The author found *S. aureus* in 58 samples from 261 raw milk and milk filters, of which 37 (14.2%) were isolated from raw milk and 21 (8.1%) from milk filters.

When 42 dairy farms in the west of Slovakia were examined for the investigation, Holko et al.[9] verified a significant incidence of intramammary infection brought on by coagulase-negative staphylococci and *S. aureus* isolated from contaminated milk samples. The coagulase-negative staphylococci were the most frequently found bacterium and accounted for 35.9% of positive findings.

After the first examination were introduced methods to reduce mastitis and the occurrence of new udder infections which reflect examinations at regular two-month intervals in the farm. From the values of the findings, the decreasing dynamics of the prevalence of mastitis of breeding is evident from the value of 53.6% after the first examination to 22.9% in October, respectively 26.0% in December (Table 1).

The prevalence of mastitis at the level of 53.6% at the beginning of the monitored period and especially the effort of the breeder to maintain and improve the quality evaluation parameters of the produced milk were the prompt of the solution the entire complex or related tasks at the level of management and primary production workers in a long-term and systematic way. The analysis of the first examination revealed above all: optimize the implementation of hygienic milking program procedures, to create conditions for the treatment of clinical cases of mastitis in lactation with preparations containing antibiotics with a confirmed effect against isolated bacteria, respectively, it was to decide to treat dairy cows with an antibiotic preparation according to the current sensitivity of the bacteria. The result of each subsequent examination were a check on the effectiveness of the applied procedures and served to correct and possibly supplement the measures. As part of the reduction of the overall prevalence of mastitis in breeding, a significant reduction in the incidence of *Staphylococcus spp*. bacteria was recorded from 33.4% to 7.6% or 8.1% while the occurrence of *S. aureus* was reduced to a minimum (Table 1).

One of the methods of checking the established anti-mastitis measures and health status of the mammary gland of the dairy cows is the monitoring of somatic cells count (SCC) together with the total bacteria count (TBC) in raw milk.[11] SCC and TBC values recorded in monthly intervals, which are shown in Graph 1 and Graph 2, do not reflect the dynamics of mastitis prevalence. The discrepancy is also apparent at higher SSC values (369 and 350 x 10^3) a TBC (4.9 – 4.8 log.CFU.ml^{-1} from max. values 5), in the months of January to March, when the prevalence of mastitis was in the level of 53.6%-40.8% and should logically be related to their higher values above the maximum limit allowed. The mentioned contrast was explained in the anamnesis

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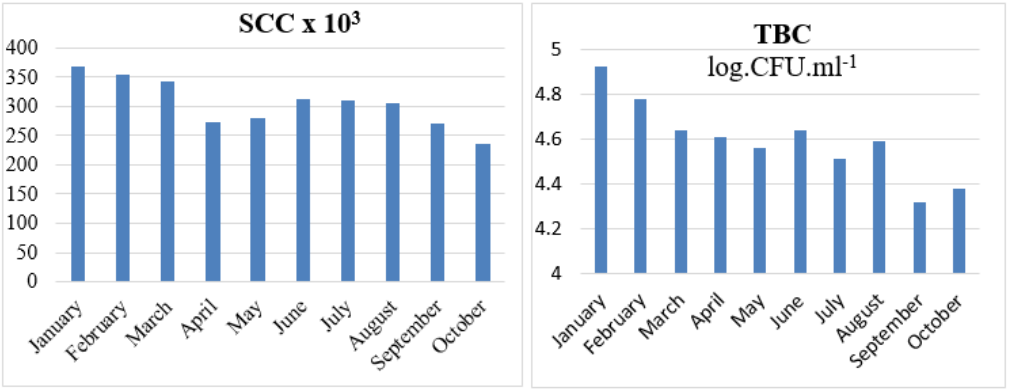
when the farmer used proactive separation of milk during milking to solve the economic valorisation of production.

Based on the assessment of changes during the first squirts, the milk was milked separately into the tankard and was not part of the evaluated milk in the pool sample. The mentioned phenomenon of solving the quality at the expense of the quantity of milk in the absence of solving the causal links of the health of the udder of the part of the breeders is unfortunately becoming a reality.

Table 1 Overview of the isolated bacteria from individual cow´s milk samples during six examinations

Examinations/number of dairy cows	January 123		March 125		May 121		August 120		October 118		December 123	
Isolated bacteria	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Staphylococcus spp.	41	33.4	23	18.4	17	14.1	12	10	9	7.6	10	8.1
S. aureus	13	10.6	7	5.6	3	15	0	0	0	0	2	1.6
CNS	28	22.8	16	12.8	14	11.6	1 2	10	9	7.6	8	6.5
Streptococcus uberis	2	1.6	1	0.8	0	0	0	0	0	0	0	0
Streptococcus spp.	4	3.3	2	1.6	0	0	0	0	1	0.8	1	0.8
Aerococcus viridans	15	12.2	10	8	2	1.6	6	5	5	4.3	4	3.3
Enterococcus spp.	1	0.8	2	1.6	1	0.8	1	0.8	3	2.6	5	4.1
E.coli	0	0	7	5.6	4	3.3	0	0	1	0.8	3	2.4
Bacillus spp.	1	0.8	1	0.8	6	5	4	3.3	3	2.6	3	2.4
Arcanobacterium spp.	2	1.6	3	2.4		0.8	2	1.7	1	0.8	2	1.6
Prote us spp.	0	0	2	1.6	5	4.1	4	3.3	4	3.4	4	3.3
Findings	**66**	**53.6**	**51**	**40.8**	**36**	**29.8**	**29**	**24.1**	**27**	**22.9**	**32**	**26**

Note: CNS - coagulase-negative staphylococci.



Graph 1 and Graph 2 Overview of SCC and TBC from examination of pool samples of cows´ milk at monthly intervals.

Note: SCC, somatic cells count; TBC, total bacteria count.

Conclusion

The reduction in the prevalence of mastitis from 53.6% to 22.9%, or 26.0%, was achieved by applying preventive and mitigation procedures guided by the results of mastitis diagnosis. The occurrence of udder pathogens, mainly *Staphylococcus spp*. was reduced from 33.4%, gradually to 18.4%, 14.1%, 10.0%, 7.6%, or 8.1%. The optimal values of SCC and TBC, and obvious decreasing dynamics in pool samples were recorded after the third examination, when the effect of the reducing the occurrence of *Staphylococcus spp*. as the result of the targeted treatment of affected dairy cows based on the antibiogram and culling of chronically infected cows with less milk production.

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Conflicts of Interest

Author declares there is no conflict of interest in publishing the article.

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