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ETIOLOGY OF BOVINE MASTITIS AND THE ANTIBIOTIC SENSITIVITY PATTERN IN NORTH TAMIL NADU

C.S. Arunaman[1], C. Jayanthy[2] and N.R. Senthil[3]
[1]C.S. Arunaman, Associate Professor and Head, Department of Veterinary Medicine, VCRI, Theni, TN.; [2]C. Jayanthy, Assistant Professor, Department of Clinics, Madras Veterinary College, Chennai, TN.; [3]N.R. Senthil, Assistant Professor, Centralised Clinical Laboratory, Madras Veterinary College, Chennai, TN.
E-mail: arunamancs@gmail.com

Abstract: Mastitis is a production disease of major economical concern worldwide. The present study is conducted to map the common causative bacteria of mastitis, in and around Chennai of North Tamil Nadu and the antibiotic sensitivity pattern. Dairy cows showing apparent changes in milk were subjected to this study. Microbial culture and Antibiotic sensitivity were done. The colony forms were identified and phenotypic ABST was done using antimicrobial disc with eight antimicrobials. Out of 352 cases, the most common pathogen was found to be *Staphylococcus spp* (37.21%) followed by *E.coli* (27.26%). And the most effective antibiotics were Gentamicin (78.14%) and Enrofloxacin (65.89%).
Keywords: Bovine mastitis, ABST, antimicrobial resistance.

Introduction

Mastitis is characterized by a range of physical and chemical changes in the milk and pathologic changes in the glandular tissue (Radostits *et al.,* 2016). This is one of the ancient diseases, recorded even before 8000 years (Pamela, 2017). Mastitis is the major concern throughout the world, which is an important economical concern to the dairy farmers, despite the scientific growth of any country. In India, the economical loss due to mastitis, recorded as INR. 52.9 Crores in 1962 has grown to 8333.5 Crores in 2019.

Economical loss associated with mastitis are due to reduced milk production, reduced cow sale value, increase in discarded milk, increase in veterinary services, increased cost of veterinary treatment, high penalties on milk quality, culling of continuously infected cows and early cow replacement costs (Seegers *et al.,* 2003). No dairy farm of any managemental practice is free from mastitis. Let it be free range, semi-intensive, intensive, modernised; every system has its own merits and demerits which expose the dairy cows to the occurrence of mastitis, though the percentage of prevalence may vary.

Udder and milk itself are a medium for a spectrum of microbiota. Though more than 250 species of bacteria have been identified so far, it is 15 to 20 species of bacteria (Hoque *et al.,*

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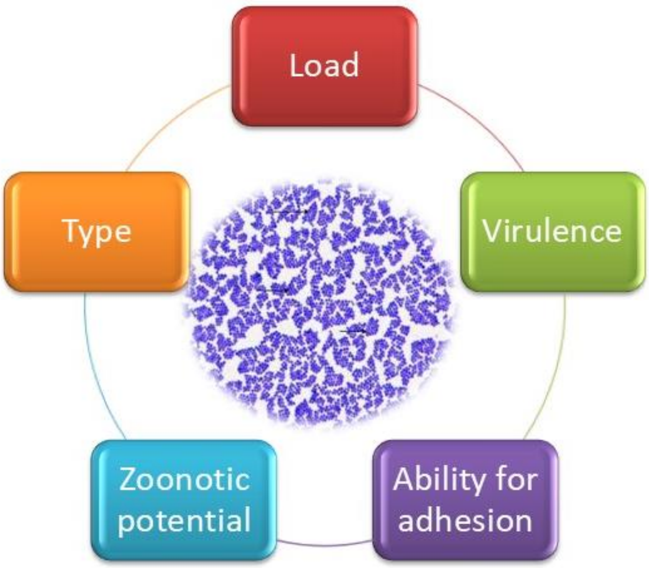
2020), which cause either severe to very severe clinical mastitis or subclinical mastitis, which again may differ from place to place. The prevention of mastitis is a difficult task, as the etiology is multifactorial, which can broadly be classified into host factors, pathogen factors and environmental factors.

Host factors:

Pathogen factors:



Environmental factors:

The primary source of environmental pathogens is the bedding used to house cattle. Contaminated teat dips, intramammary infusions, water used for udder preparation before milking, water ponds or mud holes, skin lesions, teat trauma, milk fed to calves and flies are also potential sources of infection (Kumar *et al.,* 2017). During the summer, the humidity and temperature are favorable for the development of coliform in the bedding. Environmental pathogens (*E. coli* and *Str. uberis*) were more common in summer and *S. aureus* was found more common in winter (Zhang *et al.,* 2016 and Sharun *et al.,* 2021).

The better understanding on aetiology of the disease, identification of causative and initiation of proper treatment at an earlier stage of the disease are of paramount importance to achieve good therapeutic response.

Though numerous studies are available elsewhere about the mastitis causing pathogens and antimicrobial sensitivity, they are not universally practicable, as there is significant influence of many other local factors. With this backdrop, the present study was conducted to document the spectrum of bacterial cause of mastitis in dairy cows and their antibiotic sensitivity, in and around Chennai, Tamil Nadu.

Methodology:

Dairy cows presented to Large Animal Medicine Unit of Madras Veterinary Teaching Hospital with clinical signs of udder inflammation were identified. A total number of 352 cows with signs of clinical mastitis were included for the study. Clinical mastitis was identified based on clinical signs of mastitis, such as udder abnormalities including swelling, hardness, heat, redness, or pain, and abnormalities in the appearance of the milk produced, such as watery appearance, clots, flakes, and blood stains (Rosemary and Mustafa, 2024). Milk samples were aseptically collected from the affected animals to avoid environmental contamination. Milk samples were cultured and species identification and antimicrobial sensitivity were done as per standard protocols (Wattenburger *et al*., 2020).

Results and Discussion:

The causative organisms identified in the mastitis milk samples are listed in table-1. Among the causative pathogens, *Staphylococcus spp.* (37.21%) was found to be the major cause of clinical mastitis, followed by *E.coli* (27.26%). Polymicrobial growth was observed in 09.66% samples and no growth was observed in 04.54% samples. The major pathogens are in accordance with the previous study by Chandrasekar et al. (2014) and Dufour et al. (2019). Among 16 samples of no growth, four samples proved to be of fungal positive in later phase.

Table-1. Spectrum of microorganisms from mastitis milk and their prevalence

Microorganism spp	No. of positive samples (n=352)	Percentage
Staphylococcus spp	131	37.21
E.coli	96	27.26
Streptococcus spp	67	19.03
Mycoplasma	02	0.57
Klebsiella	06	01.70
Polymicrobial	34	09.66
No growth	16	04.54

The antimicrobial sensitivity pattern is given in table-2.

Table-2. Antimicrobial sensitivity pattern

Antimicrobial	**No of cases susceptible (302/352)**	**Percent susceptible (out of 302)**
Amoxicillin	56	18.54
Amoxicillin - clavulanate	183	60.59
Ampicillin	27	08.94
Ceftriaxone	124	41.06
Chloramphenicol	103	34.11
Enrofloxacin	199	65.89
Gentamicin	236	78.14
Oxytetracycline	63	20.86

Gentamicin was found to be effective in 78.14% samples, followed by Enrofloxacin (65.89%). Highest resistance for recorded for Ampicillin, with least sensitivity of 08.64%. Though the sensitivity pattern grossly matches with the findings of Chandrsekaran *et al.* (2014), there was a sensitivity shuffle between Gentamicin and Enrofloxacin. E.coli and Staphylococcus, the major pathogens in this study were highly sensitive to Gentamicin and Enrofloxacin, crediting to their highest scores. This is in concurrence with the findings of Karthikeyan (2003) and Chandrsekaran *et al.* (2014).

Highest level of resistance was again shown by Staphylococcus and E.coli, which is in concurrence with the report of Chandrasekaran *et al*. (2014) and Anuragh *et al.* (2021), where Chandrasekaran *et al.* (2014) postulated that ‘all antimicrobial use in the herd might affect the resistance of E.coli by increasing the presence of these antimicrobial agents in the cow's environment'. He further opined that he incidence of resistant mastitis was higher which might be due to indiscriminate use of antibiotics and intramammary preparations containing combinations and broad-spectrum antibiotics. As reported by Melchior et al., (2006) biofilm formation is an important virulence factor that might result in recurrent or persistent udder infections and treatment failure through increased resistance to antibiotics and protection against host defences (Schönborn *et al.,* 2017). Further, it was proved by Schönborn *et al.,* (2017), Singh *et al.,* (2017) and Vaidya *et al*., (2017) that a large number of food spoilage and/or pathogenic bacteria, Pseudomonas spp., Klebsiella spp., Staphylococcus spp, E. coli, were associated with biofilm-formation from diary niches. The resistance documented in the present study is in accordance with previous studies, which is a global concern and necessitates ethical usage of antibiotics. The impact of antibiotic resistance was also documented by Hoque *et al.,* (2020), where they opined that the microbial resistance and genomic functional potentials represented important mechanisms for antibiotic resistance, which would lead to treatment failure and persistence of the disease.

Conclusion

Mastitis of dairy cows being an important disease from the economical perspective, there by the livelihood of small farmers, who make the majority of livestock farming community in India. The present study revealed the prevalence of spectrum of mastitis causing microorganisms, which are in concurrence with the previous studies, worldwide, signifying the global status of the microbes with significant variation in terms of sensitivity and resistance. The growing level of multi drug resistance necessitates earlier and scientific method of diagnosing the causative organism and their sensitivity to antibiotics, facilitating selection proper and case specific antibiotic, instead of choosing a wide spectrum antibiotic, which may further worsen the antibiotic resistance, which is a major concern in today's 'One Health' concept.

Conflict of Interest

The authors declare that was no conflict of interest.

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