The objective of this study was to test if body weight (BW) and starter intake increased and reaction to novelty decreased for preweaning Holstein heifer calves pair housed in modified hutches (n = 8 pairs) versus individually housed in a single hutch (n = 14 calves). Calves were alternately assigned to housing treatment at d 5 of age. Cross sucking was recorded in 5-min scans for 30 min after milk feeding once per week over 14 wk. Calf health and BW were measured weekly from birth until approximately 88 d. When calves were 60 d old they underwent a food neophobia test where they were exposed to a novel feed for the first time. Cross sucking was observed only 5 times (in 4 different pairs) over the entire milk-feeding period. Pair-housed calves ate more starter than individually housed calves [0.89 (0.72–1.08) vs. 0.48 (0.42–0.56) kg/d; median and confidence interval], these calves also consumed 2.6 times more novel feed in the neophobia test (150 ± 27 vs. 58 ± 20 g/30 min). We observed no effect of treatment on BW. We concluded that social housing in modified hutches promotes solid feed intake and decreases fearfulness in dairy calves.

Key words: welfare, group housing, behavior, neophobia
Calves were fed from a nipple bottle High Performance Pro-Gro calf milk replacer (150 g DM/L; Grober Nutrition, Cambridge, ON, Canada; 22% CP, 17% crude fat, 0.15% crude fiber, on a DM basis) for 2 meals per day (at 0800 and 1630 h). From d 1 to 7 calves were fed 6 L/d and from d 8 to d 35 they were provided 10 L/d. At d 35, the daily milk ration was then reduced to 6 L/d over a 2-d period, and on d 58 milk volumes were further reduced such that weaning was completed by d 60. During the milk-feeding period, all pair-housed calves were observed for cross sucking once per week using 5-min scan sampling for 30 min immediately following the afternoon milk feeding during 14 observational weeks.

Throughout the experiment calves were also offered ad libitum hay and a medicated calf starter (LifeLine; Otter Co-op, Aldergrove, BC, Canada; 18% protein, 4% fat, and 9% fiber, medicated with decoquinate at 50 mg/kg, on a DM basis). Starter intake was recorded twice per week by disappearance; the amount of starter remaining was subtracted from the amount fed 24 h previously.

To account for effects of health on response measures, calves underwent a health check once per week (see Costa et al., 2015), recording temperature and signs of respiratory and digestive disorders. Body weight was estimated using a heart-girth tape (following Heinrichs et al., 1992). Respiratory health was assessed by visually inspecting nasal discharge, and a veterinarian or animal health technician listened for sounds of pulmonary infection during auscultation. On the day of examination, air temperature was recorded from a thermometer held inside the hutch. Diarrhea scoring followed De Paula Vieira et al. (2010), where 1 = normal feces, 2 = plaques but not watery, 3 = watery and body temperature <39.5°C, and 4 = watery and body temperature ≥39.5°C. All calves displaying signs of illness were subject to a full veterinary exam and the interaction between treatment and age. Starter intake was transformed using a natural log to normalize residuals.

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A food neophobia test, exposing calves to 900 g of novel feed (TMR), was performed at 60 ± 1 d of age; calves ranged from 52 to 69 d of age. The first 3 pairs and 1 individual were tested in the outdoor, wire enclosure in front of the hutch, which allowed calves to see each other (and thus potentially influence their responses); thus, the methodology was changed so that the rest of the calves were tested inside the hutch such that they could not see and were not visible to other calves when eating. In the case of pair-housed calves, the combined hutch was separated during the test into 2 single hutches using a gate divider. Calves were individually given access to the novel feed for 30 min. The test bucket containing the novel feed was identical to that used for the routine feeding of calf starter and was placed in the same location of the pen. Behaviors during the test were recorded with a camera (Panasonic HDC, Osaka, Japan). The latency to approach the feed (muzzle <5 cm from the bucket) was recorded. The amount of novel feed consumed was measured by disappearance at the end of the trial.

All analyses were performed with SAS (version 9.4; SAS Institute Inc., Cary, NC) using pen (individual calf or pair) as the experimental unit. Intake of calf starter (kg/d), BW (kg), novel feed intake (g/30 min), and latency to approach the feed (s) were considered dependent variables. Treatment differences in starter intake and BW over the trial were analyzed using a mixed model (with an autoregressive covariance structure) that included pen (specified as subject), treatment, age, and an interaction between treatment and age. Starter intake was transformed using a natural log to normalize residuals.

Novel feed intake (g/30 min) was analyzed with the GLM procedure including age, treatment, and the interaction between age and treatment. Analyses were completed with all the calves and without the first 7 calves, as those calves had been tested in the outdoor area with visual contact; results were similar, so the entire data set was used. The distribution of latency to approach the novel feed could not be normalized by transformation, so a Kolmogorov-Smirnov test was used to analyze treatment differences. In this case, age and the interaction between age and treatment were not considered. Results are presented as least squares means and standard errors of the mean for BW and novel feed intake, and results of the back-transformed data for starter intake are presented as geometric means and confidence intervals. We report F-values in the format F(treatment df, error df). Significance was declared at P < 0.05.

Age (F1,139 = 380.58; P < 0.001) and housing (F1,20 = 26.93; P < 0.001) both affected the amount of starter calves consumed (Figure 1 A), but we found no interaction between age and housing (F1,139 = 1.67; P = 0.20). Intake [geometric mean (95% CI)] over the entire experiment was higher for pair versus individually housed calves [0.89 (0.72–1.08) vs. 0.48 (0.42–0.56) kg/d]. Body weight increased with age (F1,247 = 2334.22; P < 0.001; Figure 1 B), but did not vary with treatment (F1,20 = 1.08; P = 0.31), and we observed no interaction between age and treatment (F1,247 = 0.43; P = 0.51). At weaning (measured at 63 ± 0.4 d of age), paired calves weighed, on average, 84.3 ± 1.27 versus 82.5 ± 1.37 kg compared to the individually housed calves. Five calves had fecal scores of 4 (1 individual and 4 pair-housed), but none exhibited fever. One calf (individually housed) displayed signs of respiratory infection. On 21
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