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Short communication: Rumination and feeding behavior before and after calving in dairy cows

K. Schirmann, N. Chapinal, D. M. Weary, L. Vickers, and M. A. G. von Keyserlingk[1]
Animal Welfare Program, Faculty of Land and Food Systems, The University of British Columbia, 2357 Main Mall, Vancouver, BC, V6T 1Z4 Canada

ABSTRACT

The objectives of the current study were to describe changes in rumination and feeding behavior around calving. Rumination time, feeding time, and dry matter intake were monitored in 11 freestall-housed cows from 96 h before to 48 h after calving. Data were summarized in 2-h and 24-h periods, adjusting for calving time. Differences between baseline (96 to 24 h before calving) and subsequent 24-h periods were evaluated. Compared with baseline, cows spent, on average, 63 ± 30 min/24 h less time ruminating and 66 ± 16 min/24 h less time feeding in the 24-h period before calving. These behaviors continued to decline during the 24-h period after calving when, compared with baseline, time spent ruminating decreased on average by 133 ± 35 min/24 h and time spent feeding decreased by 82 ± 18 min/24 h. Dry matter intake tended to decrease by 3.8 ± 1.9 kg in the 24-h period before calving but returned to baseline values in the 24-h following calving. Rumination time and time spent feeding started to decline approximately 4 and 8 h before calving, respectively, and increased in the 4 to 6 h following calving. Rumination time and time spent feeding show promise as tools to identify cows close to calving.
Key words: welfare, Holstein, parturition, dry matter intake

Short Communication

Providing a comfortable environment around parturition is important to minimize the risk of dystocia and enhance the subsequent health of the cow and the calf (Mee, 2004), but identifying cows that are about to calve can be difficult on farm. The onset of calving is typically determined by visual signs, such as udder firmness, pelvic ligament relaxation, and vulval swelling (Berglund et al., 1987), but there is a large variability in these signs. For example, the relaxation of the sacrosciatic ligaments has been reported to start, on average, 1 wk before calving but can range from as early as 15 d to only 7 h before the calf is born (Berglund et al., 1987). Other signs, such as vulva edematization and milk leakage from the teats, are more consistent across animals but are also recognized as being associated with the first stage of labor (Wehrend et al., 2006) or even the second stage in the case of amniotic sac appearance (Noakes et al., 2001). Moving a cow during the first stage of labor may interrupt and prolong parturition (Wehrend et al., 2006; Mainau and Manteca, 2011). Proudfoot et al. (2013) showed that moving cows in the advanced first stage of labor prolonged the second stage. Similarly, Carrier et al. (2006) reported a 2.5-fold increase in stillbirths for cows that were moved late in the first stage of labor.

Recent studies have identified changes in behaviors associated with calving that can be monitored automatically on farm. Miedema et al. (2011) visually assessed feeding time during the 24 h before calving and compared it with baseline recordings during the late prepartum period and found a decrease in feeding time during the 6 h before calving. Methods exist to automatically monitor individual feeding behavior and DMI in group-housed cows (Chapinal et al., 2007), but these systems can be expensive and technically challenging for routine use on commercial farms. More recent work has shown that the automatic monitoring of rumination time can be practical for use on commercial farms (Schirmann et al., 2009).

Normal rumination behavior has been considered an indicator of well-being in cattle (Radostits et al., 2007), and rumination is the second most common behavior (after grazing) expressed by pastured cattle (Kilgour, 2012). Rumination can be monitored using rumination loggers attached to collars (Schirmann et al., 2009).

Two recent studies (Adin et al., 2009; Soriani et al., 2012) found decreases in rumination time on the day of calving, but neither reported changes relative to calving time, making it difficult to assess to what extent this decrease happened before the calf was expelled. The objectives of the current study were to determine changes in rumination and feeding behavior around

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[1]Corresponding author: nina@mail.ubc.ca

calving. We hypothesized that both behaviors would decrease as expulsion of the calf approached.

Eleven multiparous Holstein dairy cows (mean parity ± SD = 3.9 ± 1.9; range = 2 to 8) at The University of British Columbia's Dairy Education and Research Centre (Agassiz, BC, Canada) were used in the current study. All animals were managed and cared for according to the guidelines set by the Canadian Council on Animal Care (2009). Prepartum cows were housed in a group pen containing 24 freestalls and moved to a fresh cow pen containing 12 freestalls after calving. All freestalls were fitted with a mattress (Pasture Mat, Promat Inc., Woodstock, ON, Canada) covered with approximately 5 cm of sand bedding. Cows had access to 12 Insentec feed bins (Insentec BV, Marknesse, the Netherlands) and 2 Insentec water troughs during the prepartum period and 6 Insentec feed bins and 1 Insentec water trough during the postpartum period. In both groups (pre- and postpartum), the cow:stall ratio was 1:1 and stocking density was constant. Group composition was dynamic, with cows entering and leaving the group pen depending on their expected and actual calving dates. When a cow was removed from either the prepartum or the postpartum pen, another cow was immediately moved to that pen to maintain a constant stocking density; if necessary, cows from the main herd, at a similar stage of lactation, were used as filler cows.

Prepartum cows were checked multiple times a day for relaxation of tail ligaments, vulval discharge, and milk letdown, and were moved to a sawdust-bedded maternity pen (equipped with 1 Insentec feed bin and a self-filling water trough) when calving was considered imminent. However, 4 cows were not identified as calving approached and calved in the prepartum pen; these animals were moved after calving. The other cows were moved to the maternity pen within 1 h (n = 4), 2 h (n = 1), 3 h (n = 1), or 4 h (n = 1) before calving. Cow and calf were separated within 2.6 ± 1.3 h after calving and the calves were moved to a separate calf barn. Cows were milked at the next scheduled milking (morning or afternoon) and moved to the postpartum pen immediately after milking.

Pre- and postpartum groups were fed a TMR twice daily at approximately 0700 and 1600 h. The TMR was formulated according to the recommendations provided by NRC (2001). Prepartum cows were fed a close-up ration from 3 wk prepartum until calving. After calving, cows were fed the regular lactating diet following standard farm procedure. Total mixed ration samples were taken twice weekly at the time of fresh feed delivery, and samples were pooled weekly. The samples were stored in a freezer and then thawed and dried at 60°C for 48 h to determine DM content. Samples were then pooled monthly and sent to Cumberland Valley Analytical Services Inc. (Maugansville, MD; Cumberland Valley Analytical Services, 2013) and analyzed using wet chemistry methods, according to the standards of AOAC International (2005), to determine average (±SD) CP, ADF, NDF, and NE_L content of the diets fed throughout the study. The prepartum TMR consisted of 44.0% alfalfa hay, 33.0% corn silage, and 23.0% mineral and concentrate mix on a DM basis (CP: 15.0 ± 0.6; ADF: 29.4 ± 1.9; NDF: 29.4 ± 1.9; and NE_L: 1.45 ± 0.02 Mcal/kg). The postpartum TMR consisted of 5.0% alfalfa hay, 29.0% corn silage, 11.0% grass silage, 4.0% grass hay, and 51% mineral and concentrate mix on a DM basis (CP: 16.9 ± 0.7; ADF: 21.5 ± 1.2; NDF: 35.6 ± 1.9; and NE_L: 1.59 ± 0.1 Mcal/kg). For a more detailed description of the diet, see Vickers et al. (2012).

Previously frozen TMR samples were thawed and analyzed using the Penn State Particle Separator (Kononoff et al., 2003) consisting of 3 sieves and the bottom pan. The pore sizes of the 3 sieves were 19 mm (upper sieve), 8 mm (middle sieve), and 1.18 mm (lower sieve). The prepartum TMR was composed of 24.4% of particles >19 mm, 39.2% of particles >8 mm, 24.6% of particles >1.18 mm, and 11.8% of particles <1.18 mm. The postpartum TMR was composed of 22.5% particles >19 mm, 35.0% of particles >8 mm, 29.8% of particles >1.18 mm, and 12.7% of particles <1.18 mm. Particle lengths are reported for descriptive purposes only.

To monitor rumination time, all cows were fitted with an individual rumination logger (HR-Tag, SCR Engineers Ltd., Netanya, Israel) fitted to the collar. This logger has a built-in microphone that allows for the recording of the sound of rumination. Time spent ruminating was recorded using a 2-min resolution and stored in 2-h intervals, as described and validated by Schirmann et al. (2009). For automatic data transfer, identification units using infrared technology were placed above the water bins. These units captured the data that were then sent to a computer.

The Insentec system, previously validated by Chapinal et al. (2007), was used to record individual feed intake and time spent feeding. The cow's individual radio frequency identification transponder opened the feed bin and allowed the Insentec system to record the time the cow entered the bin as well as the duration of her visit at the feed bin and the amount of feed consumed during that visit. Recorded feed intake and the measured DM content were used to calculate DMI. The duration and intake of each visit to the feed bin were summed to calculate total feeding time and DMI by 2-h intervals.

Continuous video was recorded using cameras (WV-BP330, Panasonic, Osaka, Japan) 6 m above the pen. Cameras were connected to a digital video recording