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COMPARISON OF THE EFFECTIVENESS OF DIFFERENT PROCEDURES IN CLEANING COWS' UDDERS AND TEAT CUPS

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ABSTRACT

The use of effective preparations and means for the sanitary treatment of cow's udder affects the contamination of the skin of the teats therefore reducing the overall bacterial contamination of milk. This study was performed to determine the effictiveness of teats and teat cups disinfection have on microbial load reduction prior to milking. Two farms with different milking hygiene regimes were analysed and compared. The second farm did not perform teat dipping with foam prior to milking in contrast to the first farm. The results indicated that cleaning cows'udders before milking and teats cup during milking has improved the hygiene conditions and reduced microbial load in both farms. However, farm one obtained a greater microbial load reduction than farm two due to performing teat dipping with active foam. This study emphasises the importance of teat and teat cup disinfection prior to milking to reduce the microbial load and hence, reduce the risk of milk contamination.

KEYWORDS: Cows, milking, teat, teat cup, disinfection.

INTRODUCTION

Roughly 150 million families around the world are engaged in milk production. In the majority of developing countries, milk is produced by smallholders, and this production contributes to household livelihood, food security and nutrition.[1] Despite the well-known

hygienic measures for obtaining milk, often many farmers do not follow these procedures in the correct order or, due to the reduction of economic costs, they omit certain procedures. Insufficient hygiene practices such as poor mechanical cleaning, using of unsuitable disinfectant and poor cleanness of equipment, the microbial load of surrounding air in the milking parlor, and other environmental factors including water supply, housing conditions have an important effect on the contamination of raw milk.[2,3] Typical microflora of milking equipment present bacteria such as *Escherichia coli*, *S. aureus*, *Listeria monocytogenes*, *Salmonella* spp., *Micrococcus* spp., *Campylobacter jejuni*, *Enterococcus faecalis*, *Citrobacter freundii* which can be transferred to raw milk by not following a hygienic milking program. Some studies have shown that premilking teat disinfection is beneficial for microbiological load reduction.[4,5]

During preparation for milking or after the procedures a number of different types of disinfectants are used in teat dips, including iodine, chlorhexidine; acidified sodium chlorite; peroxides; organic acids (lactic acid, salicylic acid, capric acid, glycolic acid); quaternary ammonium chlorides and others. Chlorinated compounds are used extensively as disinfectants to control both spoilage bacteria and pathogenic bacteria. Chlorine, whether in the form of chlorine gas (Cl_2) or as the solids sodium hypochlorite (NaOCl), dissolves in water to form hypochlorous acid (HOCl) and hypochlorite ion (OCl^-). It can function as both an oxidizing agent and a halogenating agent. Lactic acid is a non-chlorine-containing compound commonly used in sprays and washes for the control of pathogens.[3] Sanitary measures can reduce morbidity of inflammation in the mammary gland in cows in the herd by 50-70%, increase the level of hygienic cleanliness of the udder and reduce infection with pathogens of mastitis.[6]

In some studies, the concentration of microorganisms such as *Staphylococcus aureus* obtained by teat skin swabbing was lower after dipping of teats into disinfectant solution post milking compared to untreated teats[7], therefore the reducing bacterial load on teat skin can have a positive impact on minimizing new infection rates milk.[8] This study hopes to shed light on the potential harm microbials can have on human health and the importance of strict hygienic protocols to minimize microbial contamination.

MATERIAL AND METHODS

Monitored dairy herds and hygienic milking program

The practical part of the study was carried out on two dairy farms located in eastern Slovakia with 250-350 cows of the Slovak Spotted Cattle breed, between the 1st and 4th lactation. with an average daily milk yield of 21.6 +/- 2.4 L and 23.2 +/- 3.1 L. In both farms the dairy cows were milked in the morning and in the evening, following different hygienic milking programs. First farm, at the beginning of milking, the preparation Prefoam+ (Hypred S.A., Dinard, France) was used, intended for soaking the teats. Prefoam+ with the active biocidal component 5% L-(+) - lactic acid was used for udder hygiene before milking, applied as a foam. After foaming, the first squirts of milk were made into a container with a double bottom and the teats were mechanically cleaned with wet wipes UdderClean (Agromont, Nitra), which are intended for cleaning the entire udder. After milking, the ends of the teats were disinfected with a solution containing the active ingredient lactic acid. As an important intermediate step, the teats were washed and disinfected with 2% hydrogen peroxide after each cow group change in the milking parlor. The milk was stored in cooling tanks at the temperature of + 4 °C until it was collected the next day.

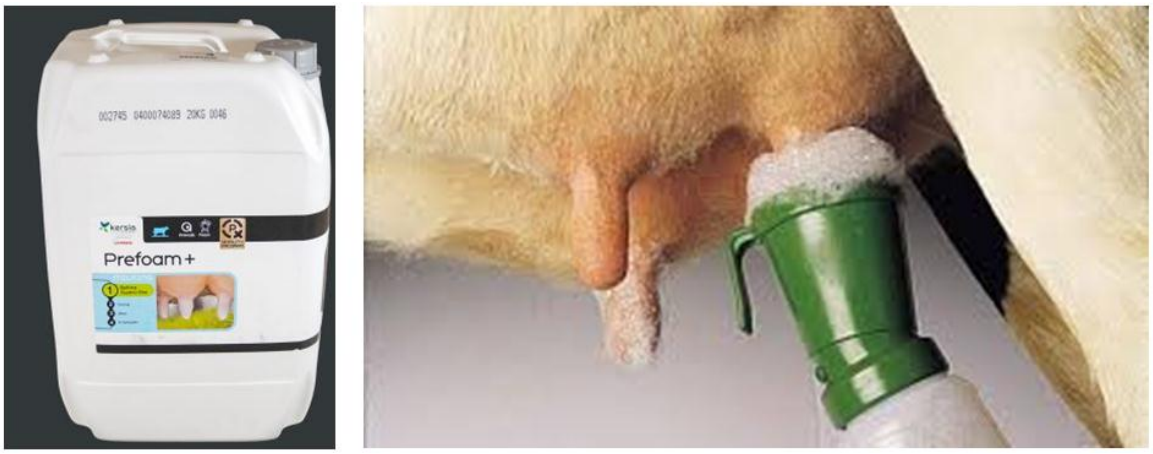

Figure 1: Udder cleaning with Prefoam+.

On the second farm, the main steps in preparation for milking included cleaning the udder with wet wipes soaked in a disinfectant solution Dermisan+ (Agromont Nitra, SR, active substances: 15000 mg/kg N-(3-aminopropyl)-N-dodecylpropane-1,3-diamine) to remove dirt from udder and teats without additional foaming and wiping. Subsequently, the first milk squirts were made with the deployment of the milking unit. After milking, teats were disinfected by the soaking them in a disinfectant Ioderm 5000 (Agromont Nitra, SR, active substance: 5000 mg/kg iodine). Teat cups were washed only with water during milking without the use of disinfectants. The milk was stored in cooling tanks at the temperature of + 4 °C until it was collected the next day.

Collection and examination of samples

Fifteen dairy cows and milking equipment from each farm were sampled from surfaces, while two teat skin samples were taken from each dairy cow. In the case of teat samples, swabs were taken before milking and after foaming (the second farm did not perform pre-milking teat foaming) or after mechanical cleaning. In the case of the samples of the teat cups, the samples were taken 3 times, and that: before milking, after milking, after disinfection with hydrogen peroxide or washing with water. The samples taken were evaluated in the laboratory according to the methodologies Vargova et al.[3]

For total count of bacteria (TCB) and coliform bacteria (CB) swab samples were diluted in sterile saline. Dilute solutions (volume 0,1 ml) were then plated using the casting method on selective media Endo agar (EA; HiMedia, India) a Nutrient agar no. 2 (NA; HiMedia, India) according to established procedures ISO 6887-5.[9] TCB detection was performed according to ISO 18593.[10] and the detection of the number of CB was performed according to ISO 4832.[11] Endo agar a Nutrien agar results were obtained after 24 hours of incubation at 37 °C.

Data analysis

The microbial contamination of TCB and CB obtained from teats and teat cups swabs were converted to decimal Logarithmic values (Log_{10} CFU/cm^2), submitted to Analysis of Variance (ANOVA).

RESULTS AND DISCUSSION

Contaminated environment within the milking parlor is a potential source of food-borne pathogens and spoilage bacteria, which will affect the milk quality and represent a public health risk.[2,12] The procedures before and after milking, as well as the cleanliness of the equipment used for milking cows, includes or combines milking hygiene.Teat disinfection and disinfection of teat cups reduce bacterial load on teat skin but also reduce the risk of bacterial contamination of milk.[8]

In this study the teats on farm 1 showed a significance decrease in microbial load TBC 58.4 % and CB 31.1% Log_{10} CFU/cm^2) after teat dipping in active foam with mechanical cleaning with wet wipes (table 1). Furthermore on the second farm where teat dipping was not performed (only mechanical cleaning with wet wipes) a lower microbial load reduction was obtained TBC of 40.2% and CB of 42.9% (table 2). Therefore this study indicates that teat dipping obtains a significant role in teat disinfection and microbial load reduction. On Irish

farms, pre-milking teat disinfection is generally applied directly to teats without prior cleaning, which may impact on the antimicrobial effectiveness of the disinfectant.[13]

Table 1. First farm - microbial contamination of monitored surfaces.

Surface	Initial microbial Load		Final microbial load		Change in microbial load		Microbial load reduction	
	(mean Log_{10} CFU/cm^2)						%	
	TBC	CB	TBC	CB	TBC	CB	TBC	CB
teat	4.36	2.33	0.99	0.95	3.37	1.38	77.3	59.2
teat cup	1.85	0.90	0.77	0.62	1.08	0.28	58.4	31.1

Legend: TBC total bacteria count, CB coliform bacteria

Table 2. Second farm - microbial contamination of monitored surfaces.

Surface	Initial microbial Load		Final microbial load		Change in microbial load		Microbial load reduction	
	(mean Log_{10} CFU/cm^2)						%	
	TBC	CB	TBC	CB	TBC	CB	TBC	CB
Teat	4.81	2.54	2.88	1.45	1.93	1.09	40.2	42.9
Teat Cup	1.50	1.0	1.1	0.95	0.4	0.05	26.7	5.0

Legend: TBC total bacteria count, CB coliform bacteria.

The microbial load of raw milk is influenced by microorganisms present in the teat canal and on the surface of teat skin. Teat surface was identified as the greatest contributor to the raw milk microbiota, followed by feces.[12] This is consistent with a study of Verdier et al.[14] which suggested that the teat skin was a source of microbial populations in raw milk. Teat skin of cows represents the primary source of bacterial populations found in raw milk with the rate of mastitis and intramammary infections having previously been shown to increase with increasing bacterial numbers on the teat skin.[15] The variation in naturally present microbial levels on the teat skin is caused by environmental factors and sanitation regime which can affect the level of occurring bacterial contamination of the teat skin surface.[14]

Figure 2 shows the results obtained from the study analysing both farms microbial load reduction regarding teat surface. Farm one which performed teat dipping in active foam with mechanical cleaning prior to milking obtained a greater microbial load reduction percentage than farm two.

Which did not perform teat dipping. Farm one's microbial load reduction was 77.3% TBC and 59.2% CB while farms two's results were lower with a TBC of 40.2% and CB of 42.9% microbial load reduction.

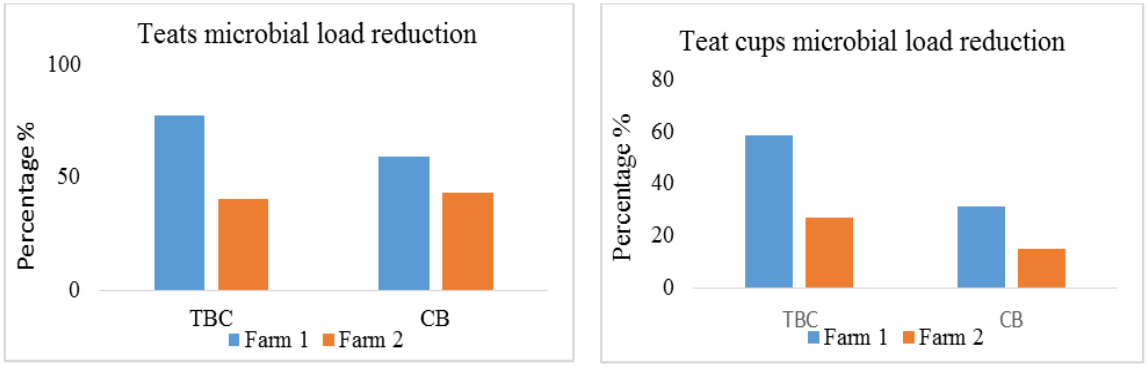

Figure 2: Comparison of microbial load reduction in monitored farms before and after application of different udder cleaning procedures.

Farm one also had significantly greater results with the efficacy of disinfection of teat cups when compared to farm two. Farm 1 contained 58.4% TBC and 31.1% CB microbial load reduction when analysing the teat cups. In contrast, farm two obtained a lower percentage of 26.7% TBC and 15.0% CB microbial load reduction. Therefore based on the obtained results it can be concluded that farm 1 has a superior hygienic programme.

CONCLUSION

Our results state that treating the udder with disinfectant wipes together with lactic acid pre-milking foam as the main active ingredient is suitable for bacterial reduction. On the other hand, treating the teat only with disinfectant wipes during udder cleaning has proven to be of little effectiveness. In conclusion this study emphaisises the importance of teat and teat cup disinfection to reduce the microbial load in order to obtain less contaminated milk, safer for human consumption.

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REFERENCES

1. Food and Agriculture Organisation of the united nations, 2021, Dairy market review, www.fao.org,. Available at:, https://www.fao.org/3/cc1189en/cc1189en.pdf
2. Velazquez V., Carranza B., Tenorio-Borroto E.. et al. Microbial contamination in milk quality and health risk of the consumers of raw milk and dairy products. In book: Nutrition in Health and Disease, 2019; 10. 5772/intechopen.86182.

3. Vargova M., Vyrostkova J., Lakticova K., Zigo F. Effectiveness of sanitation regime in a milking parlour to control microbial contamination of teats and surfaces teat cups'. Ann Agric Environ Med., 2023; 30(1): 55-60.
4. EFSA Biohaz Panel (EFSA Panel on Biological Hazards). Scientific Opinion on the public health risks related to the consumption of raw drinking milk. EFSA J., 2015; 13: 3940, 95.
5. Zastempowska E., Grajewski J., Twarużek M. Food-borne pathogens and contaminants in raw milk – A review. Annals of Animal Science, 2016; 6: 10. 1515/aoas-2015-0089.
6. Alrabadi1 N.A., Sultan K.I. The effect of using different detergents in cleaning cows' udders on the microbial content of produced milk. International Journal of Biology, 2018; 10: 47-51.
7. Boddie R., Owens W.E., Foret C.J., Janowicz P. Efficacy of a 0.1% iodine teat dip against *Staphylococcus aureus* and *Streptococcus agalactiae* during experimental Challenge. Journal of Dairy Science, 2004; 79: 3089-3091.
8. Suriyasathaporn W., Chupia V. Reduction in numbers of bacteria after pre-milking teat dipping in milking dairy cows. CMU. J. Nat. Sci., 2011; 10: 301–306.
9. ISO 6887-5:2010. Microbiology of food and animal feeding stuffs. Preparation of test samples, initial suspension and decimal dilutions for microbiological examination. Part 5: Specific rules for the preparation of milk and milk products.
10. ISO 18593:2004. Microbiology of food and animal feeding stuffs: Horizontal methods for sampling techniques from surfaces using contact plates. International Standard Organisation.
11. ISO 4832:2006. Microbiology of food and animal feeding stuffs: Horizontal method or the enumeration of coliforms. International Standard Organisation.
12. Zekarias T. Milk quality and sources of microbiological contamination: A review. World Journal of Dairy & Food Sciences, 2020; 15(1): 21-31.
13. Baumberger C., Guarin J.F., Ruegg P.L. Effect of 2 different pre-milking teat sanitation routines on reduction of bacterial counts on teat skin of cows on commercial dairy farms. J. Dairy Sci., 2016; 99: 2915–2929.
14. Verdier-Metz I., Gagne G., Bornes S., Monsallier F., Veisseire P., DelbèsPaus C., Montel M.C. Cow teat skin, a potential source of diverse microbial populations for cheese production. Appl Environ Microbiol, 2012; 78: 326–333.
15. Ruegg P.L. A 100-Year review: Mastitis detection, management, and prevention. J. Dairy Sci., 2017; 100: 10381–10397.