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Effect of social housing on the development of feeding behavior and social feeding preferences of dairy calves

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ABSTRACT

This study investigated how social housing affects pre- and postweaning feeding behavior and social feeding preferences of dairy calves. Twenty Holstein bull calves were housed either individually (IH; 10 calves) or in pairs (PH; 10 calves) from birth. Calves were offered grain concentrate and milk replacer ad libitum via an artificial teat (1 teat provided per calf) and weaned by incrementally diluting the milk replacer from 39 to 49 d of age. Postweaning, IH calves were paired within treatment and all pens (n = 5 per treatment) were offered a complete pelleted diet ad libitum and followed until 13 wk of age. We recorded feeding times from video for 3 consecutive days in wk 6, 9, and 12 of age and used this to calculate daily meal frequency and meal duration. In wk 9 and 12, frequency and duration of synchronized feeding were also calculated. In addition, preference tests were conducted at time of feed delivery in wk 10 to assess the preference of each calf to feed alongside or out of visual contact of their pen mate. Pair-housed calves consumed more concentrate, in more frequent meals, than IH calves in the week before weaning (wk 6) and continued to have greater concentrate intake during weaning. Milk intake was not affected by treatment, but calves in PH pens consumed their milk in more frequent and smaller meals. Postweaning, intake was similar between treatments, but calves raised in PH pens continued to have meals that were more frequent and shorter in duration. Both treatments had a similar frequency of synchronized meals. However, when offered a choice to feed alone or alongside their pen mate during preference testing, calves raised in PH pens spent more time feeding in the presence of their pen mate than calves raised in IH pens. These results suggest that meal patterns established in response to different early social environments may persist after weaning and that early social contact may have longer-term effects on social feeding behavior.

Key words: dairy calf, feeding behavior, social behavior

INTRODUCTION

Recent research suggests that social housing may improve the growth and welfare of dairy calves by encouraging greater feed intake (Phillips, 2004; De Paula Vieira et al., 2010), reducing stress and supporting weight gain around weaning (Chua et al., 2002; De Paula Vieira et al., 2010), and supporting the development of normal social behavior (Veissier et al., 1994; Duve and Jensen, 2011). The presence of a social companion appears to be particularly influential when calves are managed on enhanced milk-feeding programs, which provide higher milk allowances or allow ad libitum milk intake, as social contact stimulates starter intake to a greater extent when calves are provided higher milk allowances compared with low allowances (Jensen et al., 2015). Whereas it has been well established that social housing holds potential to encourage early solid-feed intake, the influence of social contact on meal patterning in calves with free access to milk and solid feed has not been widely explored.

After weaning, it is common to house calves in groups, at which point they may encounter novel social situations and competition for feed. Much evidence shows that social contact early in life affects the development of social behavior. Previously group-housed calves have been found to respond to novel social situations with less fear and reactivity (Jensen et al., 1997; De Paula Vieira et al., 2012a) and have greater competitive success when feed access is restricted (Duve et al., 2012). This suggests that prior social contact may influence preference for social feeding and degree of social synchrony in feeding. In addition, De Paula Vieira et al. (2010) reported that calves previously housed in pairs had more frequent concentrate meals and spent more time at the feeder during 2 wk of transition to group pens with an automated feeder, suggesting that prior

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social environment may influence the ability of calves to adapt to a competitive feeding environment. It is unclear, however, whether early social housing influences the development of feeding-behavior patterns that are likely to persist over a longer period of time into the postweaning stage.

The objectives of this study were to assess the effect of preweaning social housing of dairy calves on the development and persistence of meal patterning and social feeding behavior, both before weaning and after grouping in pairs after weaning. We hypothesized that calves housed in pairs before weaning would have more frequent meals, based on the expectation that feeding would be elicited by social factors. After weaning, when all calves were housed in pairs, we hypothesized that differences in meal characteristics, such as more frequent meals in previously pair-housed calves, would persist and that calves raised in a social environment would exhibit more feeding synchrony than calves that were previously housed individually. Furthermore, we hypothesized that early social housing would influence preference for social feeding. Specifically, we predicted that calves previously raised in individual pens would prefer to feed alone, especially when feeding space was restricted, whereas calves raised in paired pens would prefer to feed with another calf.

MATERIALS AND METHODS

Animals and Housing

Twenty male Holstein calves were used in this study. Calves were purchased and transported to the University of Guelph Kemptville Campus Dairy Education and Research Centre (Kemptville, ON, Canada), where they were managed according to the standard operating procedures of the research facility, in accordance with guidelines set by the Canadian Council on Animal Care (CCAC, 2009) and as approved by the University of Guelph's Animal Care Committee (AUP# 1913). All calves received colostrum (at least 4 L within the first 12 h of life) and arrived at the research facility within 24 h of birth. All calves received injections of 1 mL of selenium (Dystosel, Pfizer Animal Health, Kirkland, QC, Canada) and 1 mL of tulathromycin (Draxxin, Pfizer Animal Health) on the day they were placed on the study, as a preventive measure to reduce incidence of illness (Stanton et al., 2013). No serious illness was reported throughout the study.

Milk-Feeding Procedure

During the milk-feeding stage, calves were provided acidified milk replacer ad libitum by teat (according to the procedure outlined by Anderson, 2013). The feeding setup involved rubber teats (Peach Teats; Skellerup Industries Ltd., Woolston, New Zealand) mounted at the front of the pen and attached to tubes fitted with a one-way valve running into covered buckets placed outside the pen. All buckets, lines, and teats were cleaned daily. Calves were fed Shur-Gain Optivia Advantage Milk Replacer (Nutreco Canada Inc., Guelph, ON, Canada), containing 26% CP and 16% fat. The milk replacer was mixed daily, at a rate of 150 g/L, in sufficient volume to feed all calves. At the time of preparation, a prediluted form of formic acid [The Acidified Milk Solution (9.8% formic acid), NOD Apiary Products Ltd., Frankford, ON, Canada] was added to acidify the milk replacer to a target pH between 4.0 and 4.5, to prevent microbial growth over the course of the day.

Experimental Design

The number of replicates per treatment was determined through power analysis (Morris, 1999) for those primary response variables, which had been measured in previous studies, including meal frequency and meal duration of dairy calves. Estimates of variation for these variables were based on previously reported values, obtained under similar experimental conditions (Miller-Cushon et al., 2013, 2014). It was determined that, at 80% power, biologically relevant treatment differences (e.g., differences of 2–4 meals per day) could be detected with the target sample size.

As calves were born and enrolled in the study, they were paired by age and alternately assigned to different preweaning housing treatments: (1) pair housing (**PH**) or (2) individual housing (**IH**) in adjacent pens. Pens for PH calves were twice the size of IH pens (2.4 × 1.8 m; width × depth). Pen walls were solid on 3 sides (1.3 m in height) with a metal gate at the front. Calves in IH pens were able to have physical and visual contact with the adjacent calf through a single window (~20 × 20 cm) located toward the rear of the pen but had no visual contact with other calves while feeding. Openings in the gate at the front of the pen provided access to pails for water and solid feed (pails with an 8-L capacity were used before weaning and pails with a 20-L capacity were used after weaning). The interior of each pen was bedded with wood shavings, with bedding replaced weekly and fresh bedding added as needed. Calf pens were located under a 3-sided, roofed shelter, with the front of the pen facing the open side of the shelter to allow for natural ventilation while protecting the pens from rain. Calves in PH pens had access to milk via 2 teats (placed 50 cm apart in the center of the pen) and 2 feed buckets, whereas calves in IH pens