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Research Article

ETIOLOGY AND FARM PREVALENCE OF INTRAMAMMARY INFECTIONS IN DAIRY COWS AT DRYING OFF

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ABSTRACT

The dry period in the dairy cows is a sensitive period for the occurrence of new intramammary infections (IMI), especially shortly after drying off and just before calving. Therefore, the knowledge of IMI at drying off is crucial for implementation of selective dry cow therapy for the control of mastitis in dairy cows. The present investigation was planned to study the prevalence of IMI in dairy cows at the time of drying off. A total of 69 lactating pregnant cows at the time of drying off between July, 2015 and June, 2018 at an organized dairy farm were screened for IMI by culture examination of quarters' milk which revealed 46 (66.67%) cows and 134/266 (50.37%) quarters positive for IMI. Bacterial pathogens isolated were *Staphylococcus* spp. (55.22%), *Streptococcus* spp. (20.89%), *Staphylococcus* spp. and *Streptococcus* spp. (20.89%) and *Staphylococcus* spp. and *Diplococcus* spp. (2.98%). Occurrence of IMI was highest for left fore-quarter (26.86%), followed by left and right hind quarters (26.12%) and right fore-quarter (21.4%). Thus, our study has shown high farm prevalence of IMI in pregnant dairy cows at drying off with isolation of only Gram-positive pathogens which warrants the institution of selective dry cow therapy using antimicrobials effective against these pathogens for mastitis control in dairy cows.

Keywords: Dairy cows, Drying off, Intramammary infections, Mastitis control

Mastitis presents a significant health problem in dairy animals in India and accounts for economic losses of Rs. 71655 millions to dairy annually (Bansal and Gupta, 2009). Organisms as diverse as bacteria, mycoplasma, yeasts and algae have been implicated as mastitis pathogens (Bradley, 2002). However, mastitis usually occurs in response to intramammary bacterial infection (Zhao and Lacasse, 2008). It has been shown that the rate of occurrence of new intramammary infections (IMI) during dry or non-lactating period is ten times the rate of new infections during lactation (Green *et al.*, 2002). Even during the dry period, the highest risk of IMI is within first three weeks, followed by period just prior to parturition (Constable *et al.*, 2017). Usually a keratin plug forms in the teat canal after drying off which appears a major defense mechanism against IMI but the rate of closure of teat canals after drying off varies with 50% teats remain open for 10 days after drying off. This delay in closure of teat canal may lead to onset of new infections (Crispie *et al.*, 2004). High risk of new infections during just prepartum period might be attributed to swelling of mammary gland, increase in volume of secretion and leaking colostrum (Constable *et al.*, 2017). Although the clinical mastitis is rare during dry period, probably due to high concentration of lactoferrin and leucocytes in mammary gland at this time (Green *et al.*, 2002; Constable *et al.*, 2017); IMI at drying off may cause clinical mastitis early in the next lactation. Therefore, the knowledge of IMI at the time of drying off is crucial for implementation of selective dry cow therapy for mastitis control in dairy cows. To fulfil the objective, the present investigation was planned to study the farm prevalence of IMI in dairy cows at time of drying off.

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MATERIALS AND METHODS

The present investigation was conducted on cross-bred dairy cows maintained at an organized dairy farm at Hisar, Haryana. A total of 69 lactating pregnant cows at drying off between July, 2015 and June, 2018 were screened for IMI through culture examination of quarter's milk as per Quinn *et al.* (2004). The quarters which were blind or atrophied due to mastitis in previous lactation were excluded. About 10 ml of milk sample from each quarter was collected separately in sterile tubes taking all aseptic precautions and transported to laboratory on ice for examination. Milk samples were thoroughly mixed and streaked primarily on 5% sheep blood agar and Mac Conkey's lactose agar (MLA) plates with a sterile platinum loop. The inoculated plates were incubated at 37º C for 24 to 48 hours. The causative organisms were identified by colony characteristics, Gram staining and biochemical characteristics. After the cultural examination, the milk samples were also examined for California mastitis test (CMT) point score and somatic cell count (SCC) in quarter's milk as per Schalm and Noorlander (1957) and Schalm *et al.* (1971), respectively. The data generated were analysed statistically by chi-squared test (χ^2 test) for comparison of proportions using

MedCalc statistical software.

RESULTS AND DISCUSSION

The culture examination of quarters' milk at drying off revealed 46 (66.67%) cows and 134/266 (50.37%) quarters positive for intramammary infection (s), suggesting a high farm prevalence of IMI at drying off. On the other hand, the CMT reaction and SCC on quarter's milk samples at drying off revealed CMT point score ≥ 2 and >0.5 million cells/ml of milk, respectively in all the samples which is the criteria used for indication of subclinical mastitis in dairy cows (Schalm *et al.*, 1971). Milk SCC has been an indicator of IMI in dairy cows; however, lactation stage also affects SCC as towards the end of lactation, SCC increases (Pyorala, 2003) which might be related to the concentrating effect of lesser quantity of milk being produced. This increase might also be due to increase in leucocytes concentration in mammary gland at drying off, responsible for not flaring IMI to clinical stage (Green *et al.*, 2002). Correlating the rise in milk SCC towards end of lactation, the present investigation also revealed high SCC and its indirect measure i.e. the CMT reaction to be positive in all the milk samples at drying off. However, all the samples were not culturally positive of IMI. Therefore, CMT and SCC on quarter's milk seem to be insensitive markers to detect IMI at drying off.

Bacterial pathogens isolated were *Staphylocccus* spp. (n=74; 55.22%), *Streptococcus* spp. (n=28; 20.89%), *Staphylocccus* spp. and *Streptococcus* spp. (n=28; 20.89%) and *Staphylocccus* spp. and *Diplococcus* spp. (n=4; 2.98%). Statistically, isolation of *Staphylocccus* spp. alone was significantly ($P<0.001$) higher than that of *Streptococcus* spp. alone and *Staphylocccus* spp. in combination with either *Streptococcus* spp. or *Diplococcus* spp. Overall *Staphylococcus* spp. bacteria were the most common isolates (n=106; 79.10%). Quarter-wise occurrence of IMI was highest for left fore-quarter (n=36; 26.86%), followed by left and right hind quarters (n=35; 26.12% each) and right fore-quarter (n=28; 20.89%). However, these differences were not statistically significant ($P>0.05$). These findings are in agreement with Petzer *et al.* (2009) who reported high quarter-wise prevalence of IMI at drying off in dairy cows, with coagulase-negative staphylococci being the most prevalent pathogens. On the contrary, Macesic *et al.* (2012) revealed *Streptococcus* spp. Lancefield group D and *Staphylococcus aureus*, the most common isolates of IMI at drying off. However, no Gram-negative pathogens have been isolated at drying off which might be due to high concentration of lactoferrin in dry secretions (Constable *et al.*, 2017), chelating iron required for bacterial growth. Therefore, only the Gram-positive bacteria are the major mammary pathogens at drying off and may be responsible for clinical mastitis early in the next lactation in dairy cows. Accordingly, attention should be directed towards selection of suitable dry cow therapy with the antimicrobials selectively active against Gram-positive infections. The intramammary preparations containing penicillin, cloxacillin, cephalexin or cephalonium which are selectively active against Gram-positive bacteria might be the most appropriate for the treatment (Petzer *et al.*, 2009). Further, the antimicrobial treatment at this phase offers a higher likelihood of elimination of IMI as the drug is not milked out and a higher and more uniform concentration of antibiotics is maintained in the udder (Janosi and Huszenicza, 2001). Blanket dry cow therapy using different dry cow intramammary antimicrobial products has been shown a higher cure rate for existing IMI as well as prevents new infections during the dry period (Petzer *et al.*, 2009). Even the selective dry cow therapy has been shown to achieve similar results with respect to treatment and prevention of IMI over the dry period as blanket dry cow therapy (Cameron *et al.*, 2014). In conclusion, a high farm prevalence of IMI at drying off with isolation of only Gram-positive pathogens warrants the institution of selective dry cow therapy using antimicrobials effective against these pathogens for mastitis control in dairy cows.

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