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Parity differences in the behavior of transition dairy cows

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ABSTRACT

During the transition period, around the time of calving, cows experience a suite of stressful events, including regrouping, diet changes, parturition, and the onset of lactation. These changes may be more difficult for primiparous cows that have not had these experiences previously. The objective of this study was to compare feeding, social, exploratory, and lying behaviors of primiparous and multiparous cows during the transition period. Thirty-eight healthy primiparous and 62 healthy multiparous dairy cows were housed in mixed-parity groups of 20 with access to 12 electronic feed bins from 3 wk before to 3 wk after calving. Primiparous cows had lower dry matter intake, spent more time feeding, ate more slowly, visited the feeder more frequently, and explored their feeding environment more compared with multiparous cows. Primiparous cows also lay down more frequently, but for shorter periods, such that total lying time did not differ between these parity classes. Primiparous cows were also replaced at the feeder more often than multiparous cows. These results show how the behavior of primiparous and multiparous cows differs during the transition period, and support the idea that primiparous cows may benefit from different management during this period.
Key words: heifer, development, social competition, animal welfare, mixing

INTRODUCTION

During the transition period, from 3 wk before to 3 wk after calving, cows undergo physiological changes associated with the birth of a calf and initiation of lactation (Grummer, 1995). Cows also typically experience multiple regroupings and diet changes at this time (Cook and Nordlund, 2004). Perhaps in part due to these multiple stressors, many animals become ill over the transition period; LeBlanc et al. (2006) estimated that 75% of illness events occur within 3 wk of calving.

Whereas all cows face these changes, one might expect that some changes will be especially disruptive for primiparous animals. Authors of previous studies have found that primiparous cows are more likely to experience negative health outcomes during transition compared with multiparous cows. For example, primiparous cows are more susceptible to dystocia and mastitis (Matthews et al., 1992). Higher rates of disease for primiparous cows may be due to nutritional deficiencies (Heinrichs et al., 2009) and a depressed immune response (McDougall et al., 2009) associated with stressors, including competition from older animals (Parker et al., 2007).

Several studies have used changes in behavior to identify animals that are ill or at risk of becoming ill during the transition period (reviewed by Proudfoot et al., 2012; Sepúlveda-Varas et al., 2013). Changes in feeding and social behaviors have been documented for several diseases in dairy cattle, including metritis (Urton et al., 2005; Hammon et al., 2006; Huzzey et al., 2007), ketosis (González et al., 2008; Goldhawk et al., 2009), hypocalcemia (Jawor et al., 2012), and lameness (Proudfoot et al., 2010; Calderon and Cook, 2011). Identifying behavioral changes related to illness requires an understanding of how healthy cows behave.

Few studies have measured differences in feeding behaviors between healthy primiparous and multiparous dairy cows during peak lactation, including differences in feed intake, feeding rate, meal frequency (Azizi et al., 2009), feeding time, and meal size (Beauchemin et al., 2002). Many studies include parity as an effect in statistical models or consider primiparous and multiparous cows as separate data sets; yet, to our knowledge, no study has compared feeding and social behaviors of primiparous and multiparous cows over the transition period.

Feeding behavior studies commonly focus on measures of feed intake, feeding time, and meal characteristics, but another important aspect of feeding behavior is exploratory sampling of the feed bunk. Cows perform exploratory sampling of feeding sites to assess the quality of feed available (Provenza, 1995). In a freestall barn, this behavior involves the animal moving between feeding locations along the feed bunk that

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ultimately increases time spent not feeding and may increase competitive interactions with other animals in the feeding area. Exploratory feed sampling has been reported in growing heifers (Huzzey et al., 2014), but little is known about this behavior in mature cows, how it changes over the transition period, and how it varies with parity.

Limited research exists on the differences in lying behavior of primiparous and multiparous cows during the transition period. Before calving, primiparous Jersey cows housed in a freestall barn spent less time lying down than multiparous cows, with a greater number of shorter duration lying bouts per day (Lobeck-Luchterhand et al., 2015). Grazing primiparous Holstein cows showed similar behaviors compared with multiparous cows in the 3 wk after calving, with shorter lying times that were divided into more numerous but shorter bouts (Sepúlveda-Varas et al., 2014). However, lying behaviors are influenced by housing system (Krohn and Munksgaard, 1993; Navarro et al., 2013), and it is unclear how primiparous and multiparous Holstein cows differ in lying behavior during the weeks around calving when housed in a freestall barn.

Primiparous cows are typically smaller and produce less milk than multiparous cows (Beauchemin and Rode, 1994), and these factors may affect behavior even within parity. To date, no study has examined how the behaviors described above are affected by the combined effect of parity (including the correlated differences in size and milk production) as well as examined the residual effects of parity after accounting for variation due to these other factors.

The aim of this study was to describe feeding, social, and exploratory behaviors at the feed bunk, as well as lying behaviors of healthy transition primiparous and multiparous cows. We hypothesized that healthy primiparous dairy cows would show reduced DMI, feeding time, and feeding visits, increased competitive interactions at the feed bunk, less exploratory behavior, and reduced lying times in comparison to multiparous cows. We tested parity differences using a simple model that included just the effect of parity, as well as using a more complex model that first accounted for the effects of BW and milk production and then considered any residual variation due to parity.

MATERIALS AND METHODS

Animals, Housing, and Diet

Data were collected from July 2013 to November 2014 at the University of British Columbia (**UBC**) Dairy Education and Research Center in Agassiz, British Columbia, Canada. All procedures were approved by the UBC Animal Ethics Committee (Protocol A14–0040). Throughout this paper, we refer to primiparous cows as those animals that are experiencing the transition period (both pre- and postpartum) for the first time. During the study period, 337 Holstein dairy cows, including 105 primiparous cows and 232 multiparous cows [average parity = 1.8 ± 1.9 (mean ± SD); range = 0–8 lactations], calved. Cows were housed together in mixed-parity groups of 20 (proportion of primiparous to multiparous cows = 0.32 ± 0.15; range = 0.08–0.68) beginning 3 wk before their predicted calving date. Pens were equipped with 12 Insentec (Insentec, Marknesse, the Netherlands) feed bins, 2 Insentec water bins, and 24 freestalls with pasture mats (Pasture Mat, Promat Inc., Woodstock, Ontario, Canada) covered with 5 cm of sand bedding. Upon imminent signs of calving (i.e., udder enlargement, milk letdown, relaxation of tail ligament) cows were moved from the prepartum pen to a maternity pen holding a maximum of 2 cows and equipped with 6 Insentec feed bins and 1 Insentec water bin. Within 24 h of calving cows were moved to a postpartum pen (same setup as the prepartum pen), where they remained until 3 wk postpartum. Cows were weighed over 2 consecutive days during the prepartum (d −21 to −1) and postpartum (d 20 to 23) periods and an average BW for each period was calculated.

Postpartum cows were milked twice per day at approximately 0700 and 1700 h. Both pre- and postpartum cows were fed a TMR twice daily at approximately 0800 and 1600 h. Both diets were formulated according to the NRC (2001) guidelines to meet or exceed the requirements of a 620-kg Holstein cow producing 40 kg/d of 3.5% FCM. The prepartum cow TMR included 32% corn silage, 37% alfalfa hay, 18% rye grass straw, and 13% concentrate (DM = 52.4 ± 4.7%, CP = 14.3 ± 0.34% DM, ADF = 34.6 ± 0.60% DM, NDF = 46.5 ± 0.17% DM, and NE_L = 1.39 ± 0.0071 Mcal/kg). The postpartum cow TMR included 26% corn silage, 13% grass silage, 7% alfalfa hay, 4% grass hay, and 50% grain concentrate mash (DM = 50.35 ± 2.5%, CP = 18.3 ± 0.58% DM, ADF = 18.1 ± 0.71% DM, NDF = 28.5 ± 1.2% DM, and NE_L = 1.72 ± 0.014 Mcal/kg).

Because 30 to 50% of dairy cows become ill over the transition period (LeBlanc, 2010), we followed stringent health assessment methods to reduce the risk that any ill animals would be part of the study. All animals in the herd were subjected to routine, detailed health assessments by trained farm staff to identify healthy cows with a much higher degree of certainty than would be common on a commercial farm. Clinical cases of mastitis, ketosis, downer cow syndrome, and displaced abomasum were recorded using Dairy Comp 305 (Valley Agricultural Software, Tulare, CA). Mastitis was detected by inspection of the udders for inflamed or