J. Dairy Sci. 96:1–11
http://dx.doi.org/10.3168/jds.2012-6464

Effects of weekly regrouping of prepartum dairy cows on metabolic, health, reproductive, and productive parameters

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ABSTRACT

The objectives of the current experiment were to determine the effect of 2 prepartum grouping strategies on the health, metabolic, reproductive, and productive parameters of dairy cows. Jersey cows enrolled in the experiment at 253 ± 3 d of gestation (d 0 = calving) were balanced for parity and projected 305-d mature equivalent and assigned to 1 of 2 treatments. Cows assigned to the traditional (TRD; n = 6 replicates with a total of 308 cows) treatment were moved to the study pen as a group of 44 cows and weekly thereafter groups of 2 to 15 cows were moved to the study pen to reestablish stocking density. Cows assigned to the All-In-All-Out (AIAO; n = 6 replicates with a total of 259 cows) treatment were moved to the study pen in groups of 44 cows, but no new cows entered the AIAO pen until the end of the replicate. At the end of each replicate, a new TRD and AIAO group started but pens were switched. Cows were milked thrice daily and monthly milk yield, fat and protein contents, and somatic cell count data were recorded up to 305 d postpartum. Plasma nonesterified fatty acid concentration was measured weekly from d −18 ± 3 to 24 ± 3 and plasma β-hydroxybutyrate was measured weekly from d 3 ± 3 to 24 ± 3. Cows were examined on d 1, 4 ± 1, 7 ± 1, 10 ± 1, and 13 ± 1 for diagnosis of uterine diseases and had their ovaries scanned by ultrasound on d 39 ± 3 and 53 ± 3 to determine resumption of ovarian cycles. Average stocking density was reduced for the AIAO (71.9%) treatment compared with the TRD (86.9%) treatment. Treatment did not affect the incidences of retained fetal membranes (TRD = 10.9, AIAO = 11.6%), metritis (TRD = 16.7, AIAO = 19.8%), and acute metritis (TRD = 1.7, AIAO = 3.6%). Concentrations of nonesterified fatty acids (TRD = 80.4 ± 8.2, AIAO = 62.9 ± 8.5 μmol/L) and β-hydroxybutyrate (TRD = 454.4 ± 10.9, AIAO = 446.1 ± 11.1 μmol/L) were not different between treatments. Percentages of cows that resumed ovarian cycles by d 39 ± 3 (TRD = 70.8, AIAO = 63.1%) and 53 ± 3 (TRD = 90.1, AIAO = 90.2%) were not different between treatments. Similarly, treatment had no effect on rate of removal from the herd {TRD = referent, AIAO [(adjusted hazard ratio (95% confidence interval)] = 0.85 (0.63, 1.15)} or rate of pregnancy [TRD = referent, AIAO = 1.07 (0.88, 1.30)]. Finally, treatment did not affect energy-corrected milk yield (TRD = 34.4 ± 0.6, AIAO = 34.3 ± 0.7 kg/d). In conditions of adequate feed bunk space, the AIAO treatment did not improve health, metabolic, reproductive, or productive parameters compared with the TRD treatment.

Key words: lactating dairy cow, transition period, grouping strategy

INTRODUCTION

Cows are social animals and are affected by interactions with herd-mates. Regrouping of dairy cows is used in dairy operations to maintain homogenous groups of cows in terms of gestation stage, reproductive status, or milk yield to optimize management (i.e., nutritional management). In most herds with dry periods of 50 to 60 d, cows are grouped into far-off dry cow pens (from dry-off to approximately 28 d before expected calving date) and close-up dry cow pens (from approximately 27 d before expected calving date to calving). In large dairy operations, cows from the far-off pens are usually moved to the close-up pens weekly, which has been suggested to result in weekly disruption of social interactions and, for many cows, disruption of social interactions in the last days before parturition (Cook and Nordlund, 2004).

Constant regrouping of cows changes the hierarchical order among them, forcing cows to reestablish social relationships through physical and nonphysical interactions and exacerbating aggressive and submissive behaviors (Zelena et al., 1999; von Keyserlingk et al., 2008). Cows had reduced feeding time, greater rate of displacement from the feed bunk and stalls, and re-

Received December 8, 2012.
Accepted March 11, 2013.
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duced milk yield within 24 h following regrouping (von Keyserlingk et al., 2008). Furthermore, Schirmann et al. (2011) demonstrated that regrouping of prepartum cows housed in pens with 1 feed bin for every 2 cows and 1 stall per cow resulted in reduced feed intake compared with feed intake before movement. Although the question has not yet been definitively answered, some researchers have suggested that cows may require 3 to 14 d after regrouping to reestablish social stability to preregrouping levels (Grant and Albright, 2001). In the study by von Keyserlingk et al. (2008), however, the changes in behavior observed after regrouping were transitory, and behavioral patterns returned to preregrouping values within hours or the day after regrouping..

During the peripartum period cows are predisposed to reduced DMI, negative energy balance, and immune suppression (Goff and Horst, 1997). Associations among reduced DMI and feeding time in the prepartum period and metritis have been observed (Hammon et al., 2006; Huzzey et al., 2007). Weekly regrouping of prepartum cows has been suggested to increase the risk for postpartum diseases and reduced productivity because of the observed behavioral changes associated with regrouping that could result in reduced DMI and increased stress (Cook and Nordlund, 2004). In a recent experiment, Coonen et al. (2011) demonstrated that Holstein cows housed in a stable pen with no entry of new cows in the prepartum period (14–28 d before expected calving date) had similar DMI and NEFA concentrations during the prepartum period and similar milk yield in the first 30 DIM compared with cows housed in pens with entry of new cows twice weekly in the last 14 to 28 d before expected calving date. However, this study had an insufficient number of cows to evaluate health and reproductive performance and milk yield was not measured throughout the entire lactation.

The hypothesis of the current experiment was that cows submitted to an All-In-All-Out (**AIAO**) prepartum grouping strategy (no entry of new cows in the prepartum pen) would have reduced incidence of health and metabolic disorders in the periparturient period compared with cows submitted to a traditional (**TRD**) prepartum strategy (weekly entry of new cows in the prepartum pen). Furthermore, we hypothesized that reduced frequency of regrouping (AIAO vs. TRD) during the prepartum period would result in increased milk yield, reduced death or culling rates, and increased pregnancy rates. The objectives of the current experiment were to compare health, metabolic, reproductive, and productive parameters of lactating dairy cows submitted to the AIAO or TRD prepartum grouping strategy.

MATERIALS AND METHODS

Cows, Facilities, Management, and Nutrition

The experiment was conducted from February 2011 to October 2012 with cows enrolled from February 2011 to August 2011 and calving occurring from February 2011 to October 2011. Prepartum Jersey cows (≥1 lactation) were enrolled in the experiment at 253 ± 3 d of gestation (d 0 = calving). During the prepartum period cows were housed in 1 of 2 freestall pens with 44 stalls and 48 headlocks that were identical in size (31.7 × 11 m, 347.8 m^2) and design. Stalls measured 230 cm (length) × 107 cm (width) × 114 cm (neck rail height) and headlocks measured 0.61 m/headlock. Pens had 2 water troughs at each end of the pen that measured 366 cm by 56 cm. The barn was cross-ventilated and had artificial lighting (8 h of light and 16 h of dark). Temperature and relative humidity were recorded hourly in each study pen throughout the experiment and daily average temperature-humidity index was calculated for each pen. During the prepartum period and at the start of each replicate the target stocking densities were 100% of stalls and 91.6% of headlocks. In the freestall, including stalls and alleys, 7.9 m^2/cow was allotted.

As cows demonstrated signs of calving (discomfort, restlessness, tail twitching, and exteriorization of the allantoic sac through the vulva) cows were moved to a box stall. During the immediate postpartum period (d 1 to 21 ± 3) all cows were housed in the same freestall pen with 240 stalls and 260 headlocks. Five water troughs were available per pen that measured 366 cm by 56 cm. The barn was cross-ventilated and had artificial lighting (16 h of light and 8 h of dark). From d 1 to 21 ± 3, pens were stocked at 100% and 91.6% of stalls and headlocks, respectively. From d 21 ± 3 until diagnosis of pregnancy 66 ± 3 d after AI cows were housed in cross-ventilated freestall barns with 240 stalls and 260 headlocks. From the second pregnancy diagnosis to the end of the lactation cows were housed in a nearby naturally ventilated freestall dairy with 260 stalls and 280 headlocks. Stocking density from d 21 to the end of lactation varied between 110 and 120% of headlocks and between 119 and 130% of stalls.

From enrollment to calving, all cows were fed the same TMR once a day. From d 1 until the time of the second pregnancy diagnosis cows were fed the same TMR and from the time of the second pregnancy diagnosis to dry-off cows were fed the same TMR. Feed was delivered twice a day (70% in the a.m. and 30% in the p.m.) for lactating cows. Composition of TMR fed in the prepartum and immediate postpartum period (d 1 to 21 ± 3) are described in Table 1.