J. Dairy Sci. 90:4157–4170
doi:10.3168/jds.2006-880

Epidemiology of Mastitis in Pasture-Grazed Peripartum Dairy Heifers and Its Effects on Productivity

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ABSTRACT

An observational field study was conducted on 708 heifers in 30 spring-calving dairy herds in the Waikato region of New Zealand. The aim of the study was to describe patterns and effects of intramammary infection (IMI) and clinical mastitis (CM) in the peripartum period. Mammary secretion samples for bacteriological testing were taken from all quarters approximately 3 wk before the planned start of the calving period and within 5 d following calving, in addition to quarters diagnosed with CM within 14 d of calving. Precalving IMI was diagnosed in 18.5% of quarters, and of these, coagulase-negative staphylococci were the predominant isolate (13.5% of quarters). *Streptococcus uberis* prevalence increased 4-fold to 10.0% of quarters on the day of calving compared with the precalving period. Prevalence of all pathogens decreased rapidly following calving. Clinical mastitis cases were predominantly associated with *Strep. uberis* (64%). The daily hazard of diagnosis was higher in heifers than in cows (0.06 vs. 0.02/d on d 1 postcalving, respectively), but was not different by d 5 (0.005 vs. 0.002, respectively) of lactation. Intramammary infection with a major pathogen was associated with an increased risk of removal from the herd (15 vs. 10% for infected and noninfected heifers, respectively) and somatic cell count >200,000 cells/mL at subsequent herd tests (15 vs. 8%), but neither CM nor IMI were associated with reduced milk yield or milk solids production. Results suggest that bacterial species involved and the pattern of IMI prevalence in pasture-grazed peripartum heifers differ from those in other production systems. Further, mastitis control programs need to target major environmental pathogens causing precalving IMI, because new infections are likely before the onset of lactation, whereas existing detection and control measures are generally implemented after calving. Novel control programs that reduce new infections due to *Strep. uberis* immediately before calving are required to reduce the incidence of CM in pasture-grazed dairy heifers.
Key words: mastitis, epidemiology, heifer, peripartum

INTRODUCTION

Heifers (2-yr-old primiparous cattle) have a high incidence of clinical mastitis (**CM**) in the peripartum period relative to older animals in herds. Studies reported a high incidence of CM and IMI in first-calving heifers immediately following calving (Pankey et al., 1991; Barkema et al., 1998; Barnouin and Chassagne, 2001). A high prevalence of IMI was reported in heifers before calving (Trinidad et al., 1990), and a positive association was found between pre- and postpartum infection (Oliver and Sordillo, 1988; Aarestrup and Jensen, 1997). Yet, the incidence and prevalence of IMI in peripartum heifers varies between locations and management systems (Myllys and Rautala, 1995; Waage et al., 1998).

Milk yield losses reported in heifers diagnosed with peripartum CM are variable, from less than 1% (Myllys and Rautala, 1995; Barnouin and Chassagne, 2001) to 5% (Oltenacu and Ekesbo, 1994) over a lactation, and 2.5 kg/d in the 7 d following *Streptococcus* spp. cases in the first week of lactation (Grohn et al., 2004).

First-calving heifers represent a valuable current and future resource. They make up the largest parity group in most herds, usually have the highest genetic merit of any age group in the herd, and, until a calf or milk is sold following their first calving, have not generated any revenues. For these reasons, diseases occurring at high frequency, and adversely affecting the production and lifetime performance of heifers must be a serious concern of dairy producers.

Little information has been published on the epidemiology of peripartum mastitis in pasture-grazed dairy heifers. Pankey et al. (1996) reported that 35% of heifers in pasture-grazed herds in New Zealand had one or more quarters diagnosed with IMI within 5 d following calving, and 8% of heifers had CM in the same period. But there are no data on the prevalence of IMI before

Received December 21, 2006.
Accepted May 16, 2007.
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calving in heifers in pasture-grazing farming systems, or on any productivity effects following naturally occurring IMI pre- or postcalving, or following CM in these systems.

Hence, the main aims of this study were to 1) describe at the quarter and heifer level the prevalence of IMI several weeks before, and within 5 d following calving, and 2) describe the incidence of CM in the first 14 d of lactation in first-calving heifers in pasture-grazed dairy herds. The study aimed to describe the bacteria involved in heifer peripartum IMI and CM and the repeatability of bacterial isolations over time. Additional aims were to estimate the risk of thelitis and loss of quarter symmetry or function by mid lactation, individual SCC (**ISCC**), milk yield and milk solids production at first postpartum production recording and averaged over the lactation, and the risk of premature culling in heifers.

MATERIALS AND METHODS

Herd and Heifer Selection

Thirty spring-calving dairy herds were selected for a prospective observational study within a 30-km radius of Morrinsville in the Waikato region of New Zealand. The selected herds routinely used DHI production recording 4 times during lactation, used an electronic database for the recording of individual animal details including breed, date of calving, and milk production records, and were willing to follow the study protocol. Before animal enrollment, informed consent to participate was gained from each herd owner and approval for the study to proceed was given by an animal ethics committee. Average herd size was 332 ± 138 (standard deviation) cows and the average planned start of the seasonal calving period was July 13, 2004 (± 7 d). The average milk yield and milk solids (milk fat and milk protein) production for all cows was 3,843 ± 709 kg and 331 ± 53 kg, respectively. For first-parity heifers, production was 3,190 ± 648 kg and 279 ± 43 kg, respectively. A systematic random selection of heifers in each herd that were due to calve in the season of the study were enrolled on one calendar date, approximately 3 wk before the planned starting date of the seasonal calving period. This meant that the interval between enrollment and calving for individual heifers varied between 3 wk and >10 wk. A total of 708 heifers were enrolled in this study. Twenty of the 30 herds each contributed 27 heifers, and the other 10 herds each contributed between 6 and 26 heifers. Heifer breeds were Friesian (n = 291), Jersey (n = 214), and other (predominantly Friesian-Jersey crossbreed, n = 203). Heifers diagnosed with CM by the farmers were treated with i.m. antibiotics with label claims for treatment of IMI. Enrolled heifers were managed with the others of the same parity group in a consistent way until calving for all heifers was completed. Diet was predominantly ryegrass (*Lolium perenne*) and white clover (*Trifolium repens*) fed in situ, with a new area of pasture offered daily and with small amounts (1 to 2 kg of DM) of hay and pasture silage fed on the grazing area. Data on CM (treatment date, cow identity) and calving dates were available from all cows in the study herds.

Sample and Data Collection

At the time of enrollment, a single sample of mammary secretion was collected from each gland for bacteriologic examination following aseptic preparation of the teat end (only a single sample could be taken because of the low volume of secretion available). A commercial iodine-based teat antiseptic with 0.5% available iodine was applied by spray to the teats immediately after sampling. Duplicate milk samples were collected using the same method from all glands of each heifer within 5 d of calving during preplanned twice-weekly visits to the herds by trained technicians. If CM was diagnosed before a planned visit, duplicate milk samples were taken from all glands by a trained technician. Duplicate milk samples were collected from all first cases of CM occurring after the preplanned 1 to 5 d period; that is, between 6 and 14 d of lactation. On each sampling occasion, any abnormalities of the glands or teats were recorded. Heifer data including breed, New Zealand EBV, calving date, and individual animal milk production records were obtained electronically from a database (Livestock Improvement Corporation, Hamilton, New Zealand). All individual animal disease treatments from 1 mo before enrollment date and reason for removal of any cows from the herds throughout the lactation were collected from farm records. Results of microbiological tests of milk from heifers treated with systemic or intramammary antibiotics in the 21 d preceding sampling were excluded from analysis. At approximately 3 mo after the start of the calving period, each heifer was examined for the presence of thelitis (defined as a manually detectable thickening of the teat canal) and for the presence of nonfunctional or scantily functional mammary glands (defined as a visually apparent smaller gland compared with the contralateral gland in the same heifer immediately before attachment of milking units).

Bacteriological Examination

Microbiological procedures, diagnosis of IMI, and categorization of results were undertaken using standard methodology (Hogan et al., 1999). Milk samples were mixed thoroughly by inverting 2 to 3 times and then