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Providing supplementary milk to suckling dairy calves improves performance at separation and weaning

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ABSTRACT

Dam rearing can provide health and welfare benefits, but separation and weaning are major welfare challenges. We investigated whether access to an additional source of milk from an automatic milk feeder (AMF) would improve weight gains after separation and weaning. During the first 6 wk of life (dam phase), calves were assigned to 1 of 3 treatments using a parallel group design with repeated measures: nursing (n = 10) and combined (n = 10) calves could suckle from their dams at night (between 2000 and 0800 h), and combined calves also had access to 12 L of milk/d accessible 24 h/d from an AMF. Milk feeder calves (n = 10) also had access to an AMF 24 h/d and were housed with the dam at night but were prevented from suckling by an udder net. Separation from the dam occurred after 6 wk in 2 phases with decreasing contact between cow and calf: partial separation (duration 4 d) and total separation (duration 3 d). At separation, all calves were granted access to 12 L of milk 24 h/d from the AMF until weaning began at 7 wk of age. We hypothesized that access to an AMF during the dam phase would result in less weight loss at separation and weaning compared with calves that had been nutritionally dependent upon the cow (i.e., nursing calves). Calf weight gain during the dam phase averaged (±SD) 1.1 ± 0.26 kg/d and did not vary with treatment. Combined calves drank less milk from the AMF compared with milk feeder calves during the dam phase (mean ± SEM daily milk intake: 1.1 ± 0.38 vs. 8.2 ± 0.34 L/d) and tended to drink less during partial separation (6.7 ± 1.28 vs. 9.8 ± 1.02 L/d), but milk intake from the AMF did not differ between these treatments in the later phases. During the same phases, nursing calves consumed less milk from the AMF than the other treatments; of the 10 calves, 6 did not use the AMF (consuming <1.5 L/d) after the dam phase. After separation, nursing calves gained less weight than calves in both the milk feeder and combined treatments (0.8 ± 0.16 vs. 1.2 ± 0.08 kg/d). Calves using the AMF after separation (n = 23; 4 nursing calves, 9 combined calves, and 10 milk feeder calves) had a higher average daily gain compared with calves that did not (n = 7; 6 nursing calves and 1 combined calf; 1.2 ± 0.07 vs. 0.6 ± 0.21 kg, respectively). In conclusion, use of the AMF after separation varied, but providing an additional milk source reduced nutritional dependency on the dam, improving calf performance at weaning and separation.
Key words: body weight gain, welfare, dam rearing, milk production, behavior

INTRODUCTION

Dam rearing can provide health and welfare benefits for calves (Krohn, 2001; Flower and Weary, 2003). When compared with limit-fed calves, dairy calves nursed by their dams have higher conception rates, calve at an earlier age, and have higher milk production during their own first lactations (Bar-Peled et al., 1997). In addition, nursed calves show less cross sucking (Roth et al., 2009a), improved weight gain, and fewer bouts of diarrhea before weaning (Weary and Chua, 2000).

Cow-calf nursing during part of the colostrum period (defined as the first 3 d postpartum; Vaarst et al., 2001) is a requirement for organic dairy farms in some countries, including Denmark, Norway, and Sweden (Debio, 2005; KRAV, 2012; Videnscenteret for økologisk landbrug, 2012). Some farmers allow cows to nurse their calves for extended periods. We showed that calves in a partial suckling system can have high weight gains preweaning (Johnsen et al., 2015). However, calves reared with the dam show more signs of distress (Froberg et al., 2011) and gain less weight (Haley et al., 2005; Veissier et al., 2013) at weaning compared with calves raised without dams. The combination of separation from the dam, a change in diet from milk to solids, and introduction to new social partners and a new environment likely accentuate the distress response of the calf (see Weary et al., 2008).

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Under naturalistic conditions, weaning is gradual and involves both nutritional and social independence from the dam (von Keyserlingk and Weary, 2007). Encouraging nutritional independence from the dam before separation may ease the transition from milk to solid food. This can be done by covering the dam's udder to prevent offspring from suckling (Orihuela and Hernandez, 2007) by or fitting an anti-sucking device that allows calves to eat solid food but not suckle (Haley, 2006).

Our aim was to investigate how calf access to an additional source of milk provided by an automatic milk feeder (**AMF**) would affect performance at separation and weaning. We hypothesized that calves accustomed to feeding from an AMF would continue to use this after nursing was prevented and that these calves would therefore lose less weight after separation compared with nursed calves not accustomed to feeding from an AMF. In this way, separation from the dam and weaning from milk could be separated in time. Once calves were established on the milk feeder after separation, milk intakes could be systematically reduced, easing the transition to solid feed.

MATERIALS AND METHODS

This study took place at the University of British Columbia's Dairy Education and Research Centre (Agassiz, Canada) from June to October 2012 and was part of a larger study that aimed to explore the bond between cow and calf (Johnsen et al., 2015). The university's animal care committee approved the study following the guidelines of the Canadian Council for Animal Care (Olfert et al., 1993).

Experimental Design

Thirty-three Holstein cow-calf pairs were included in the study, but 3 cow-calf pairs, 1 from each treatment, were excluded from the final analysis due to illness. Immediately following parturition and for 6 wk postpartum (dam phase), the pairs were assigned to 1 of 3 treatment groups (Figure 1 shows a schematic outline of the trial), each representing a different level of nutritional dependency on the dam. Nursing calves (n = 10) could only obtain milk by suckling from the mother; milk feeder calves (n = 10) could obtain milk only from an AMF (CF1000 CS-Combi automatic feeder, DeLaval, Tumba, Sweden) 24 h/d; and combined calves (n = 10) could obtain milk both by suckling and from the AMF 24 h/d. Pairs from all 3 treatments were kept together in the experimental area, which contained a cow pen, a calf creep, and a separation pen (Figure 2). Cows and calves were kept together at night (between 2000 and 0800 h) and housed in separate but adjacent pens during the the day (between 0800 and 2000 h). During the day, calves were housed in a calf creep allowing visual, auditory, and limited tactile contact with the cows in the cow pen. Cow-calf pairs were enrolled over a 2-mo period, and cows and calves were included in the trial for 6.5 and 8 wk, respectively. A maximum of 24 cows were housed in the cow pen at any one time. The calf creep and separation pen housed a maximum of 24 and 12 calves at a time, respectively. All pens housed only animals included in the experiment. Cow-calf pairs were blocked by birth date into blocks of 3 cow-calf pairs and the maximum age difference within a triplet was 6 d. Treatment was assigned at random within the blocks, with one pair being assigned to each treatment. The separation of the calf from its dam occurred in 2 phases starting when the calves were 6 wk old: partial separation (duration 4 d), during which the calves were fence-line-separated from their dams (described below), and total separation (duration 3 d), when dams were in a remote pen. At the start of the partial separation, calves were granted 24 h/d access to 12 L/d of milk from the AMF (described in detail below). At 7 wk of age, calves were gradually weaned off milk from the feeder through a step-down procedure (described below).

Cows were milked twice daily throughout the study (at approximately 0800 and 1700 h) in a double-12 milking parlor. Four first-parity cows were included in both the nursing and the combined treatments, and 3 first-parity cows were included in the milk feeder treatment. Median parity for all 3 treatments was 2, and the mean (±SD) 305-d lactation estimate was 11,730 ± 3,189 L.

Calving Management

Calving took place in individual calving pens (4 × 4 m). The cow-calf pairs remained in the calving pens for 33 to 76 h postpartum. Established nursing (i.e., calf suckles without assistance) for the nursing and combined treatments was a prerequisite for moving a cow-calf pair to the group pen. Udder nets (model no. 87355301, DeLaval) were attached to cows in the milk feeder treatment directly following parturition. The udder nets covered the teats and prevented the calf from suckling. Calves were assisted to stand (milk feeder treatment) or stand and suckle (nursing and combined treatments) if the calves were not seen to do so on their own within 6 h of birth. All newborn calves were hand fed 2 to 4 L (depending on voluntary intake) of quality-controlled colostrum (i.e., colostrum with specific grav-