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When and where do dairy cows defecate and urinate?

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ABSTRACT

The accumulation of urine and feces can be responsible for many cow and environmental problems. Despite this, little is known about the factors affecting defecation and urination. In the first experiment, the occurrence of defecation and urination behaviors of 48 lactating Holstein cows was observed [days in milk (DIM) = 144.7 ± 38.0 d, body weight (BW) = 667.1 ± 72.0 kg, parity = 2.8 ± 2.3] in freestalls over 48 h. In the second experiment, defecation and urination by 29 lactating Holstein dairy cows were observed (DIM = 62 ± 22.1 d, BW = 590 ± 70.0 kg, parity = 2 ± 1.3) in another freestall barn over a period of 5 d and related to cow activity and feeding behavior. In both experiments, based on total occurrence of eliminative behaviors, cows mainly defecated (experiment 1: 33.4 ± 2.0%; experiment 2: 42.3 ± 3.1%) and urinated (experiment 1: 28.2 ± 2.5%; experiment 2: 42.7 ± 4.0%) in the feed alley and while occupying a stall (defecation: experiment 1: 28.5 ± 1.0%; experiment 2: 26.2 ± 3.0%; urination: experiment 1: 42.2 ± 1.5%; experiment 2: 39.9 ± 3.8%). Occupying a stall included lying, standing in the stall, or standing with 2 feet in the stall and 2 feet in the alley. In both experiments, differences were found between cows in frequency of defecation (experiment 1: 9.8 ± 4.2/d, range = 3 to 20; experiment 2: 15.4 ± 4.3/d, range = 6 to 36) and in frequency of urination (experiment 1: 7.0 ± 3.1/d, range = 2 to 18; experiment 2: 9.3 ± 2.8/d, range = 3 to 19). Large differences between cows were observed in the frequency of defecation and urination, but these were not correlated with parity, milk production, BW, DIM, or dry matter intake.

Key words: dairy cow, defecation, urination, cleanliness

INTRODUCTION

The accumulation of feces and urine in dairy barns can be related to a variety of problems, such as poor cow hygiene, mastitis, and lameness, which are important concerns for the welfare and productivity of the cows (Warnick et al., 2001; Schreiner and Ruegg, 2003; Zdanowicz et al., 2004). Cow feces can contain infectious bacteria, contribute to the spread of Johne's disease (Stabel, 1998), and pose a risk to human health. The release of volatile ammonia is related to several environmental problems (Moreira and Satter, 2006; Sheppard et al., 2007).

Despite their importance, little is known of the factors that influence defecation or urination by cattle. Most research on defecation and urination behaviors of dairy cows has been done on cows kept in tie-stall barns or on pasture with little research having been done in freestall barns. In tie-stall barns, Aland et al. (2002) found a frequency of defecation of 16/d (range 8 to 29) and a frequency of urination of 9.0/d (range 5 to 18), but little is known of the factors that affect how often cows defecate and urinate.

A better understanding of when and where cows are most likely to defecate or urinate might permit more efficient use of cleaning routines. Aland et al. (2002) found that most defecation occurred during the hours when the animals were most active; that is, during milking and feeding. Some studies have tried to identify the locations where cows were most likely to defecate or urinate. Whistance et al. (2007) found that in freestall housing, cows defecated mostly in the alleys and urinated mainly in the alley behind the stall, whereas in straw yards, cows defecated and urinated slightly more in the bedded area than on the concrete alley. Oudshoorn et al. (2008) found that cows on pasture defecated and urinated more or less equally over their entire grazing surface, suggesting that the amount of feces and urine that accumulate in an area would depend on how much time the cows spent in that area.

The aim of the study was to determine where and when dairy cows in a freestall barn defecate and urinate most frequently, and to relate the frequency of defecation and urination by individual cows to other

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characteristics of those cows such as DIM, parity, BW, and feeding behavior.

MATERIALS AND METHODS

The institutional animal care committees, following the guidelines of the Canadian Council on Animal Care (2009), approved all procedures described in this study.

Experiment 1

Animals and Experimental Area. The 48 lactating Holstein cows were between 34 and 193 DIM (mean ± SD: 144.7 ± 38.0 d), between first and tenth parity (2.8 ± 2.3), and between 540 and 820 kg of BW (667.1 ± 72.0 kg). Projected 305-d milk production ranged from 7,200 to 16,610 kg (11,425 ± 2,223 kg). Milking was twice daily on a regular schedule, during which time the cows were out of camera view (from 0600 to 0630 h and from 1625 to 1700 h). During the experiment, all cows were fed the same TMR containing, on a DM basis, 18.7% CP and served twice daily on a regular schedule (0700 and 1645 h). All cows were housed in groups of 8 in similar pens in a freestall barn with river-sand bedding and a concrete floor (Figure 1). Stocking density in the pens was 1 cow per lying stall. The pens had 12 lying stalls (stall length = 245 cm; width = 122 cm; neck rail height = 123 cm) and feeder space for 12 cows, but 4 lying stalls and 4 feeding spaces were blocked off. The alley scrapers were set to run 9 times/d in each alley on a regular schedule.

Animals from 6 groups were filmed (3 frames/s) over 2 nonconsecutive days (separated by 1 or 2 d) under normal daily management. Recording dates were between mid August and the end of September depending on the group. In each pen, 2 video cameras (CA Panasonic CCTV Camera, Panasonic, Osaka, Japan) were placed on the ceiling, 1 above the feeder and 1 above the lying stall, to capture the entire pen (Figure 1). To recognize each cow individually, cows were marked with symbols using hair dye at the beginning of the experiment. Red lights (100 W) were used to help recording during the night.

Behavioral Observations. The Omnicast digital system (Genetec Inc., Montreal, QC, Canada) was used to record and view the videos. The videos were read at a speed of 4 times normal speed when 5 or fewer animals were standing in view, but slowed to 2 times normal speed when more than 5 animals were standing in view or when tail activity increased. One observer watched all videos.

The time (to the nearest hour) and location of every instance of defecation and urination was recorded for each cow on each of the 2 d of digital video observations. Characteristic positions of cows seen during elimination were tail up and evidence of manure (new feces on the floor) for defecation and tail up, round back, and urine appearance (spray of urine on the floor) for urination. When cows were lying down, the tail being stretched out followed by the appearance of new manure at the back edge of the stall or in the scraper alley or a urine flow were evidence of defecation and urination. The location of the cow during defecation and urination was recorded using 6 locations as shown in Figure 1. Cows were recorded as perching when they were standing with the front feet in the stall and the back feet in the alley. If the cow was moving, the location where the first drop of urine or feces fell was recorded. During milking, the cows were out of view. To assess inter- and intraobserver reliability, 3 different observers watched the same 12 h of video and estimated the total frequency of defecation and urination, and 1 observer watched the videos a second time. The total number of eliminative events observed over the 12-h period by one observer was compared with total number of eliminative events observed by another observer and multiplied by 100 to obtain interobserver reliability. Interobserver reliability was 95.5% and intraobserver reliability was 98.0%.

The time of feed delivery and milking time were recorded daily. Cows were weighed before the beginning of recording, and milk production was recorded digitally during each milking (twice daily) using the Dairy Comp 305 program (Valley Agricultural Software, Tulare, CA).

Experiment 2

Animals and Experimental Area. Twenty-nine Holstein dairy cows were housed and observed in a

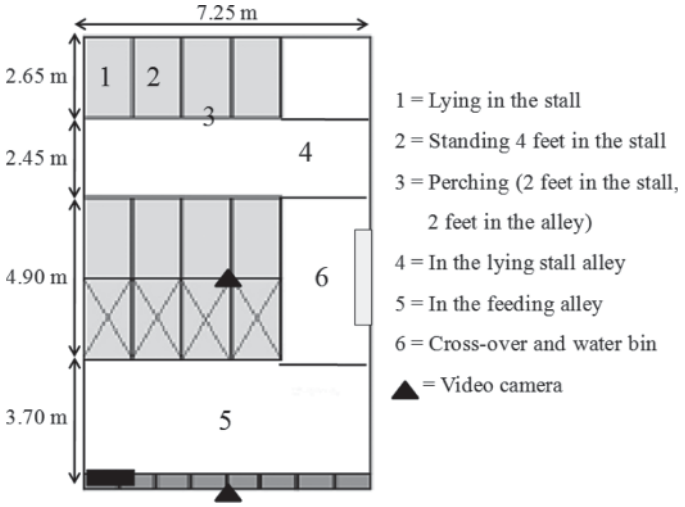

Figure 1. Pen dimensions, video camera placement, and locations recorded in a pen for experiment 1.