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Complex social housing reduces food neophobia in dairy calves

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ABSTRACT

Animals are often reluctant to consume novel feeds. Research suggests that social housing can reduce fearfulness in animals. The aim of this study was to test the prediction that social housing reduces food neophobia in dairy calves. Beginning immediately at birth, Holstein bull calves were either reared individually (n = 18) or in a complex social group with other calves and cows (n = 18). In food neophobia tests, calves were exposed to 2 identical buckets, one empty and the other filled with a novel food (chopped hay in trial 1 and chopped carrots in trial 2). Calves were tested for 30 min/d on 3 consecutive days starting at 70 d of age. Regardless of the type of food, socially housed calves consumed more of the novel feed compared with individually housed calves. In trial 1, intake of hay as fed averaged 35 ± 6 versus 18 ± 6 g/d for socially versus individually housed calves. In trial 2, intake of chopped carrots as fed averaged 27 ± 6 versus 6 ± 6 g/d for socially versus individually housed calves, respectively. Social rearing decreased the latency to eat the novel feed. Calves housed in a complex social group began eating the hay after 1:23 ± 1:13 versus 3:58 ± 1:10 min:s for individually housed calves. Latency to begin eating the chopped carrots averaged 3:09 ± 1:17 versus 6:38 ± 1:13 min:s for socially versus individually housed calves. Treatment had no effect on time spent eating, latency to approach the food bucket or the empty bucket in either trial, or on time spent manipulating the empty bucket. These results indicate that housing dairy calves in a complex social group reduces food neophobia. More generally, this study contributes to a series of studies showing that calves raised in more complex social environments may be better able to transition to other changes in their environment.

Key words: feeding behavior, group housing, weaning, dietary transition

INTRODUCTION

Dairy cattle are often exposed to new foods. For example, calves are weaned from milk to a grain-based calf starter and later to forage-based diets (see review by Khan et al., 2011). Food neophobia is well known in ruminants (Chapple and Lynch, 1986) and is defined as avoidance of, and reluctance to taste, unfamiliar foods (Cooke et al., 2006). Food neophobia is adaptive in that it helps animals avoid toxic foods and those too rich in certain nutrients (Provenza, 1995), but food neophobia can be problematic when animals refuse novel feeds provided as part of the farm's management requirements (Villalba et al., 2010). Ruminants offered novel diets often sample these cautiously, resulting in decreased food intake and productivity (Launchbaugh et al., 1997).

Surveys on dairy practices in Canada (Vasseur et al., 2010) and the United States (USDA, 2008) indicate that more than 90% of farms routinely separate calves from their dams within 24 h of birth and then typically house calves in individual pens or hutches. In more naturalistic settings, the dam and calf will typically remain in close contact until approximately 6 to 8 mo and commingle with other calves and cows (Reinhardt and Reinhardt, 1981).

Early socialization during the milk-feeding phase, generally the first 6 to 8 wk of life for dairy calves, appears to reduce the problems associated with the transition to new social and feeding environments (de Paula Vieira et al., 2012b). Social contact with the dam and other calves has been shown to decrease responses to restraint and increase play (Duve et al., 2012). Also, calves that are pair housed early in life begin to ingest solid feed sooner and eat more solid feed during the milk-feeding phase compared with calves housed individually (de Paula Vieira et al., 2010). Calves housed individually show less exploratory behavior (Jensen et al., 1997; de Paula Vieira et al., 2012a) and are more reactive to environmental and social novelty compared with socially housed calves (de Paula Vieira et al., 2012b). Collectively, these results suggest that providing access to more complex social environments may improve the calf's ability to cope with novel feeds. We therefore hypothesized that providing a complex social environment for calves would improve calves' willingness to consume new food items.

An important aspect of modern dairy cow management is the ability to change diets to meet the changing needs of the animal and to match availability of

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feedstuffs, making it important that the animal be able to transition to new types of feed. Thus, the aim of this study was to investigate the effect of complex social housing on neophobic responses to new food items.

MATERIALS AND METHODS

This experiment was carried out between October 2012 and May 2013 at The University of British Columbia's Dairy Education and Research Centre (Agassiz, British Columbia, Canada; 49°N, 121°W). All procedures were approved by the University of British Columbia Animal Care Committee.

Animals and Housing

Thirty-six Holstein dairy bull calves were assigned either to individual (n = 18) or to complex social (n = 18) housing. Individually raised calves were separated from their dams immediately after birth and moved to sawdust-bedded pens (1.2 m × 2.0 m) with auditory but no visual contact with other calves (Figure 1a). Socially housed calves were kept with their dam in the calving pen for 3 d after parturition. Immediately after parturition, cows were fitted with udder nets (Large Mesh Udder Support, Franksville Specialty Company, Phillips, WI) to prevent calves from accessing the teats. Cow and calf were moved to a dynamic group of cows and calves housed in a single pen containing 12 freestalls (Figure 1b). The dynamic group varied in size from 4 to 8 cow-calf pairs over the course of the study; calves were removed from the group at 75 d and calves entered the group at all times up to the maximum of 8 calves per pen. Calves were granted access to the cows' pen at night (1900 to 0700 h). During the day, calves were restricted to a sawdust-bedded calf creep located immediately adjacent to the cow' pen and connected by 2 doors located at either end of the pen. A fence-line system allowed cows and calves to physically interact (e.g., nose touch) during the day. Pens and the calf creep were cleaned and new sawdust replaced once per week. Calves were weighed and received weekly health checks following the standard operating procedures of the farm, and the herd veterinarian treated any calves identified as ill. Four calves from the social group and 3 calves from the individual group were treated for diarrhea, and 1 calf from the social treatment was treated for respiratory disease during the experimental period.

Calves in both treatments were fed 4 L of colostrum by bottle within 6 h of birth. From d 0 to 28 of age, all calves received 8 L/d of whole pasteurized milk, divided in 2 feedings, delivered by bottle at 0700 and 1630 h. From d 29 to 49, calves were fed 6 L/d, also divided into 2 feedings as described above. From d 50 to 54, milk was reduced by 20%/d such that calves were completely weaned at d 55. Calves remained in the same pen until d 75. All calves had ad libitum access to water, TMR (49% DM; consisting of 26% corn silage, 15% grass silage, 10% alfalfa hay, and 49% concentrated mix), and calf starter (90% DM; CP 21%, NDF 19%, ADF 11%; Hi-Pro Medicated Calf Starter, Chilliwack, BC, Canada). Fresh feed and water were delivered daily at approximately 0830 and 1700 h, and feed refusals were removed and weighed just before fresh feed was delivered. Eight calves were continuously observed by video from 0800 h on the day before neophobia testing until 0800 on the test day, and the time spent eating TMR and calf starter were recorded. Eating was defined as when the calf's muzzle was inside the feed bucket.

Procedures

Neophobia tests were chosen to assess the calves' behavioral responses toward a novel food. The test was repeated for 3 consecutive days to assess habituation to the new food. Testing started when calves were 70 d of age (2 wk after weaning) and tests were performed starting at 1500 h.

The test arena, measuring 1.2 m × 2 m with 1.2-m walls, was located adjacent to the pens where the calves were housed and was bedded with 5 cm of fresh sawdust. Calves received all their milk meals in the test arena from 4 d of age until weaning at 56 d, so calves were fully habituated to the enclosure at the time of testing. Calves were not able to see other calves while in the test arena.

Two white 20-L plastic buckets, identical to those used to provide water in the home pens, were placed in each corner of the wall opposite the door of the arena. One bucket contained 2 kg of the novel food; the other bucket remained empty.

A subset of (20 of the 36) test calves was tested with orchard grass hay (83% DM; CP 17%, NDF 49%, ADF 28%) as the novel feed (trial 1; n = 10 per treatment). A second subset (the remaining 16 test calves) was tested with chopped carrots as the novel feed (trial 2; carrots were manually chopped into approximately 3-g pieces on the morning of the test day; n = 8 per treatment). The position of the bucket containing the novel food was varied at random between the 2 corners for each test. Calves were placed into the test arena for 30 min. At the end of the test, feed refusals were weighed and total intake (on an as-fed basis) was determined.

Behavior was video recorded continuously during the neophobia tests (DCRSR100 HDD Handycam Camcorders; Sony Corp., Park Ridge, NJ) using video