Veterinary Microbiology 134 (2009) 186–191

Contents lists available at ScienceDirect

Veterinary Microbiology

journal homepage: www.elsevier.com/locate/vetmic

Heifer teats sprayed in the dry period with an iodine teat sanitizer have reduced *Streptococcus uberis* teat-end contamination and less *Streptococcus uberis* intra-mammary infections at calving

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ARTICLE INFO

Keywords:
Mastitis
Streptococcus uberis
Management
Transition period
Peri-partum
Teat spray

ABSTRACT

Heifers managed under pastoral conditions are at risk from *Streptococcus uberis* mastitis infections at calving. A total of 397 heifers from six farms around New Zealand were enrolled in a study to identify and enumerate *S. uberis* on teat-ends of heifers in the peri-partum period, and to understand the effect of teat-spraying in the pre-calving period on the prevalence and incidence of *S. uberis* mastitis post-calving. Heifers were randomly assigned to Control or Sprayed groups. Sprayed heifers were teat-sprayed once, three times a week (Monday, Wednesday and Friday) with a commercial iodine-based teat sanitizer, starting at 3 weeks prior to calving and ending at day of calving. Across three farms, all glands of cows in both groups were sampled at calving to determine *S. uberis* intra-mammary infection (IMI) prevalence. For all farms, clinical mastitis (CM) cases detected during the week after calving were sampled and submitted for bacteriological analysis. Swabbing of teat-ends of 54 heifers from one farm showed that heifers had a pre-existing *S. uberis* contamination averaging 610 colony-forming units per swab (cfu/swab), at 3 weeks prior to calving. At calving, teat-end contamination was 560 cfu/swab for Sprayed heifers and 1775 cfu/swab for Control heifers. Two weeks after calving, teat-end contamination was similar between both groups, at 30 cfu/swab. The prevalence of *S. uberis* IMI was significantly lower in the Sprayed (3.5% glands) vs. the Control (7.4%) heifers in the first week after calving. There was a trend for Sprayed heifers (3.6% heifers) to have a lower incidence of *S. uberis* CM compared with Control heifers (7.4% heifers). It is concluded that teat-spraying in the dry period is a management option that could contribute to controlling heifer *S. uberis* mastitis in the transition period.

1. Introduction

During the peri-partum period, the bovine mammary gland has an increased susceptibility to new intra-mammary infection (IMI) with *Streptococcus uberis* (McDonald and Anderson, 1981). Susceptibility of the gland is generally low at drying off but increases as the dry period progresses (McDonald and Anderson, 1981) and the incidence of peri-partum clinical mastitis (CM) is generally greater in first-lactation heifers than in older animals (Barkema et al., 1998). In the New Zealand pasture-based system, *S. uberis* is the pathogen most commonly associated with CM in late lactation, dry period and early lactation (Williamson et al., 1995; McDougall, 1999). Pankey et al. (1996) observed that CM affected 8% of heifers around calving and that 67% of these cases were caused by *S. uberis*. More recently, Parker et al. (2007) observed a pre-calving prevalence of IMI of 15.5% heifer glands, with 77%

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0378-1135/$ – see front matter © 2008 Published by Elsevier B.V.
doi:10.1016/j.vetmic.2008.09.027

of these infections associated with coagulase negative staphylococci (CNS) spp. and 14% by *S. uberis*.

Environmental *S. uberis* is commonly isolated from the teat-end. Harmon et al. (1992) showed that *S. uberis* was present in high numbers in heavily used pasture. Lacy-Hulbert et al. (2005) reported that more than 40% of teats swabbed in the early dry period, in late autumn, were contaminated with *S. uberis*. Seasonal variation of the concentration of *S. uberis* in the environment is likely to influence teat-end challenge. High *S. uberis* concentrations in the environment are usually found in the colder months of the year (Lopez-Benavides et al., 2005), which coincide with the peri-partum period for the majority of New Zealand dairy cattle. Higher concentrations of *S. uberis* on farm tracks were associated with lower solar radiation, air and soil temperature and higher soil moisture content (Lopez-Benavides et al., 2005). The combination of high environmental *S. uberis* exposure, coupled with physiological factors such as udder edema and milk leakage (Waage et al., 1999, 2001), and herd factors including the mastitis history of the herd, appear to contribute to the increased susceptibility of heifers to IMI in the transition period. Oliver et al. (2005) observed that herds with an environmental mastitis problem in the lactating cows tended to be more likely to have heifers that calved with environmental IMI. Finally, unlike older cows that may have glands protected from bacterial infection over the dry period by dry period antibiotics (Woolford et al., 1998), heifers in New Zealand rarely have protection in the period prior to calving. Recent work has explored the use of an internal teat sealant, administered approximately one month prior to calving, with great success (Parker et al., 2007). Management options that provide protection of the teat-end and/or teat canal against bacteria from the environment are likely to reduce the risk of new IMI establishing in the pre-partum period. Sanitation of teat-ends before calving may be a potential and viable option for achieving this goal (Edinger et al., 2000).

In addition to environmental and physiological factors, teat-end contamination with environmental pathogens during the pre-partum period may be increased by the stocking rate of grazing animals. The integration of heifers into the social structure of the herd usually occurs during the pre-calving period, when heifers that appear close to calving are included in a calving herd, a springer mob, together with other herd mates of similar pregnancy status, for between one and several weeks prior to calving. Over this period, rationing of pasture for feeding tends to occur, as pasture growth is slower than the herd's consumption rate, and pasture is saved for lactating cows (Macdonald and Penno, 1998; Holmes et al., 2002). As a consequence, cows are confined to a smaller space and paddock rotation is slower, creating scenarios of increased cow-to-cow and cow-to-environment contact that may increase the chances of bacterial teat-end contamination (Shearer and Harmon, 1993). The objective of this study was to evaluate the use of an iodine-based teat sanitizer, applied in the pre-partum period, to lowering *S. uberis* contamination on the teat-ends of heifers, with the aim of reducing *S. uberis* IMI in the days after calving.

2. Materials and methods

2.1. Farms and animals

Heifers from five commercial herds ($n = 343$) and the DairyNZ Lye Research Farm ($n = 54$) were included in the study. Two commercial herds were located in the Waikato region, one in Taranaki, one in Northland and one in Southland. The DairyNZ (formerly Dexcel) Lye Farm is located on the outskirts of Hamilton, in the Waikato region. All farms were spring-seasonal calving herds and calving occurred between the first days of July and the last days of September. This study was conducted over 2 years, with a pilot study at the DairyNZ Lye farm in the first year (2005), and then a modified protocol conducted in the following year (2006) on commercial farms. Farmers volunteered to take part in the trial and were selected for their ability to follow the required protocol and maintain good records. They were also herd testing through LIC and recorded individual cow events in MINDApro software v4.4 (LIC, Hamilton, New Zealand). All animal manipulations were approved by the Ruakura Animal Ethics Committee.

2.2. Study design

On each farm, heifers were randomly allocated to the two treatments, Control or Sprayed. Because of uncertainty regarding likely calving dates of some heifers, farmers were advised to include heifers into the calving herd, or springer mob, at either 3 weeks prior to likely calving, or when the calving herd was set up. Heifers in the Sprayed group were leg-banded to facilitate identification and thus treatment administration. Once set up, the calving herd was taken to the dairy three times a week, on Mondays, Wednesdays and Fridays. In the dairy, animals in the Sprayed group were teat-sprayed once with an iodine-based teat sanitizer (Teatguard Plus, Ecolab, Hamilton, New Zealand) that had a final concentration of 5.75 g/l of active iodine. All animals were returned to the paddock after spraying and for each heifer, treatment administration ended when parturition occurred and the heifer joined the milking herd.

2.3. Bacterial counts of teat-end swabs and milk samples

Microbiological culture was used to identify and enumerate *S. uberis* isolated from teat-end swabs or milk samples of heifers on trial. In this study, only heifers from the DairyNZ Lye farm were subjected to teat-end swabbing. Sterile cotton-tipped swabs were pre-moistened with 0.1% peptone diluent. One teat from each heifer was randomly selected and monitored on three different occasions: before treatments commenced on the day that the heifer joined the calving herd, immediately prior to the first milking on the day that she calved, and before milking on a day approximately 2 weeks after calving. All quarters were represented in similar proportions in the swabbing procedure. For swabbing a teat-end, the proximal third of the teat barrel was held between thumb and fingers so that the teat-end could be manipulated with ease for scrubbing