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Short communication: Effect of age at group housing on behavior, cortisol, health, and leukocyte differential counts of neonatal bull dairy calves[1]

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ABSTRACT

To determine the effect of age at grouping on behavior, health, and production of dairy bull calves, 90 Holstein-Friesian bull calves were housed in individual pens until moved to 1 of 3 treatments. Calves were housed in groups of 3 calves at 3 d old (GH3), 7 d old (GH7), or 14 d old (GH14) until 7 wk of age. Ten groups of 3 calves for each treatment were used, with 5 pens/treatment in each of 2 replications (10 pens/treatment, 3 treatments, 3 calves/treatment; 90 calves total). Direct behavioral observations using instantaneous scan sampling every 10 min were conducted twice per week for 7 wk. At the same times, video data were recorded for continuous observations at feeding time to observe the overall activity of group-housed calves. Hip height, heart girth, and health scores were recorded weekly and body weight was recorded at the start and end of the study. Calves in GH3 spent more time playing and but more time cross-sucking and displacing other calves from milk bottles. Calves engaged in social interaction as early as 3 d of age, and social interactions between 3 to 6 wk of age increased markedly. Calves housed in GH14 vocalized more than did calves in GH7 and GH3. No difference was found between treatments in growth performance. Calf fecal, cough, and nasal and ocular discharge scores, differential leukocyte counts, and plasma cortisol concentrations were not affected by age at grouping. However, during the first week of grouping, when calves were moved from individual pens to group pens, some calves were unable to find their milk bottles and required guidance. In conclusion, these data show no adverse effects on health or performance and some benefits on social behavior for early (d 3) grouping of calves.

Key words: behavior, group housing, neonate, well-being

Short Communication

Isolation of calves from their dams and peers through individual housing may compromise the welfare of the calf (Costa et al., 2015; Meagher et al., 2015; Valníčková et al., 2015) due to lack of social contact. Seven out of 10 calves (USDA, 2011) are housed in individual housing until after several early stressors that influence optimum health occur, such as early transportation and enteric disease vulnerability in the first week of life (Hulbert and Moisá, 2016). Earlier group housing has been beneficial for calves and is necessary in some calf systems such as in automated feeding systems (Costa et al., 2016). Pair housing of dairy calves reduced behavioral responses to weaning and human handling and improved performance when calves were mixed with a larger group after weaning (De Paula Vieira et al., 2010). Housing young dairy calves in groups of 3 increased social interactions, calf starter intake, and ADG compared with individual housing of calves (Cobb et al., 2014), and pair housing and enhanced milk allowance increased performance and play behavior in dairy calves (Jensen et al., 2015). However, some obstacles still exist; Jensen (2007) reported that dairy calves introduced individually to a large dynamic group of 16 to 24 calves at 6 d of age faced more competition for access to a computer-controlled milk feeder and required more guidance than calves introduced at 14 d of age. Jensen and Larsen (2014) discovered benefits of pair housing calves in social tests and noted that physical contact with another calf altered responses to a novel environment. Although Meagher et al. (2015) showed that early pairing (6 d) enhanced learning, no studies in production settings have adequately addressed the exact age within the 3 wk of life is most appropriate for grouping to maintain calf health and allow social behavior. Therefore, the objective of the current study was to determine the effects of age at grouping—3, 7, or 14 d—on behavior, health, and growth of Holstein bull calves.

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Experimental procedures were approved by the Purdue Animal Care and Use Committee (PACUC, Protocol No. 1112000434). Ninety Holstein bull calves (12 to 36 h after birth) were provided by and reared at a commercial dairy calf farm in Indiana. The experiment was conducted in 2 replicates: spring (from March to May) and fall (September to November). Upon arrival, calves were housed in pens with visual but not tactile contact with other calves. Individual pens consisted of a polyethylene hutch (220 × 122 × 140 cm) and an outside run (147 × 109 × 117 cm) constructed of wire fence. Group runs were 147 × 357 × 117 cm. All management procedures were in accordance with the standard operating procedures of the farm.

Calves from individual pens were handled to measure initial BW, and blood was collected into EDTA tubes to check for total plasma protein concentration. The mean initial BW ± SEM was 43.14 ± 0.55 kg. Only calves with plasma protein concentrations greater than 5 g/dL at 24 to 48 h of age were used in the experiment (2 were excluded from the experiment due to low plasma protein concentrations). Calves were assigned randomly to 1 of 3 treatments (balanced according to BW, hip height, and heart girth upon entry). Treatments were as follows: (1) calves were individually housed until 3 d ± 1 d old and then grouped until the end of the experiment (**GH3**; n = 10 pens); (2) calves were individually housed until 7 d ± 1 d old and then grouped until the end of the experiment (**GH7**; n = 10 pens); and (3) calves were individually housed until 14 d ± 1 d old and then grouped until the end of the experiment (**GH14**; n = 10 pens). The group hutches were formed by combining 3 run areas together by removing the fence in front of 3 individual hutches and surrounding them with one fence, so that each group of hutches included 3 calves, 3 hutches, and 1 run. At grouping, milk bottles were placed in the same location as they were on individual pens, directly in front of each hutch at the same height. Five pens of each treatment were formed within each of 2 experimental replications. For the whole experiment, there were 3 calves per each of 10 pens and 3 ages at grouping, equaling 90 calves. Calves were fed 6 L of pooled colostrum within 8 h of birth and 3.8 L/d of pasteurized waste milk by bottle at 0600 and 1430 h from birth to 14 d of age. From d 15 to 49, calves were fed 5.7 L of milk replacer per day. Milk replacer was 24% CP and 28% crude fat (CalfLand, Watertown, WI). From d 50 to 57, milk replacer was reduced to 1.9 L/d until complete weaning at d 57 ± 2. Calves were assisted with milk consumption when necessary and protected from other calves consuming their milk by guiding the encroaching calf back to their nipple. Calves had ad libitum access to a starter mixture, and fresh water in buckets outside of the hutch during the entire experiment. Starter consisted of 18.8% CP, 4.1% fat, 7.2% crude fat, 1.1% Ca, 0 0.46% P, 1.2% NaCl, 0.4% Na, 0.3 mg/kg Se, and 14,639 IU/kg of vitamin A. Monensin was added at 39.7 g/ton (short ton). After grouping, all calves were observed for any refusal of milk or excessive cross-sucking; no refusals were observed. All calves were vaccinated with Calfguard at birth (Pfizer Animal Health, NY) and Draxxin (Zoetis, Florham Park, NJ) at 1 and 28 d of age. Calves remained on the study 2 wk after weaning.

Recording of behaviors (Table 1) started at d 3 and was conducted twice a week for 7 wk. Two methods were used to record the behavior of calves (Martin and Bateson, 2007). The first method was an instantaneous scan, sampling every 10 min for 3 h, registered from 1100 to 1400 h and focused on location of calves (in, out, or transition to hutch), posture (standing or lying), and activities [vocalizing, eating, drinking, moving, and oral manipulation of pen, or licking other calves (social grooming), elimination, rumination, cross-sucking, and play behaviors (locomotive, social, and object play were combined into a single play category due to low occurrence)]. Two trained observers were required to register behaviors of each calf by direct observation by scanning for all predefined behaviors. Reliability >95% was determined and checked weekly. Scan sampling pen means were calculated, and a treatment mean determined each week for 7 wk.

The second method was continuous focal sampling of each calf in group pens. Each group pen was fitted with a digital camera (15 cameras/15 group pens/replicate) positioned approximately 3 m above the ground, which ensured a full view of the entire pen and the feeding buckets and bottles. Behavior was recorded by video cameras (CBHD39N-L; Nuvico Corp., Englewood, NJ) between 1400 and 1600 h, with feeding beginning at 1430 h. Output from the cameras was recorded with Easy Net (DVRED-U1600; Nuvico Corp.) digital video recorder. Continuous observations were conducted by a single observer using Observer XT (version 5; Noldus Information Technology, Wageningen, the Netherlands). Each calf in the group was observed continuously for 5 min for duration and frequency of milk feeding, displacement, cross-sucking, and play behaviors (social, locomotor, and object). The start and stop of each respective 5-min observation window was defined by delivery of milk bottles and the end of milk feeding for the individual calf (calf lying down or returning to their hutch), respectively.

Calves were weighed individually upon arrival to determine initial BW and at the end of the experiment (final BW). Body weight gain was final minus initial BW. The means (±SE) of total plasma protein concentrations were 5.17 ± 0.2, 5.18 ± 0.2, and 5.25 ±