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Urination and defecation by group-housed dairy calves

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ABSTRACT

A better understanding of when and where group-housed calves are most likely to defecate or urinate might permit improved housing design or more efficient use of cleaning routines. However, this is the first study to address the urination and defecation habits of calves. The primary aims of this study were to report the daily frequency of calves' urination and defecation and determine when and where group-housed dairy calves defecate and urinate most frequently. We were also interested to see if incidence of urination and defecation changed with increasing age and the change in diet at weaning. We observed 36 female Holstein calves, housed in groups of 9, and fed milk, grain, and hay from automated feeders. For the purposes of another experiment, these calves were assigned to 1 of 3 experimental treatments relating to age at start of weaning and milk allowance: low milk allowance and early weaning (6 L/d, 42 d), high milk allowance and early weaning (12 L/d, 42 d), and high milk allowance and late weaning (12 L/d, 84 d) The occurrence of defecations and urinations was determined by continuous observation of video recordings taken over 72 h at 2 age periods (age, mean ± SD; period 1 = 32.0 ± 11.13 d and period 2 = 61 ± 11.29 d). Due to the treatments, weaned and unweaned calves were observed in each period (period 1: 34 unweaned and 2 weaned calves; period 2: 16 unweaned and 20 weaned calves). Large differences were found between calves in mean daily frequency of total urinations and defecations across a 3-d period (mean = 17.56 ± 5.07/d, range = 4.33 to 28.67). Differences between individual calves did not change significantly over time, provided calves remained unweaned. Two days of observation was sufficient to give a reliable estimate of daily urination and defecation frequency. Frequency of urination and defecations was higher in calves postweaning. Higher age and visits to the milk feeder were associated with a higher frequency of urinations and defecations preweaning. After weaning, frequency of eliminations increased with increasing visits to the water feeder. An effect of time of day was observed, with significantly more events during daylight hours (0600–1800 h) in comparison to night (1800–0600 h). Before weaning, calves urinated and defecated significantly more on slatted flooring and sawdust-bedded areas than within the feeder (daily mean ± SD = 6.96 ± 3.15, 6.49 ± 3.90, and 4.10 ± 2.67 for slatted floor, bedded floor, and feeder areas, respectively). Frequency of eliminations in feeders and slatted, but not sawdust-bedded, areas was higher in calves postweaning. Calves urinate and defecate more frequently during daylight hours when they are more active. Slatted flooring around feeders is useful to reduce soiling of bedded areas, particularly as calves increase in age.
Key words: dairy calf, urination, defecation

INTRODUCTION

Interest is increasing in housing unweaned dairy calves in groups, which has the potential to reduce the labor associated with both cleaning and feeding (Kung et al., 1997). Accumulation of the feces and urine of group-housed calves can increase the potential for transmission of disease between conspecifics and also pose a risk to human health (Pell, 1997). Furthermore, the release of volatile ammonia, occurring when urea (found in urine) comes into contact with urease (found in feces), is related to several environmental problems (Moreira and Satter, 2006; Sheppard et al., 2007). Despite the importance of elimination behaviors, little is known of the factors that influence defecation or urination by cattle and, to our knowledge, no studies have addressed the urination and defecation habits of calves. A better understanding of when and where group-housed calves defecate and urinate might permit improved housing design, reduced soiling of bedding, or more efficient use of cleaning routines.

Some studies have suggested a link between diet and frequency of defecations, but this link has not yet been supported by evidence (Hirata et al., 2011; Villettaz Robichaud et al., 2011). The majority of studies have examined urination and defecation in adult dairy

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cattle, which are typically subject to intensive management practices with relatively rigid daily routines. Although Villettaz Robichaud et al. (2011) found no diurnal rhythm in urination and defecation behaviors nor any correlation between the frequency of urination and defecation in each hour of the day and feeding activity, Aland et al. (2002) found that most defecation in adult cows occurred during the hours when the animals were most active; that is, during milking and feeding. Group-housed calves fed milk and grain ad libitum via automated feeders are not subject to an artificially imposed time budget and it would be interesting to see if a similar pattern of activity in elimination behaviors is seen.

Some studies have recorded the locations where cows were most likely to defecate or urinate (Whistance et al., 2007; Oudshoorn et al., 2008; Villettaz Robichaud et al., 2011). Cattle permitted limited access to pasture were found to defecate and urinate over their entire grazing surface, without accumulation in specific hot spots (Oudshoorn et al., 2008). In contrast, in freestall housing, urination and defecation was concentrated in feed alleys and alleyways behind the stalls, which may reflect how much time the cows spent in that area (Whistance et al., 2007; Villettaz Robichaud et al., 2011). The aims of the current study were to determine when and where group-housed dairy calves defecate and urinate most frequently, and to look at the relationship between the frequency of defecation and urination by calves, pre- and postweaning, and in relation to age, feed intake, feeder visits, weaning, and time of day.

MATERIALS AND METHODS

Thirty-six female Holstein calves [birth weight (mean ± SD) = 43.12 ± 4.74 kg] were removed from their dams and fed 4 L of high-quality colostrum within 6 h of birth and housed individually in concrete-floored pens (1.22 × 2.44 m) with sawdust bedding. Within the first 24 h of age, calves were weighed and an identification tag fitted with a transponder was attached to the left ear. While individually housed they received 12 L of pasteurized whole milk per day (i.e., ad libitum) in 2 meals (approximately 0800 and 1500 h) via an artificial teat attached to the pen wall.

At 4 to 5 d of age (mean = 4.5 d), calves were added to group pens until 9 calves were housed in each pen, with a maximum age range of 30 d within each group. Each group of 9 calves was housed in a pen with a 4.74- × 2.48-m plastic-coated, expanded metal floor at the front of the pen and a 4.74- × 4.64-m concrete-based area, bedded with wood shavings, at the rear (Figure 1). Fresh bedding was added to each pen once per week.

The pens contained 1 automated milk feeder and 1 automated grain feeder (DeLaval CF 1000 CS Combi, Tumba, Sweden) as well as 1 automated hay feeder and 1 automated drinker (Insentec, Marknesse, the Netherlands). The automated milk feeder, situated at the front of each group pen, provided calves with filtered and pasteurized waste milk via an artificial teat. Portions of milk became available from the feeder throughout the day and could either be consumed as each new portion became available or accumulated across several hours (e.g., for an allowance of 12 L/d, an additional 0.5 L would become available every hour, up to a maximum of 6 L in 1 visit to the feeder). Grain feeders dispensed commercial calf starter mix (17.4% protein, 6.37% fiber, and 4.38% fat; Unifeed Ltd., Chilliwack, Canada) in 20-g portions, at a maximum rate of 9 kg/d (i.e., ad libitum). Grass hay (DM = 90.8%, CP = 15.1%, NDF = 51.1%, and ADF = 33.6%) and water were freely available. For the purposes of another experiment (de Passillé et al., 2011), calves entering the group pen were assigned to 1 of 3 experimental treatments relating to age at start of weaning and milk allowance: low milk allowance and early weaning (6 L/d, 42 d), high milk allowance and early weaning (12 L/d, 42 d), and high milk allowance and late weaning (12 L/d, 84 d). Three calves from each treatment were in each group pen.

DeLaval feeders measured the daily individual milk and grain intakes for each calf using the volume of feed dispensed. Both grain and milk feeders recorded the number and duration of visits. The hay feeders and drinkers were equipped with hydraulic scales, which allowed for the number of visits and consumption of hay and water to be measured. Visits to feeders without consumption of feed were excluded from analyses. Data from milk and grain feeders were recorded and stored by Kalbmanager and Win_Institute programs (Foerster-Technik, Engen, Germany). Water and hay consumption was recorded by Insentec RIC – System IV TIRIS Identification Roughage/Water Version 11 UH7802 (Insentec, Marknesse, The Netherlands).

Behavioral Observations

Three overhead video cameras (WVBP 334, Panasonic, Oskaka, Japan) were mounted on the ceiling above each pen, and an additional camera was mounted so that the entire pen could be viewed and recorded continuously at normal speed using digital video recorders (Genetec Inc., Saint-Laurent, QC, Canada). The videos were read at 4× normal speed. To validate video identification of elimination behaviors, 4 h of direct observation were compared with overhead video.

The 4 groups of calves were randomly allocated between 3 observers. Each group of calves was watched