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Effect of group size and health status on behavior and feed intake of multiparous dairy cows in early lactation

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ABSTRACT

Dairy cows in early lactation are often housed in a large group, where they may have to compete for access to feed and space. However, a cow's ability to compete may be impaired due to production disease, and housing in a small group with minimal competition may be beneficial for cow welfare. The aim of this study was to investigate the effect of group size and health on social and feeding behavior of cows during the first 3 d after introduction to a new group. Data included 54 multiparous Holstein-Friesian cows that were moved from an individual maternity pen and individually joined an existing group pen for 6 (N6) or 24 cows (N24) on d 4 after calving. Cows were considered sick if they were diagnosed with and treated for milk fever, mastitis, or retained placenta, diagnosed with subclinical ketosis or metritis within 3 d of calving, or were diagnosed and treated for any other infection (n = 22; balanced across treatments). Stocking density of both pens was 100% at the feeding and lying areas. Behavioral data were collected from video recordings during the 1 d after introduction to the group pen, as well as via electronic feed bins and leg-attached accelerometers during the first 3 d after introduction to the group pen. No interactions between health status and group size were discovered. During the 1 d after introduction, N6 cows displaced other cows from feed less frequently than N24 cows (1.22 vs. 5.76 times/24 h), were less likely to access feed after a displacement (replacement; 0.29 vs. 1.67 times/24 h), and were less frequently being butted by another cow (0.42 vs. 1.69 times/24 h). Second-parity cows received more head butting than later-parity cows. Data obtained from feed bins showed that the number of replacements peaked on d 2 after introduction to the group pen. During the first 3 d we observed no effect of group size on DMI, but sick cows ate less than cows that were not sick (15.2 vs. 16.6 kg of DM/d). However, cows in N6 visited the feeder less often (42.4 vs. 55.6 times/d). Over the 3 d after introduction DMI and feeding time increased, whereas feeding rate decreased. Lying time and the number of lying bouts increased from d 1 to 2. The number of steps decreased over days, but the number of steps was higher among N24 than N6 cows on d 1 and d 2. Results suggest that cows experience less competition when moved to a smaller group after calving regardless of health status. Thus, minimizing competition by housing dairy cows in a small group for the first days after calving may improve cow welfare under commercial conditions.
Key words: feeding behavior, group size, regrouping, social behavior

INTRODUCTION

The welfare of dairy cows in early lactation is a concern, both because of the way they are managed and housed and because of their high risk of disease after giving birth. During the transition from gestation to lactation, dairy cows experience several social stressors including separation from their calf and regrouping with a new group of cows after calving. These cows are also at high risk of reproductive and metabolic diseases (reviewed by Mulligan and Doherty, 2008), and those that become ill have impaired ability to compete for feed compared with those that remain healthy after calving (e.g., Huzzey et al., 2007; Goldhawk et al., 2009). To assure that cows are able to obtain sufficient feed and rest after calving, providing cows that have just given birth unrestricted access to feed and lying space is important, and management and housing should ensure sufficient access to these resources to reduce social competition.

A main social challenge for cows after calving is their introduction into a new pen and group of cows. Regrouping is known to cause increased agonistic behavior because new dominance relationships have to be established among the newcomer and her new group

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mates. For instance, on the first day after mid-lactation cows were individually moved into an established group, they were displaced from feed more than twice as often as the previous 3 d (von Keyserlingk et al., 2008). Moving cows into a novel pen may pose a special challenge in terms of accessing feed, as cows that were moved into a novel pen consumed less feed and initiated more displacements from the feed bunk compared with those cows that were already in the pen (Schirmann et al., 2011).

The size of the group that a cow is being introduced to may affect her behavior; a cow introduced into a larger group may experience more agonistic behavior compared with a cow introduced into a smaller group, as the cow in the larger group may have to compete with more cows for access to resources. However, in a study using cows in mid lactation, Telezhenko et al. (2012) found that reducing the number of lactating dairy cows in a pen from 12 to 6 cows did not affect the level of aggression. Although few studies have examined the effect of group size in adult cattle (Rind and Phillips, 1999; Telezhenko et al., 2012), young dairy calves kept in larger groups (12 vs. 24 calves: Jensen, 2004; 2 vs. 6 calves: Jensen and Budde, 2006) increased the rate of milk ingestion, which suggests that competition for milk was higher the larger the group.

Some evidence has shown that housing postparturient cows in separate pens and smaller groups may reduce the level of competition and improve the social environment for healthy cows. For example, Burow et al. (2009) found that postparturient cows moved to a group of about 9 cows have fewer social interactions in the first few hours after introduction compared with those moved to the main lactating herd (group size approximately 130). In addition, housing postparturient cows in a separate pen from the milking herd after calving increased milk yield among the primiparous cows (Østergaard et al., 2010). Research is still needed to determine the effect of moving healthy and ill cows into a novel pen of various group sizes after calving. The aim of our study was to investigate the effect of group size and health status on the social, feeding, and lying behavior of postpartum cows during the first 3 d after introduction to a group.

MATERIALS AND METHODS

The experiment took place at the Aarhus University's Cattle Research facility in Foulum, Denmark, between September 2011 and February 2012. Cows were cared for according to a protocol approved by the Danish Animal Experiments Inspectorate, Ministry of Justice, Copenhagen, Denmark.

Animals, Housing, and Treatments

The experiment began with 79 multiparous Danish Holstein dairy cows, but only 54 were included in the final analysis (described in a later section). Approximately 2 wk before expected calving date, cows were assigned to 1 of 6 blocks and 1 of 2 postcalving treatments [6 cows per pen (**N6**) or 24 cows per pen (**N24**)]. Each block included an average of 14.7 cows (SD = 1.5, minimum = 12, maximum = 16) that were housed in 1 of 2 deep-bedded straw pack pens [each 9 × 15 m; see Proudfoot et al. (2014) for a detailed description of these pens]. Cows were moved into individual calving pens located directly adjacent to the bedded pack pens [median (interquartile range)] 21 (4 to 73) h before calving (except for 4 cows that were moved into the pen within 6 h after calving). In both the bedded pack pens and individual pens, cows were fed a TMR ad libitum with a forage to concentrate ratio of 79:21 (% DM basis) twice daily at 1000 and 1700 h.

After calving, cows were kept in the individual calving pen with their calves for 3 d, fed a postpartum TMR ad libitum with a 60:40 forage to concentrate ratio (% DM basis), and were milked twice daily at 0600 and 1800 h using a manual milking machine. At 1000 h on the fourth day and [median (range)] 115 (84 to 129) h after calving, cows were moved to a neighboring building and individually introduced into 1 of 2 treatment pens (N6 or N24; both pens were located in the same building), whereas calves were moved to pens in a separate building 15 to 30 min later. The 2 treatment pens were equipped with freestalls (1 stall/1 cow) fitted with 35-mm-thick rubber mattresses (Fremtiden Staldinventar A/S, Langå, Denmark), bedded daily with a thin layer of sawdust, and Insentec electronic feeding bins (Insentec B.V, Marknesse, the Netherlands; 1 feed bin/1 cow; validated by Chapinal et al., 2007). Cows were fed a TMR ad libitum with a forage-to-concentrate ratio of 60:40 (% DM basis). Feeding bins were filled by a feeding robot (Cormall, Sønderborg, Denmark, Special Robot M3, 0780032022) maintaining a minimum of 2 kg and a maximum of 25 kg of TMR in each bin. Bins were cleaned Monday, Wednesday, and Friday between 0700 and 0900 h and, after that, all bins were filled again (with the maximum of 25 kg) no later than 1000 h. All cows had previous experience with Insentec bins. Cows were milked twice daily between 0515 and 0600 h and again between 1530 and 1615 h in a herringbone milking parlor. Cows were moved to the milking parlor with their group and groups were not mixed at milking. The distance to the milking parlor was the same for both groups. The social composition of the treatment pens were dynamic, as cows were moved in on the fourth day after calving and