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Behaviour around the time of calving in dairy cows

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ABSTRACT

The aim of this study was to investigate behavioural changes before and after calving in dairy cows in order to describe behavioural signs of imminent calving and of cows' recovery after calving. Thirty-two multiparous Danish Holstein Frisian cows with an unassisted calving were studied from 96 h before until 96 h after calving while housed in individual calving pens. Data on behaviour were obtained via video recordings and accelerometers attached to the cows' legs. Cows spent less time lying, had more lying bouts and were more active the day before calving as compared to 2–4 days before calving. The number of lying bouts and the level of activity increased throughout the 6 h prior to calving. During the last 2 h prior to calving the duration of contractions and the number of times the cow turned her head towards the abdomen were increased, while the duration of feeding and drinking was decreased. Within minutes after calving cows stood up and licked their calves; second parity cows had a longer latency to stand than later parity cows. Sniffing and licking the calf peaked during the first hour after calving and decreased during the five successive hours, while calves' sniffing the cow peaked during the second hour after birth. The high level of cows' sniffing and licking their calves coincided with low levels of lying and feeding during the first hours after calving. Compared to the first 6-h period after calving, cows spent more time lying and feeding during the following two 6-h periods, while the duration of sniffing and licking calf and the number of lying bouts decreased throughout the 24 h after calving. Calves spent the most time sniffing the cow and suckling during the first 6-h period after birth, while the time spent lying increased and the number of lying bouts decreased throughout the 24 h following birth. Cows spent more time lying on the second day after calving than on the first day after calving. The results show marked behavioural changes during the last 6 h prior to calving and suggest that behavioural changes may be useful indicators of imminent calving. Furthermore, the results show that the first hours after calving contain most cow–calf interaction. These behaviours were at the expense of the cows' resting and feeding, which showed a rebound during the subsequent hours and the following day. This suggests that ample opportunity to rest and feed during the first days after calving may be beneficial for cow welfare.

1. Introduction

In the period around calving the dairy cow is vulnerable; the calving itself is physically challenging and painful (Mainau and Manteca, 2011), and the transition to lactation is associated with many physiological changes and an increased risk of production diseases (Ingvartsen, 2006). Individual monitoring of cows that are close to calving is necessary for the farmer to estimate the time of calving, to take management steps and to assist with calving if necessary. In earlier studies, isolation seeking (Lidfors et al., 1994) and increased restlessness (Owens and Edey, 1985) have been described as signs of imminent calving. Recent studies found that the number of postural changes

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and tail raises increase during the final 6 h before calving and suggest that these variables be useful predictors of calving (Miedema et al., 2011a,b). However, a detailed description of calving behaviour in cattle is missing.

In modern dairy production systems, technology to aid surveillance of animals has been developed. For instance, measures of lying behaviour obtained via sensors using accelerometer technology attached to the animals' leg (Ledgerwood et al., 2010; Nielsen et al., 2010; Trénel et al., 2009) or neck (Hokkanen et al., 2011) have been validated. On-line data obtained via sensors may be useful tools to predict the time of calving, thus, the first aim of the present study was to investigate how lying behaviour and activity obtained via sensors changed during the last days and hours before calving.

After calving the calf is the cow's first priority. During the first hour after calving the cow licks her calf intensively and this behaviour declines gradually during the next few hours (Edwards and Broom, 1982; Illmann and Spinka, 1993; Lidfors and Jensen, 1988). The intensive licking of the calf during the first 6 h is at the expense of the cow's feeding and resting behaviour (Edwards and Broom, 1982), but a description of how she distributes her time to maternal behaviour, feeding and resting during subsequent hours is missing. The second aim was to investigate behavioural changes until 96 h after calving to assess how dairy cows recover from the calving.

2. Materials and methods

The study was conducted in 2009–2010 at Research Centre Foulum, Aarhus University, Denmark, and animals were cared for and treated according to a protocol approved by The Danish Animal Experiments Inspectorate, The Danish Ministry of Justice, Copenhagen, Denmark.

2.1. Animals, housing and management

Thirty-eight multiparous Danish Holstein Frisian cows that calved in either May–June 2009 (block 1), October–November 2009 (block 2), or January–March 2010 (block 3) were used. Cows were moved to an individual calving pen five to seven days before the expected day of calving and kept in the same pen for 96 h after calving. When being moved to the calving pen cows weighed on average 727 (s.d. 64) kg.

The calving pens were bedded with deep straw and each pen measured 4.0 m × 4.8 m. The pens had 1.9 m high solid sides made from plywood which only allowed visual and tactile social contact to the cow in the neighbouring pen through a 1.0 m high and 0.8 m wide opening placed 1.1 m above floor level. In each pen, two adjacent feeding troughs (each 0.75 m wide) and a water bowl were placed opposite to the window. The calving pens, feeding and management procedures are described in detail in Jensen (2011).

Delivery of the calf was assisted if the calf was not born within 4 h after the appearance of the amniotic sac and the ease of calving was scored on a 4 point scale: (1) easy, unassisted, (2) easy, assisted, (3) difficult, assisted, and (4) difficult, requiring veterinary assistance. Four easy deliveries and two difficult deliveries were assisted. The remaining 32 deliveries were easy and unassisted. The first 24 h after calving, the cow and calf were left undisturbed except that nursing was assisted by the staff if the calf had not been observed to suck successfully within 6 h after birth or if the calf was observed to have problems suckling. Thirteen calves were assisted in nursing of which three were assisted more than once within the first 48 h after birth.

The six cows that had assisted calving were excluded from the dataset. One of these was excluded from the experiment already due to lameness. Thus, only thirty-two cows were considered for further analysis; 10 cows were entering their second parity, 12 cows were entering their third parity and 10 cows were entering later parities.

2.2. Data recorded via tags

Posture and activity were recorded using the commercially available IceTag automatic recording device (IceTag 3D, IceRobotics, Edinburgh, UK, http://www.icerobotics.com; dimensions (mm) 95.0 (H) × 82.3 (W) × 31.5 (D); weight 130 g), which uses accelerometer technology. When moved to the calving pens, each cow had an IceTag attached to the right hind leg using a strap. The IceTag was removed on the 12th day after calving, but for the present analysis only data from 96 h before calving to 96 h after calving were included. Two datasets were created; one included the 96 h before calving and another included the 96 h after calving. Seven of the thirty-two cows calved before their expected calving date and were excluded from the pre-calving dataset due to too few observation days. Another three cows had missing observations before calving, and one cow had missing observations after calving due to technical problems (e.g. battery failure of Tags). Thus, the data recorded via IceTags included data from 22 cows before and 31 cows after calving. Raw data were transferred from the IceTag device to a PC and were processed using the IceTagAnalyser software. The exact calving time (defined as the time where the calf was fully expelled) was obtained from video recordings. The final 24 h prior to calving was assigned day −1. Days −2, −3 and −4 comprised hours −25 to −48, hours −49 to −72, and hours −73 to −96, respectively. Days 1, 2, 3 and 4 comprised hours 1–24, 25–48, 49–72 and 73–96, respectively. The mean percentage of lying and standing time per hour and day was calculated. In addition, an activity index was calculated as the average acceleration (excluding gravity) during each second and this measurement was averaged per hour and day. Finally, a lying bout was defined as a period following standing where ≥50% of the time was recorded as lying for at least two consecutive minutes (Munksgaard et al., 2006) and the number of lying bouts was calculated per hour and day.

2.3. Data recorded via video during 12 h before calving

The behaviour of the cows was video recorded continuously via a camera fitted with a wide angle lens and data for the day before calving and the day of calving (starting at midnight) were stored digitally for analysis of the behaviour before calving. Twelve cows were selected for