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Review Article

Management of Subclinical Mastitis for Better Yield in Dairy Animals: A Review

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Abstract

There is a continuous challenge for improving the quantity and quality of milk yield through dairy animals. However, dairy animals from their nature are susceptible towards subclinical mastitis (SM) as their physiology depends majorly upon its management and surrounding conditions. Symptoms of SM is invisible, however, slowly it may deplete the physiology of dairy animals Especially in the case of large dairy farms, the cases of SM are higher than that of small herd or dairy farm. Maintenance of proper management conditions that lowers the chances of dairy animals from getting exposed towards SM is highly recommended. However, behavior of microbes causing SM gets changed with the varying climatic scenarios. Improved management practices such as breeding management, balanced nutrition, milking practices, hygienic milking, dry cow management, proper handling, plant-derived products; etc may help in preventing and controlling SM cases.SM causes high economic losses the whole dairy farming community and industry and it hampers the health status and well-being of dairy animals. Hence, proper knowledge of factors related to SM etiology and its management becomes necessary for both animals and dairy farmers. Therefore this review has been formulated to provide a better understanding of SM and its management in dairy animals.

Keywords: Dairy Animals; Mastitis; Management; Milk yield

Introduction

As the science progressed, advancements in improved genetics, nutrition and management practices in dairy animals have been enhanced [1-3]. The prime priority of every dairy farmer or be it any dairy industry is higher milk quality and quantity [4-6]. However, SM has emerged as one of the major challenging diseases among other diseases in dairy animals [7-9]. This disease not only causes economic losses but also harms animal health and well-being and it is a highly contagious disease [10,11]. This disease is considered as multi-factorial as this may be caused by several mis-management practices. In addition to this, SM is considered a multidimensional disease as it may lead to several other diseases by compromising the immunity status of affected animals [1,11-15].

Mastitis may be understood as inflammation of the mammary gland mainly due to different bacterial strains [1,4,5,12]. However, some studies also reported that SM may be caused by yeasts. Mastitis may be easily detected with physical characteristics of milk produced as well as in poor udder health of dairy animals however; in SM no visual symptoms are observed by naked eyes in milk or udder of dairy cattle as changes occur in alveolar cells, tissues, ducts and other systems of the mammary gland of dairy animals which may not be seen through naked eyes. Detection of this disease requires chemicals, equipments or laboratory conditions as shown in table 1 [4,9,15-17]. Animals' udder health steadily gets lowered and milk yield as well as the quality is compromised with progress of time [11]. Hence, early detection of this issue should be given priority on any dairy farm on regular basis along with the maintenance of improved animal husbandry. *Streptococci* spp., *Staphylococci* spp., *Escherichia coli* and other *Coliforms* spp. are considered as major pathogens for mastitis [18]. These pathogens are naturally present in unhygienic conditions of surrounding or skin of animals. These pathogens enter into mammary system through the passage of milk flow in the udder of dairy animals. Periods of compromised immunity such as estrus, dry period, reproduction may further elevate the chances of SM cases. Furthermore, these pathogens deplete the working of secretory cells, tissues and organs of the mammary system of dairy animals. Somatic cell count (SCC) in normal milk derived from a healthy milch animal is around 1, 00, 000/ml but when SCC crosses more than 2, 00, 000/ml, the milk is considered to sub-clinically mastitic and the animal is called to be affected from SM [19-21].

Reviews containing factors and concise management strategies for augmenting milk quantity and quality are scanty. Therefore this review has been formulated to provide better understanding of SM and its management in dairy animals.

Milk and financial losses due to SM

Some studies reported that on an average loss of 100 to 500kg/lactation from total milk occurs due to SM cases in dairy animals [22,23] which is corresponding value to 10- 30% loss in total milk yield of a dairy animal [12]. Some studies from India showed that some regions had varied rates of SM in dairy animals ranging from 20% to up to 85% cases. Kumari., *et al.* [24] indicated that about 80% of total economic loss to the dairy industry of India is caused due to SM and mastitis cases alone. SM is prevalent up to 15 to 40 times more than clinical mastitis cases in animals. Hence, proper methods for the detection of SM cases (Table 1) for its timely treatment before this disease becomes clinical mastitis. As per estimation from Project Directorate on Animal Disease Monitoring and Surveillance (2011) total economic loss due to mastitis was around 560 million US dollars which is around 4151 Crores INR under Indian conditions.

Farm side Tests	Lab Tests
Physical changes in udder structure	ELISA
Inline Somatic Cell Count	Direct Microscopic Somatic cell counter
Modified California Mastitis Test	LDH
IRT	NAGase
Somatic cell DNA Fluoroscenting	Vitronectin Estimation
Bromethyl blue card test	Proteomics
pH, EC	Culturing media
Modified White Side Test	Acute-phase Protein Estimation in Milk and Serum Components
Brix Refractometer	
Surf Filled Mastitis Test	

Table 1: Potential farm side and lab tests for detection of mastitis in dairy animals [12].

Factors and associated management practices for SM

There may be several factors responsible for SM in dairy animals. These factors includes Pathogen factors (type of organisms,

virulence factor, and treatment of animals); Animal factors (age, breed, udder health, lactation stage, udder structure, milk somatic cell count, dry period, other diseases) and Environmental factors (housing, hygiene, diet, milking technique) [11,12]. In coming subsection of this manuscript we shall focus more upon management practices for SM.

Species and breeds of animals

Pathogens gain entry to the mammary system of animals through orifice present in the teats of animals when they are opened during some phases such as during milking to few minutes after milking [11,20,21]. These orifices are closed through a natural working of tight sphincter muscles. Buffaloes suffer less from SM than cows as they have tighter sphincter muscles. Furthermore, Zebu cattle are shown to have better resistance towards mastitis cases as compared to that in exotic as well as cross bred animals [26,27]. Some animals have better physiological adoptions towards mastitis cases so they may be considered for the selection process to be kept at a dairy farm for milk production and in the production of the future generation.

Age and stage of lactation of dairy animals

Older animals are considered to be more susceptible towards SM cases [28] in the case of buffaloes; more SM cases are encountered in 3rd to 4th lactation period. Furthermore, dairy animals become more vulnerable towards SM during the end of the dry period to initial lactation period. Intra-mammary infections may be observed more in animals whose udder structures are deformed, long pendulous teats as these conditions favor the pathogens to enter to mammary system of animals [29-36].

Animal energy balance and dry period length of dairy animals

Animal whose energy balance is in the optimum range shows better and normal physiology of defence mechanism against SM. Singh and Kumari [37] indicated that the energy balance of dairy animals may be easily accessed through body condition scores usually done on a 1 to 5 or 1 to 6 scale wherein 1 shows the emaciated condition and 5 or 6 reflects fatty conditions of animals. Singh., *et al.* [1] found that dairy cows which had a body condition score (BCS) of 3.5 during the dry period (1-6 scale) performed better in terms of improved milk yield and quality. Hence, a proper ratio of feed for concentrates and fodder should be adopted for proper BCS in animals to prevent them from becoming too thin or too fat [9,38-42].

During the last trimester of dairy animals, major development of fetus and body reserves in animal takes place. Hence, animals should be provided with dry period wherein animals are not milked. This process gives animalswith proper time to replenish nutrients in their body and for mammary tissue development for proper milk production, the recommended dry period length is suggested to be of about 8 weeks of the end period of gestation [9,11,43]. Studies have shown poor results in the animals whose dry period was lowered or skipped. Provision of proper length of dry period becomes more important in the case of cow to be heifers as their bodies are not fully matured and they need proper time period to put on body reserves for coming lactation period. A remarkable change in normal physiology of animals takes place towards end of the dry period as animals prepare for the lactation period from a non- lactating stage [44,45].

Environmental factors for SM in dairy animals

Climatic conditions such as dry and moderate temperatures are considered suitable for animals to live with minimum mastitis cases. However, tropical climate conditions are adverse for animals and SM cases are seen heavily in such areas as this temperature and elevated humidity favors the growth of pathogen breeding places [9]. Hence, proper ventilation facilities must be ensured in the house of animals to avoid too much humid and hot temperature inside the house premises of animals. In order to maintain moderate temperature, blowing fans or heating sources may be provided during summer or winter season [46,47]. In addition to this, animals should be provided with soft and dry, disinfected bedding materials especially during the transition period for better comfort. Hot or cold bedding materials may cause discomfort to animals and hence these may be avoided for bedding. Moist conditions in bedding of animals should be avoided as this may become a breeding place of mastitis pathogens and hence elevated cases of SM; therefore, for a moist condition should be avoided in the bedding of animals [48-51]. In addition to this, regular removal and replacement of bedding material may be practiced in animals for providing better comfort and controlling mastitis in animals [52,53].

Nutritional management of animals

Optimum nutritional management of dairy animals is one of the main keys to success for dairy farming [9,54,55]. Safe quality and quantity of water should be assured at farm as a first step towards nutritional management for dairy animals [3]. Along with the pro-

vision of a balanced diet to the animals, provision of mineral mixture containing necessary minerals such as selenium, zinc, manganese, copper, etc. and vitamins such as vitamin A, E and C should be provided to animals [4,9,56]. These minerals and vitamins possess antioxidant and immunity modulating properties favorable for animals which helps them in fighting against mastitis cases [57-64]. Especially during transition period, animal requires a careful nutrition management that ensures proper supply of essential nutrients to animals and maintains them in proper energy balance condition. The above suggested conditions in animals showed improved performances in dairy animals [17,65,66].

Milking management

Animals are suggested to be milked under strict hygienic conditions for obtaining milk of good quantity and quality. Hands, animals' udder, teats and milk utensils should be properly sanitized before and after the milking process to ensure clean milk production through dairy animals [67-70]. Some studies showed that hygienic machine milking conditions resulted in lower SM cases than hand milking practice [9,11,71].

Provision of grazing facilities to animals for about 6-8 hours a day may enhance control of SM cases as cows get time to clean their udders as compared to that in barn or stall fed conditions [72-74].

Increasing the post milking lying period may enhance the control of mastitis cases in dairy animals. The reason behind this may be attributed towards the normal physiology of animals for closing sphincter muscles take about 30 minutes after milking. Hence, the provision of teat dip and palatable feeding materials may enhance protection of animals against mastitis cases [11,75,76].

Teat sealants containing antibiotics may be put inside the orifice of teats of animals to prevent the entry of pathogens in the udder system of animals and hence may help in the control of mastitis cases [15,77-79]. However, there may be a risk of antibiotic resistance in animals. Nevertheless, some newer approaches of plant -derived and natural products for control of mastitis may be utilized [15,80].

Phyto-additive approaches in mastitis control of animals

Phyto-additives are substances derived from plant parts. These are now utilized for the control of mastitis cases in dairy animals when are provided orally or in teat sealant formulae. These plant parts contains bio-active compounds and essential oils which posesses high anti-microbial, anti-oxidant, anti-inflammatory and cell protecting properties among others which are helpful in preventing animals from entering into SM cases [81-83]. These substances are comparatively much safer than antibiotic usage as they are environment friendly and do not pose risk of resistance in pathogens. Herbs such as turmeric, tulsi, lemongrass, garlic, cedar, etc. posses such attributes and recently they are satisfactorily introduced in application in animal husbandry to control mastitis cases and they are found to improve milk yield and quality through dairy animals [82,84-87].

Conclusions

It may be concluded from this review that mastitis is a major challenge for dairy animals, farmers and the dairy industry that leads to financial and health losses. A proper understanding of factors leading to mastitis may help in better control practices of mastitis in dairy animals. Enhanced management practices such as breeding management, balanced nutrition, milking practices, hygienic milking, dry cow management, proper handling, plant-derived products; etc may help in preventing and controlling SM cases. However, with changing climatic scenario the SM may become more complex. Nonetheless, an upgraded understanding about its factors and management practices may help in minimizing SM cases in dairy animals.

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