Study of bovine mastitis in different climatic conditions in Jharkhand, India

Rajeev Ranjan* M. K. Gupta and K. K. Singh

Department of Veterinary Pathology, Ranchi Veterinary College,
Birsa Agricultural University, Kanke, Ranchi- 834006, Jharkhand,
*Corresponding author Present address: Department of Pathology, Orissa Veterinary College,
OUAT, Bhubaneswar- 751003, Orissa, India. E-mail : drrajraj@gmail.com
Published online at www.veterinaryworld.org on 25-03-2011

Abstract

Among 190 milk samples confirmed positive for bovine mastitis by California mastitis test, Somatic cell count and White side test. Among 190 samples, 138 (72.63 %) samples. *Staphylococcus aureus* (27.37%) was found to be the most prevalent organism followed by coagulase negative *Staphylococcus* spp. (12.63%), *E. coli*. (08.95%), *Pseudomonas* spp. (07.89%), *Streptococcus* spp. (05.79%), mixed bacterial infection (04.74%), yeast (03.15%), *Klebsiella* spp. (01.57%) and *Bacillus* spp. (00.52%). Further, the incidence of bovine mastitis was recorded under different climatic conditions, which was found to be highest in winter followed by summer and least in rainy season. Additionally, it was observed that Gram positive organisms were more common cause of bovine mastitis than Gram negative and *Staphylococcus aureus* was most common isolate in all the seasons. Incidence of bovine mastitis has been also recorded under different climatic conditions. However, Streptococcus spp. showed a significant rise in incidence during summer. Our results revealed that there was a definite impact of seasonal variation on incidence of bovine mastitis and the microbe associated with it.
Keywords: Bovine mastitis, incidence, climatic condition

Introduction

Mastitis is inflammation of parenchyma of mammary gland characterized by physical, chemical and usually bacteriological changes in milk and pathological changes in glandular tissues (Radostits et al., 2000). Mastitis is the major cause of economic loss to dairy industry globally. Annual losses in the dairy industry due mastitis was approximately 2 billion dollar in USA and 526 million dollars in India, in subclinical mastitis and clinical mastitis are responsible for approximately 70% and 30% respectively of dollars losses (Varshney et al., 2004). Mastitis thus has become major area of concern in the field of veterinary clinical practice. In the present work, Incidence of bovine mastitis was studied and an effort has been made to correlate the incidence of mastitis with climatic conditions.

Material and Methods

Collection of milk samples: A total of 190 milk samples were collected from clinical cases of bovine mastitis from the Jharkhand, India. The study spanned over a period of one year, so that the effect of different climatic conditions on the etiology and pathology of bovine mastitis could be assessed. The milk samples were collected aseptically and subjected to various parameters such as California Mastitis Test, White side test and Somatic Cell Test as a part of routine examination of milk prior to cultural isolation (Schalm et al., 1971, Leslie et al., 2002).

Culture and identification of microorganisms: The samples were inoculated on nutrient agar and blood agar, identification of the isolates was done on the basis of colony morphology, Gram's staining, catalase and coagulase production, carbohydrate fermentation, oxidation fermentation test, indole production, citrate utilization, methyl red test and Voges Proskauer test and test for haemolysis (Cowan and Steel, 1975).

Data obtained during the study for one year were statistically analyzed following the methods suggested by Snedecor and Cochran (2004).

Results and Discussion

All the 190 milk samples were confirmed to be positive for bovine mastitis by California Mastitis Test, White side test and Somatic cell test. Microorganisms could be isolated from 138 samples, while 52 (27.37%) did not yield any isolate. Among these 138 isolates, *Staphylococcus aureus* was the most prevalent with 52 (27.37%) isolates followed by coagulase negative *Staphylococcus* spp. 24 (12.63%), *E. coli*. 17 (08.95%), *Pseudomonas* spp. 15 (07.89%), *Streptococcus* spp. 11 (05.79%), mixed bacterial

Table 1. chi- square value for comparison of incidence of isolates in different seasons

Case/ Seasons	G Ve	G Ve	Mixed	Yeast	Samples with no isolates
Summer Vs Winter	0 8602 NS	2 2410 NS	2 2912 NS	0 5995 NS	0 4489 NS
Winter Vs Rainy	0 2473 NS	0 0024 NS	1 0470 NS	0 6471 NS	0 2697 NS
Summer Vs Rainy	0 0013 NS	0 5645 NS	0 0005 NS	0 3322 NS	0 7984 NS

NS :Non significant

infection 9 (04.74%), yeast (03.15%), *Klebsiella* spp. 3 (01.57%) and *Bacillus* spp. With 1 (00.52%) isolates. Our findings are in accordance with the findings of Prabhakar et al. (1989); Misra et al. (1993); Banerjee et al. (2002); Mohini et al. (2002); Turutogulu et al. (2002); Grewal et al. (2005), who have also reported higher incidence of *Staphylococcus aureus*. Higher incidence of *Staphylococcus aureus* may be attributed to the fact that the principal reservoirs of *Staphylococcus aureus* are the skin of the udder and milk of the infected gland (Spencer and Lasmanis, 1952; Davidson, 1961) and *Staphylococcus aureus* is a contagious organism, with capacity to penetrate into the tissue producing deep seated foci. The organism thus, is protected by tissue barrier (Schalm *et al.*, 1971). Olmsted and Norcross (1992) have shown that the ability of *Staphylococcus aureus* to bind to epithelial cells of the ductule and alveoli in mammary gland is an important virulence factor. The coagulase negative staphylococci have been reported to be more susceptible to leucocyte enzymes than *Staphylococcus aureus* (Melly et al. 1990).

The incidence of streptococcal mastitis in the present study was found to be lower than *E. coli* and *Pseudomonas* mastitis. This finding is contrary to the report of Sudeshchander et al. (1975); Kalorey et al. (1983); Ramchandra et al. (1984); Bhattacharya et al. (1995); Shukla et al. (1998); Nagal et al. (1999), who have reported higher incidence rate for streptococcal mastitis. *Streptococcus agalactiae* is an obligate parasite of the epithelium and tissue of mammary gland. Owing to this host parasite relationship, it is susceptible to eradication from dairy herds, through detection and segregation of infected cows, use of hygienic milking practice and intramammary infusion of antimicrobial agents, (Schalm et al. 1971; Gyles and Thoen, 1993).

In the present study, incidence of *E. coli* mastitis was quite high and it superseded streptococcal mastitis. It could be due to poor hygiene condition, as it infects the udder through teat canal (Sumathi et al. 2008). Despite of the wide presence of *E. coli* in the environment, only low or sporadic incidence of *E. coli* has also been reported by various workers, Sudeshchander et al. (1975); Chanda et al. (1989); Bhattacharya et al. (1995); Krukowski et al. (1998); Shukla et al. (1998), which is in accordance with our findings. Opsonization of bacteria by IgM with subsequent phagocytosis and killing by neutrophil are some of the factors, which prevent establishment of *E. coli* mastitis. On the other hand, capsulated *E. coli* escape phagocytosis to bring about coliform mastitis (Gyles and Thoen, 1993). These inherent properties of udder defense against *E. coli* infection might be responsible for reduced incidence of *E. coli* mastitis in the present study.

Pseudomonas spp. was one of the significant causes of bovine mastitis in the present study. Cases of bovine mastitis due Pseudomonas spp. have also been reported by Sarma and Boro, (1980); Ramchandra et al. (1984); Sudhaona et al. (1985); Mohini et al. (2002). The organism has its natural habitat in soil, water and sewage. The source of herd infection with *Pseudomonas* spp. has been attributed to the use of contaminated water for washing udder (Redaelli and Perini, 1960) as well as intramammary therapy with contaminated equipment (Tucker, 1950).

Incidence of mastitis due to yeast was found to be higher than *Klebsiella* or *Bacillus* mastitis in the present study. Sporadic incidence of mastitis due to yeast has been reported by Nagal et al. (1999); Turutogulu et al. (2002); Dudko et al. (2003); Ebrahimi et al. (2005). Stored antibiotics kept for repeated use may become contaminated with yeast and act as primary source of yeast and subsequently udder infection (Schalm et al. 1971). Tissue injury may also be helpful in establishing a mycotic mastitis. This obviously emphasizes the importance of strict aseptic measures in udder therapy with antibiotics. In previous studies, *Cryptococcus neoformans* and *Candida albicans* has been reported to be the main causative agents for yeast mastitis (Sudhaona et al. 1985; Misra et al. 1993; Bhattacharya et al. 1995; Pianta et al. 1995; Seddeck et al. 1997; Beytut et al. 2002).

A high percentage (27.37%) of milk samples in the present work showed no growth of organism during cultural studies. Failure to isolate pathogens

Table-2.Chi square value for comparison of effect of variation in the climatic condition on incidence of individual causative agent of bovine mastitis

Cases/ Seasons	*S. aureus*	*Staphylo. spp*	*Strepto. spp.*	*Bacillus spp.*	*E. coli*	*Klebsiella spp.*	*Pseudomonas spp.*	Mixed	Yeast	Samples with no isolates
Summer Vs Winter	0 69 NS	1 00 NS	0 52 NS	1 05 NS	0 74 NS	0 38 NS	0 90 NS	2 2912 NS	0 5995 NS	0 4489 NS
Winter Vs Rainy	0 01 NS	0 69 NS	0 19 NS	0 00 NS	1 16 NS	0 15 NS	1 04 NS	1 0470 NS	0 6471 NS	0 2697 NS
Summer Vs Rainy	0 11 NS	0 14 NS	5 10 *	0 16 NS	1 80 NS	0 33 NS	0 00 NS	0 0005 NS	0 3322 NS	0 7984 NS

may relate to media and cultural method used. Some of the microorganism such as *Mycoplasma* spp, *Listeria* spp. etc require specialized isolation media, which were not pursued in the present work. No growth may also be observed in traumatic mastitis. In addition, the reason behind no isolation of bacteria from milk samples may include treatment with antibiotics before sampling and elimination of the bacteria in the course of inflammatory reaction. In some form of mastitis, caused by *E. coli* or other environmental organisms, systemic effects of endotoxin continues in the absence of viable bacteria in milk. Lack of bacterial growth may also be a feature of chronic mastitis in which the organisms have been eliminated but the pathological changes persist.

The incidence of bovine mastitis in the present study was found to be more or less equal during winter (47.37%) and summer (42.26%) season while least cases of bovine mastitis was recorded during rainy season (7.37%), however the variation was statistically non-significant (Table 1 & 2). The overall incidence of bovine mastitis was higher due to Gram positive organism as compared to Gram negative organism. Further the incidence of Gram positive was more in winter than in summer whereas Gram negative organisms showed the reverse trend. In all seasons the highest incidence of mastitis was due to *Staphylococcus aureus*. No incidence of *E. coli*, *Klebsiella* spp., *Bacillus* and yeast mastitis was recorded during rainy season. The variation in incidence of microorganism in different climatic condition was statistically non-significant except *Streptococcus* spp., which is significantly higher in summer season.

The higher incidence of bovine mastitis in winter in our study may be attributed to the fact that higher rate of calving and peak milk production put the teat sphincter into stress. Furthermore, the optimal temperature in summer could be the reason behind increased multiplication of pathogenic bacteria and their transmission. In rainy season, high humidity might be the restricting factor in the growth of bacteria thereby resulting into lesser incidence of bovine mastitis. Our finding are in accordance with the study of Mohamed et al. (1993); Costa et al. (1998); Ribeiro et al. (2001), who have reported higher incidence of mastitis in summer than in winter season. Contrary to our finding, Reena Mukherjee et al. (2003), reported higher incidence of subclinical mastitis during rainy season. Thus it is concluded that a definite change in the incidence of bovine mastitis occurs under different climatic conditions and a thorough knowledge of prevalence of microorganisms associated with mastitis could be immensely helpful in selection of antibiotic to be used in therapy against this problem.

Acknowledgement

Authors are grateful to the Vice Chancellor of the Birsa Agricultural University, Kanke, for providing facilities to carry out this study.

References

1. Banerjee, K., Ray, J.P., Das, R. and Chandra, S. (2002): Studies on etiological agent of sub-clinical mastitis in dairy cows in west Bengal. *Indian J. Ani. Health*, 41: 109-112.
2. Beytut, E., et.al. (2002): Pathological and Bacteriological investigations on bovine mastitis in Kars region and its surroundings. *Kafkas Universitesi Veteiner-Fakulltosi*, 8: 111-122.
3. Bhattacharya, D. and Rahman, H. (1995): Antibiogrm of pathogens isolated from case of Bovine mastitis. *Indian Vet. J.*, 72: 414-415.
4. Chanda, A., et. al.(1989): Studies on incicence of bovine mastitis, its diagnosis, etiology and in vitro sensitivity of the isolated pathogens. *Indian Vet. J.*, 66: 277-282.
5. Costa, E., Ribeiro, A.R., Watanabe, E.T. and Melville, P.A. (1998): Infectious bovine mastitis caused by environmental organisms. *J. Vet. Med.*, 45 (2): 65-71.
6. Cowan, S.T. and Steel, K.J. (1975): Manual for the identification of medical bacteria. Cambridge University Press, Cambridge.
7. Davidson, I. (1961): Observations on the Pathogenic Staphylococci in dairy herd during a period of six years. *Res. Vet. Sci.*, 2: 22.
8. Dudko, P. (2003): The microbiological examination of milk samples results conducted in the Northern Great-Poland region during the bovine mastitis control. *Annoles-University-Moriae-Curie-Sklodowska.-Sectio-DD, Medicino-Veterinaria.* 58: 103-116.
9. Ebrahimi, A. and Nikookhah, F. (2005): Identification of fungal agents in milk sample on mastitic cow. *Indian Vet. J.*, 82: 52-54.
10. Grewal, K.D., Gupta, M.P. and Singh, K.B. (2005): Therapeutic efficacy of Gentamicin in clinical cases of mastitis in Buffaloes. *Indian Vet. J.*, 82: 123-125.

11. Gyles, C.L. and Thoen, C.O. (1993): *E. coli*, In: Pathogenesis of Bacterial Infection in Animal. 2nd Edn.. pp. 164-187. International Book Distributing Co., Lukhnow.
12. Gyles, C.L. and Thoen, C.O. (1993): *Staphylococcus*, In: Pathogenesis of Bacterial Infection in Animal. 2nd Edn. pp. 21-35. International Book Distributing Co., Lukhnow.
13. Kalorey, D.R., Purohit, J.H. and Dholakia, P.M. (1983): *Indian J. Ani. Sci.*, 53: 961.
14. Krukowski, H., Majewski, T. and Popiolek, M. (1998): Changes in IgG concentration in bovine mastitis. *Medycyna-weterynaryjna.* 54: 770-771.
15. Leslie, K.E.; Jansen, J.T. and Lim, G.H. (2002): Opportunities and implications for improved on- farm cowside diagnostics. *Proc. De Laval Hygiene Symp.* Pp. 147.
16. Mekibib, B., Furgasa, M., Abunna, F., Megersa, B. and Regassa, A.(2010):Bovine Mastitis: Prevalence, Risk Factors and Major Pathogens in Dairy Farms of Holeta Town, Central Ethiopia. *Veterinary World*, 3(9):397-403
17. Melly, M.A., Thomison, J.B. and Rogers, D.E. (1990): Fate of staphylococci in leucocytes. *Journal of Experimental Medicine.* 112: 1121.
18. Misra, P.R., Roy, P.K. and Das, K.L. (1993): Bovine mastitis in Orissa: predominant microflora and antibiotic sensitivity test patter. *Indian J. Dairy Sci.*, 46: 543.
19. Mohamed, I.E.,et. al.(1993): A study on the incidence and etiology of bovine mastitis in Sudan. Proceedings of the 2nd scientific congress Egyptian Society for cattle disease, 5-7 December. *Assiut. Egypt*., 2: 326-336.
20. Mohini, K.P., Janaki, R. and Gupta, B. (2002): Diagnosis and therapy of udder mcroflora obtained from clinical mastitis casesin cross bred cows. *Indian vet. Med. j.*, 25: 365-366.
21. Nagal, K.B., Sharma, M., Katoch, R.C. and Sharma, M. (1999): Etiology of bovine mastitis in and around Palampur in Himachal Pradesh. *Indian J. Ani. Sci*., 69: 150-152.
22. Olmsted, S.B. and Norcross, N.L. (1992): Effect of specific antibody on adherence of *Staphylococcus aureus* to bovine mammary epithelium cells. *Infect Immunology*, 60: 249-56.
23. Pianta, C. (1995): Bovine mastitis due to *Candida albicans. Pesquisa Agropecuaria Gaucha.*, 1: 253-255.
24. Prabhakar, S.K.,et. al. (1989): Studies on the management factors, incidence and etiology of clinical mastitis in cows. *Indian J. dairy Sci.*, 42: 452-455.
25. Radostits, O. M., et.al.(2000): Bovine mastitis, In: A Textbook of Cattle, Sheep, Pigs, Goat and Horse. Veterinary Medicine. 9th edn. pp. 563-618. ELBS and Bailliere Tindau.
26. Ramchandra, R.N., Bhaskaran, R., Subbasastry, G.N. and Seshadri, S.J. (1984): Some observation on the trends of bovine udder infections. *Indian J. Comp. Micro. Immunol. Infect. Dis.*, **5**: 20-26.
27. Redaelli, G. and Perini, G. (1960):. Contributo allo studio della mastite bovina da *Pseudomonas aeuruginosa*. Arch. Vet. *Ital.*, 11: 273.
28. Reena- Mukhajee, Das, P.K. and Mukherjee, R. (2003): Status of subclinical bovine mastitis in lactating cows of a livestock production research farm. *Indian J. Ani. Sci.*, 73: 775-777.
29. Ribeiro, A.R., Garino (Jr), F., Silva, J.A.B., Watanabe, E.T., Vallue, C.R. and Costa, E.O. (2001): Seasonality on the occurrence of environmental bovine mastitis. *Nopgama.*, 4: 19-22.
30. Sarma, G. and Boro, B.R. (1980): Isolation and sensitivity test of etiological agents from bovine mastitis. *Indian J. Ani. Health.*, 19: 47-49.
31. Schalm, O.W., Carroll, E.J. and Jain, N.C. (1971): Bovine mastitis. 1971 Edn. Lea and Febiger, Philadelphia, USA.
32. Seddeck, S.R. (1997): Bovine mastitis (age, cause and control) in Assiut Governorate. *Assiut Vet. Med. J.*, 36: 149-162.
33. Shukla, S.K., Dixit, D.C., Thapliyal, D.C. and Kumar, A. (1998): Bacteriological studies of mastitis in dairy cows. *Indian Vet. Med. J.*, 22: 261-264.
34. Snedecor, G.W. and Cochran, W.G. (2004): Statistical Methods, 8th Edn., Oxford and IBH Pub. Co., Kolkata.
35. Spencer, G.R. and Lasmanis, J. (1952): Reservoirs of infection of *Micrococcus pyogenes* in bovine mastitis. *Am. J. Vet. Res.*, 13: 500.
36. Sudeshchander and Baxi, K.K. (1975): Diagnosis and treatment of Subclinical mastitis in cow. *Indian Vet. J.*, 52: 275-281.
37. Sudhaona, O., Nair, G.K., Piliai, R.M. and Sulochana, S. (1985): *Kerela J. Vet. Sci.*, 16: 99.
38. Sumathi, B.R., Veeregowda, B.M. and Amitha, R. Gomes. (2008): Prevalence and antibiogram profile of bacterial isolates from clinical bovine mastitis. *Veterinary World.*, 1: 237.
39. Tucker, E. W. (1950): *Pseudomonas* infection of the bovine udder apparently contracted from contaminated treatment equipment and materials. *Cornell Vet*., 40: 95.
40. Turutogulu, H. and Mudul, S. (2002): Is *E. coli* 0157: H_7 an etiological agent of bovine mastitis. *Israel Journal of Veterinary Medical*., 57: 82-83.
41. Varshney, J.P. and Naresh, R. (2004). Evaluation of homeopathic complex in the clinical management of udder diseases of riverine buffaloes. *Homeopathy*, 93: 17.

* * * * * * * *