ISSN:2321-1156

International Journal of Innovative Research in Technology & Science(IJIRTS)

BLOOD STAINED CONTAMINATED MILK FROM LOCAL DAIRY FARMS

T. Usai, R.S. Tshalibe, B.C. Nyamunda, Midlands State University, P. Bag 9055, Gweru, Zimbabwe

Abstract

Poor hygienic conditions on dairy farms cause contamination of milk by microorganisms which cause mastisis. Milk samples were sampled from four dairy farms and tested for *Staphylococcus Aureus* and *Streptococcus Agalactiae* populations that cause mastitis. The hygiene of the equipment, parlour, milkers, feeds and feeding places was monitored for bacteria by collecting swabs. It was found that milk samples contained microorganisms that cause mastitis. Milk was contaminated by microorganisms emanating from equipment, milking parlour, feeding places and feeds. The workers lack hygiene in handling milk and milking equipment. There is need for training of workers on hygiene and proper use of cleaning chemicals.

Keywords: hygiene, mastitis, milk, microorganisms, parlour

.

Introduction

The quality of milk produced from dairy farms is important in determining the quality of products. It is necessary to perform laboratory tests so as to establish if the milk is of good quality that meets minimum prescribed health standards. Farm hygienic conditions also play a pivotal role in determining the safety of milk delivered at milk processing plants.

Microorganisms found in milk if left unchecked can cause a lot of health hazards [1]. *Listeria Monocytogenes* [2] can survive in aerobic and non-aerobic environment and can live in different types of foods including milk and milk products. *Listeria* can be found in animal intestines, green water plant and sewerage of which farmers must exercise cleanliness of the feeds, drinking water and equipment they use for milking. Listeria Monocytogenes cause spontaneous abortion or still birth of the foetus in pregnant women and weaken immune systems in adults [3].

Mastitis is the inflammation of the mammary gland or udder [4]that adversely affects the quality and quantity of milk production. In nearly all cases this is caused by bacteria growing in the milk secreting tissues of the udder [5]. When a disease causing bacteria gets into the udder it attaches to the tissue and begins to multiply. As it multiplies it produces noxious substances which irritate the tissue. Antibiotics such as penicillin have proved to be the most useful therapeutic agents in the treatment of mastitis [6]. A five point strategic plan drawn up in controlling mastitis involves post-milking teat dipping, dry cow therapy, early detection and treatment of clinical cases, culling of persistently infected cows and maintenance of a correctly functioning milking plant [6].

The hygienic quality of milk is determined by the total bacterial count for bulked and pre-cooled farm milk or the methylene blue dye reduction test for milk tested within a few hours of milking and which has not been subjected to extreme cooling. Both tests are done in conjunction with the triphenyl tetrazolium chloride test [7] which is a qualitative test for the presence of inhibitory substances.

There are four main sources of bacterial contamination in milk namely the inside and outside udder of cows, milking equipment, workers and storage facilities. Raw milk can be contaminated with human pathogens by an infected milker and containers. Human infection that may contaminate milk during milking are *Streptococcus pyogenes,* causing streptococcal sore throat and scarlet fever [8, 9, 10], *Corynebacterium diphtheriae* causing diphtheria [11, 12] and *Salmonella typhi* which causes typhoid [2]

This study deals mainly with the conditions at local farms that could cause the production of milk with blood stains. The study endeavoured to establish causes of milk contamination and come up with possible ways of improving hygiene on the dairy farms.

Method

Milk samples were taken from four selected farms and the same method of testing was used in all farms. From each farm, milk samples were collected from five cows one of which affected by mastisis. *Staphylococcus aureus* and *streptococcus Agalactiae* were tested using serial dilution and then spread plates. Streak plates were done in blood and McConkey agars.

Staphylococcus aureus and Streptococcus Agalactiae tests

Milk samples from each cow were separately incubated for 24 h at 37°C before undergoing serial dilution in *Staphylococcus aureus* broth as shown in Fig. 1. Separate raw milk samples were serially diluted in three stages (1-3). Diluted milk samples (1 ml) from stage 3 were used to perform Mackonkey (stage 4) and blood (stage 5) agar tests for spread plate. Streaking was done to Mackonkey (stage 6) and blood (stage 7) agar, looping from 10^{-3} dilutions. The tests and dilutions were done aseptically to avoid contamination. *Streptococcus Agalactiae* tests on separate milk samples were performed following a similar procedure.

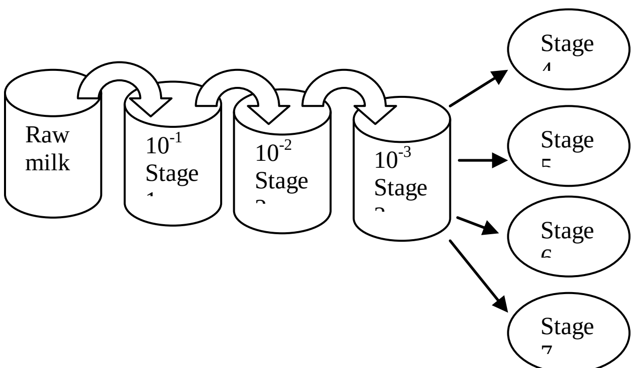

Figure 1: Flow chart for serial milk dilution to perform tests for microorganisms

Microorganisms in working area

Swabs were collected from stock feeds, milking equipment and working areas in the parlour to establish the different types of microorganisms that are responsible for contaminating milk.

Results and discussion

Staphylococcus aureus and Streptococcus agalactiae bacterial population

Fig. 2 shows the total bacterial population in cow milk from the farms. All milk samples showed the presence of *staphylococcus aureus* and *Streptococcus agalactiae*. *Staphylococcus aureus* population was higher than *Streptococcus agalactiae* in all samples. Milk from cows which had not shown signs and symptoms of mastitis contained the bacteria.

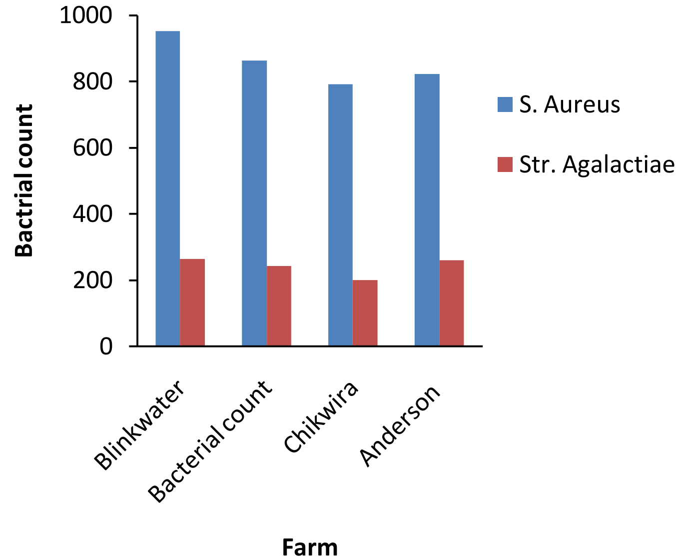

Figure 2: Population count for Staphylococcus aureus and Streptococcus agalactiae

Bacteria population in parlour

The microorganism population in parlour is shown in Fig. 3. Anderson had the highest population of micro organisms in the parlour followed by Blinkwater. As for Chikwira and Coolmoreen their population of micro organisms in the parlour are almost the same with Coolmoreen having slightly higher counts of microorganisms.

For the hygiene of the udder, Coolmoreen had the highest bacterial counts, followed by Chikwira. The above two farms practice hand milking. Blinkwater had slightly higher counts on the udder than Anderson. Poor udder hygiene could be attributed to milkers who do not wash their hands when milking the cows. Careless preparation of the udder may transfer bacteria from the skin to the teats thus increasing the risk of mastitis. Making the upper part of the udder wet is not recommended, because the dripping water carries bacteria down to the teats

All four farms had similar bacterial counts on feeds, drain water and feeding places. The differences in bacterial count in the parlour could be caused by the different type of chemicals used for cleaning and also the limited knowledge of the cleaners. Farm workers are not adequately trained on how to make correct dilutions of cleaning chemicals.

ISSN:2321-1156

International Journal of Innovative Research in Technology & Science(IJIRTS)

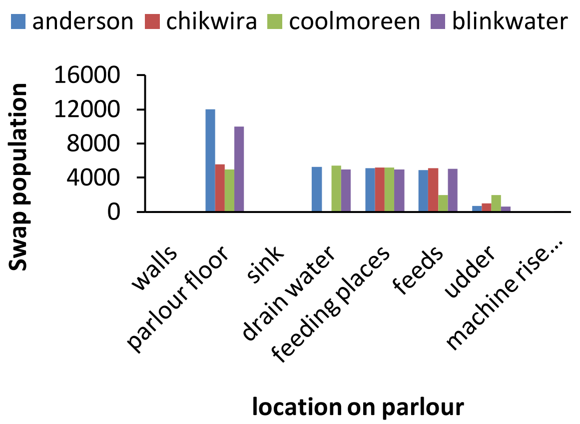

Figure 3: Microorganisms population in parlour

Overall microorganism population in surrounding areas

Fig. 4 shows the overall total population of microorganisms in areas surrounding the parlour on all the four farms. Anderson had the highest total bacterial counts because of the dust coming from the grinding mill and fresh flower field nearby. Blinkwater has second highest bacterial count (29.1%) due to the small milking parlour which is used by a large herd of cows. Coolmoreen had a bacterial count of 21.4% due to poorly trained workers and lack of proper monitoring. Coolmoreen has the least number of cows compared to the other three farms. The workers at Coolmoreen used cheap and ineffective disinfectants for cleaning. Chikwira had the least microbial population probably due to response to the researcher's frequent visits on monitoring farm hygiene.

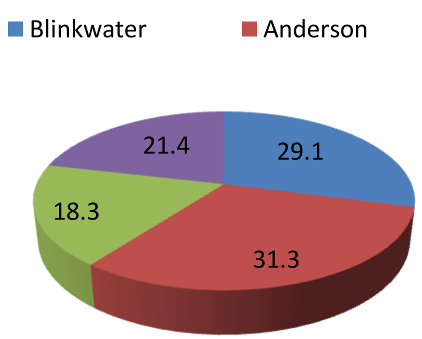

Figure 4: Overall microorganisms pollution in areas around the parlour

Worker related microorganisms

Fig. 5 shows the population of microorganism that are related to milk handlers. Milkers can actually increase contamination on the milk cows if they do not follow hygienic procedures. Milkers must have the right attitude which must be instilled into them by farm owners and managers. Milker related microorganism were very high especially at Chikwira and Anderson farms where workers do not wash their hands and also do not thoroughly clean cow teats. Milkers do not go for health checkups to reduce milk contamination emanating from infections such as tuberculosis, flue, tonsils and toothaches. Farm owners are reluctant to send their workers for medical checkups to cut on running costs. There was cross contamination of milk since the milking machiner was used from one cow to the next without cleaning its mouth.

The hands of the milkers were not washed well before handling milking equipment. Anderson had the highest bacterial population (54.4%) followed by Chikwira (17.2%). Coolmoree and Blinkwater have almost the same microbial population. The hygiene of the mouth of the milking machine needs to be improved on Chikwira and Anderson farms.

Workers at Anderson need training on the hygienic use of tissues or towels used to dry teats. Workers from other farms showed proper use of towels or tissues as illustrated by very few microbial population.

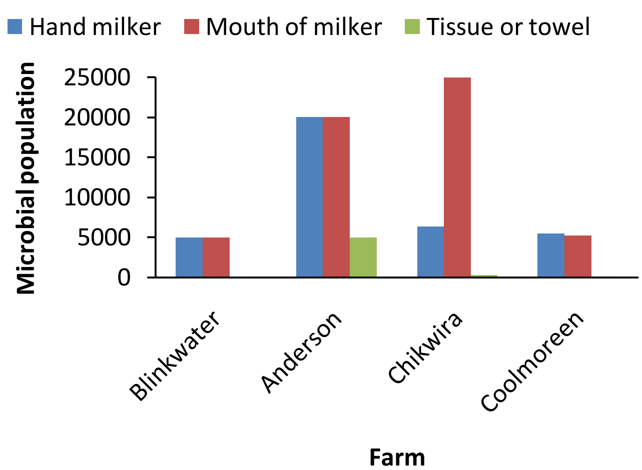

Figure 5: Population of microorganisms that are related milker contamination

Microorganisms population from equipment

Table 1 shows the population of microorganisms on milking related equipment. The greater the number of equipment used the higher the microorganism population. The equipment and general environment contain abundant bacteria which can be transferred to the udder and cause infection. Anderson had the highest population of microorganisms on the milking machines. Anderson had the highest microbial population on equipment followed by Chikwira as shown in Fig. 6. Coolmoreen and Blinkers had lower microbial count than the other two farms.

Table 1: Microorganism population on equipment

Equipment	Blinkwater	Anderson	Chikwira	Coolmoreen
Lid of tank	537	40	178	17
Side of tank	63	1590	5178	43
Inlet of tank	8	5056	150	144
Outlet	363	336	5265	333
Floor	153	316	82	48
Milking machine	38	220	No	No
Milk cluster	783	10038	No	No
Milk jar	461	5000	5009	46
Milk receiver	51	60	No	No
Sink	144	5144	5000	150
Bucket of milk	20	500	5004	628

No- no such equipment

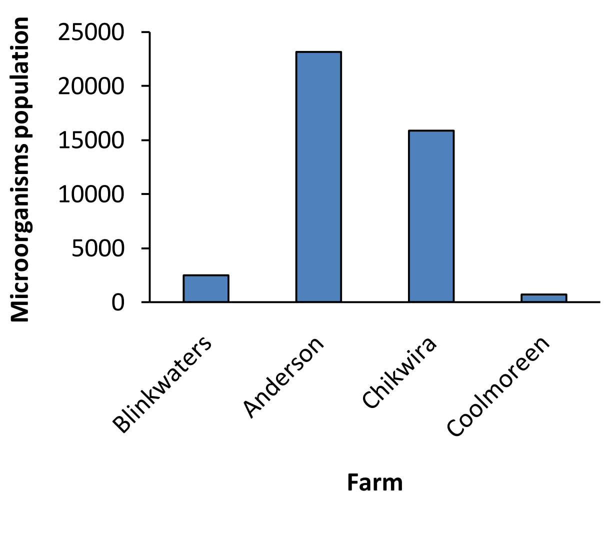

Figure 6: Total microbial population on milk equipment on farms

Microorganisms population from feed and feeding places

Fig. 7 shows the microbial population on feeds and feeding places. The microbial count increases following the following order of farms: Blinkwater, Coolmoreen, Anderson and Chikwira. Blinkwater had more fly catchers in feeding places which reduces the spread of microorganisms while at other farms there were fewer fly catchers.

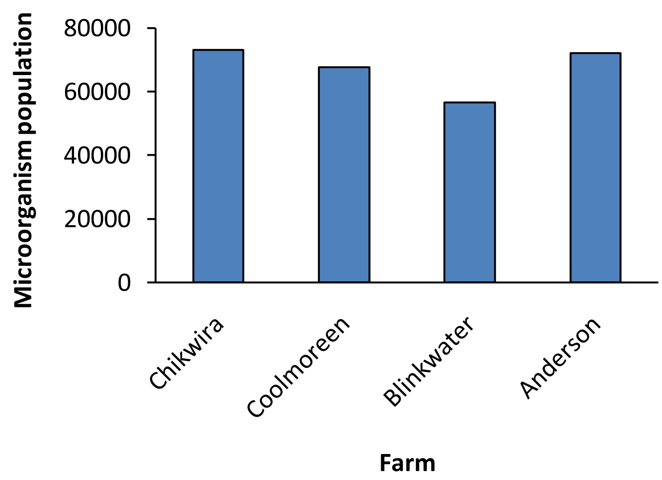

Figure 7: Total microbial population on feeds

Conclusion

This study has demonstrated that milk from the farms under study is contaminated with bacteria that cause mastitis which results in blood stained milk. The main sources of contamination were the milking equipment, feeds, milking parlour and workers. Workers lack appropriate hygiene in handling milk and milking equipment. They also lack appropriate knowledge on the use of detergents and sanitizers used in cleaning equipment, feeding places and parlour. There is need for thorough worker training on the use of cleaning chemicals and also proper hygiene when handling milk equipment. Supervision of workers also needs to be thoroughly done.

Acknowledgments

The authors would like to thank the dairy farmers for allowing this study to be carried out on their farms.

References

[1] Oliver S P., Gillespie B.E.,Headrick S.K., and Dowlen H.H., (2005), Prevalence Risk factors and strategies for controlling mastisis in Heifers during the Periparturient period, International Journal of Applied Research Veterenary Medicine, 3(2), 150-157.

[2] Adesokan I.A..,Ekanola Y.A and Fakorede S.S., (2009), Influence of lactic starters on sensory properties and shelf life o wara- a Nigeria (unripened) sot cheese, Journal of Applied Bioscience 13, 714-719.

[3] Jaskievicz W.C., (1965), Soviet biomedical journals: index to selected abstracts Fordham University of New York bronx institute of contemporary Russian Studies, Series 2, 1-6.

[4] Milner P., Page K.L and Hillerton J.E., (1997), The effects of early antibiotic treatment following diagnosis of mastitis detected by a change in the electrical conductivity of milk, Journal of Dairy Science 80, (5), 859–863.

[5] Ma Y, Ryan C., Barbano D.M., Galton D.M., Rudan M.A. and Boor K.J., (2000), Effects of Somatic cell count on quality and shelf-life of pasteurized fluid milk, Journal of Dairy Science83, (2) 264–274.

[6] Coconnier M.H., Lievin V., Bernet-Carmard M.F., Hudault S. and Servin A., (1997), Antibacterial effects of the adhering human *Lactobacillus Acidophilus* strain L.B, Journal of Antimicrobial Agency and Chemotherapy, 4(5), 1047-1052.

[7] Bapat P., Nandy S.K., Wangikar P. .and Venkatesh K.V., (2006), Quantification of metabolically active biomass using Methylene Blue dye Reduction Test (MBRT): Measurement of CFU in about 200, Journal of Microbiological Methods, 65(1), 107–116.

[8] Kapur V., Topouzis S., Majesky M.W., Lil L., Hamrick M.R., Hamill R.J., Patti JM., Musser JM., (1993), A conserved *Streptococcus pyogenes* extracellular cysteine protease cleaves human fibronectin and degrades vitronectin, Journal of Microbial Pathogenesis 15(5), 327–346.

[9] Spellerberg. B., Rozdzinski E., Martin S., Heynemann W., Schnitzler N.1. Lütticken R. and Podbielski A., (1999), Lmb, a Protein with Similarities to the LraI Adhesin Family, Mediates Attachment of *Streptococcus agalactiae* to Human Laminin Journal of Infection and. Immunity, 67(2), 871-878.

[10] Phuektes P., Browning G.F., Anderson G. and Mansell P.D., (2003), Multiplex polymerase chain reaction as a mastitis screening test for *Staphylococcus aureus, Streptococcus agalactiae, Streptococcus dysgalactiae* and *Streptococcus Uberis* in bulk milk samples**,** Journal of Dairy, 70(2), 149-155.

[11] Brooks B.W. and Barnum D.A., (1984), The susceptibility of bovine udder quarters colonized with *Corynebacterium Bovis* to experimental infection with *Staphylococcus aureus or Streptococcus agalactiae,* Canadian Journal of comparative Medicine, 48(2), 146–150.

[12] Hoban D.J., Bouchillon S.K., Johnson B.M., Jack L. Johnson J.L., Dowzicky M.J., (2005), In vitro activity of tigecycline against 6792 Gram-negative and Gram-positive clinical isolates from the global Tigecycline Evaluation and Surveillance Trial, Diagnostic Microbiology & Infectious Disease 52, (3), 215-227.

Biographies

Mrs .T Usai is a university lecturer. She is a specialist in food science and nutrition. usait@msu.ac.zw.

Miss R.S. Tshalibe is a lecturer in food technology at an university. tshalibers@msu.ac.zw

Dr B.C. Nyamunda is a lecturer in chemical technology at an university. nyamundab@gmail.com