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Reduced stocking density mitigates the negative effects of regrouping in dairy cattle

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ABSTRACT

In freestall systems, cows are frequently moved among pens and regrouped. This practice involves mixing unfamiliar cows, and can result in changes in stocking density after regrouping. Both regrouping and changes in stocking density can affect cow welfare, but no study to date has assessed the combined effects. The aim of this study was to test if reductions in stocking density can mitigate the responses to regrouping. By manipulating group size (6 vs. 12 cows) and pen size (12 vs. 24 stalls), 3 different stocking densities were created (25, 50, and 100%). Four groups of Holstein cows were regrouped weekly for 4 wk and the stocking density changed at regrouping. The change in density varied as follows: a decrease by a factor of 4 (100 to 25%), a decrease by a factor of 2 (100 to 50% or 50 to 25%), no change (50 to 50%), an increase by a factor of 2 (25 to 50% or 50 to 100%), and an increase by a factor of 4 (25 to 100%). Displacements at the feeding area, feeding time, and lying time were scored. The daily means for each group were used to calculate the differences in responses from 1 d before to 1 d after each regrouping. The number of displacements at the feed bunk decreased and lying time increased when stocking density decreased at regrouping. In conclusion, increases in competitive behavior and the associated decrease in lying times can be mitigated by reducing stocking density when regrouping dairy cows.
Key words: cow, housing, group size, pen size, feeding behavior

INTRODUCTION

In freestall systems, cows are often required to compete for access to resources, including feed and lying stalls (Val-Laillet et al., 2008). Regrouping and changing stocking density are 2 management practices that increase this competition (e.g., Miller and Wood-Gush, 1991; Hasegawa et al., 1997; Olofsson, 1999), potentially compromising cow welfare.

On commercial farms, cows are frequently moved to form groups similar in age, stage of lactation, milk production, health, and reproductive status (Grant and Albright, 2001; Bøe and Færevik, 2003), such that cows may experience 4 to 5 regrouping events during a single lactation (Grant and Albright, 2001). Research on the effects of regrouping in dairy cows is minimal and some of this work suffers from poor replication and limited sample size (e.g., Brakel and Leis, 1976; Hasegawa et al., 1997). Previous work suggests that mixing cows with unfamiliar animals that already have an established social order destabilizes the social dynamic within the group (Bøe and Færevik, 2003). After regrouping, dairy cows increase physical competition (e.g., Kondo and Hurnik, 1990; Bøe and Færevik, 2003) and this increased competition can result in reduced lying and feeding, further compromising welfare (e.g., Phillips and Rind, 2001; von Keyserlingk et al., 2008; Schirmann et al., 2011).

Regrouping may also affect the stocking density within the pen, which also affects competitive encounters among cows (Bøe and Færevik, 2003). Increasing stocking density can increase competition over feed and decrease the time cows spend feeding (Huzzey et al., 2006) and lying down (e.g., Cook et al., 2005; Telezhenko et al., 2012).

Separate lines of experimental work suggest that both regrouping and increased stocking density have negative effects on cows, but to date, no study has assessed the combined effects despite these events occurring simultaneously on many commercial farms. The aim of this study was to evaluate competitive, feeding, and lying behaviors of dairy cows following regrouping into pens with varying densities. We predicted that competition would decrease when density decreased at regrouping, with positive effects on feeding and lying time.

MATERIALS AND METHODS

This experiment was performed at the University of British Columbia's Dairy Education and Research

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Centre (Vancouver, BC, Canada) and used 72 lactating Holstein cows. Experimental cows were selected randomly from mid- and late-lactation cows in the herd with average parity of 2.6 ± 1.8 (mean ± SD; range 1 to 9), average DIM of 204 ± 47 (range 125 to 296), and average milk production of 19 ± 3.5 kg (range 12 to 29.5 kg). These are the same cows as described in Telezhenko et al. (2012), but the present study addresses a different question and reports different data, specifically focusing on responses to regrouping. Before the study, cows were managed as part of our 240-cow milking herd. The experiment used cows from different pens within the barn, but it is likely that many of the cows had some social experience with one another before the experiment began. Cows were managed in compliance with the guidelines set by the Canadian Council on Animal Care (CCAC, 2009).

Cows were housed in either small pens (7.2 × 13.5 m) with 12 stalls or large pens (14.4 × 13.5 m) with 24 stalls, configured in 3 rows of 4 stalls (small pen) or 3 rows of 8 stalls (large pen). In each pen, 2 rows of freestalls faced one another and were open at the front (head to head), with a bed length of 2.4 m. The third row of freestalls faced a chasing alley (separated by a low concrete wall); these stalls were 0.3 m longer. Stalls were bedded with 0.4 m of sand, measured 1.2 m wide center to center, with a neck rail 1.14 m above the stall surface. Cows accessed the feed bunk via a pendulous feed rail. The alley closest to the feed bunk was 3.6 m wide and the alley between the freestall rows was 2.5 m wide. Flooring throughout the pen (including the crossover alley) was grooved concrete. Alleys were cleaned 6 times/d with automatic scrapers and the crossover alley manually scraped twice per day.

Cows were fed a TMR consisting of 27.2% corn silage, 16.7% grass silage, 8.5% alfalfa hay, and 47.6% concentrate and mineral mix on a DM basis. Major ingredients of concentrate include fine ground barley, rolled barley, rolled corn, distillers corn wheat blend, canola meal, and soybean meal. Feed was formulated based on NRC (2001) recommendations. Water was available ad libitum. Milking took place twice per day at 0500 to 0600 h and 1500 to 1600 h. Fresh feed was delivered twice daily during each milking so that cows had access to the fresh feed when they returned to their pens.

Experimental Design

Two replicates were conducted, each lasting 5 wk; the first replicate took place in October and November 2009 and the second in April and May 2010. In each replicate, 24 cows were randomly selected as focal cows and 12 others as nonfocal cows. Focal cows were randomly assigned to 4 groups of 6 cows each; nonfocal cows were assigned to 2 constant groups of "filler cows."

Stocking density in this study relates specifically to the number of stalls per cow, as feeding space was held constant across treatments (at 0.6 m/cow). Stocking density related to group size (6 vs. 12 cows) and pen size (small vs. large) and varied from 4 stalls/cow (25%) to 2 stalls/cow (50%) to 1 stall/cow (100%). Gates were moved to form small and large pens and 6 nonfocal cows used to change the group size. Focal cows remained in the same pen throughout the experiment but nonfocal cows were moved upon return from morning milking and grouped with focal cows to form the large groups (12 cows). Groups remained in the same pen for 7 d. Experimental pens were separated by nonexperimental pens that were stocked at 100% density.

At each regrouping, pen size, group size, or both were changed (Table 1 and Figure 1). A total of 8 different types of change were tested. Each group was tested with 4 changes, such that within each replicate of 4 groups, each type of change was tested twice.

Behaviors

Pens were monitored 24 h/d using 16 digital cameras (WV-BP330; Panasonic Corp., Osaka, Japan). Small and large pens had 2 and 4 cameras, respectively. Videos were recorded using a digital video surveillance system (GeoVision, version 8.3; GeoVision Inc., Corona, CA). A red light (100 W) was placed beside each camera to improve the video quality at night. Focal cows were marked with individually distinct symbols using hair dye on the back and sides to aid in identification. Feeding and lying time were scored using scan sampling every 5 min from 1 d before to 1 d after regrouping. Cows were considered to be feeding when the neck collar was beyond the feed rail.

Videos were watched continuously for 3 h following afternoon delivery of fresh feed (from approximately 1530 to 1830 h) 1 d before and 1 d after regrouping,

Table 1. At regrouping, cows were moved to pens that were formed by changing group size (either 6 or 12 cows) and pen size [either large (24 stalls) or small (12 stalls)], resulting in different stocking densities (no. of stalls/cow)

Treatment no.	Change in group size	Change in pen size	Change in density
1	6 to 12	Large to small	4 to 1
2	12 to 6	Small to small	1 to 2
3	6 to 12	Small to large	2 to 2
4	12 to 6	Large to large	2 to 4
5	6 to 12	Large to large	4 to 2
6	12 to 6	Large to small	2 to 2
7	6 to 12	Small to small	2 to 1
8	12 to 6	Small to large	1 to 4

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