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Effect of age of introduction to an automated milk feeder on calf learning and performance and labor requirements

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ABSTRACT

Group housing of dairy calves with automated milk feeders (AMF) is increasingly being used, but the effect of introducing calves to the AMF at a very young age (<24 h) on calf performance, health, and welfare, as well as farm personnel labor requirements are unknown. The objective of this controlled trial was to investigate whether early (<24 h after birth) introduction of calves affects the time to learn how to drink from the AMF, labor requirements for feeding milk during the learning phase, and average daily gain during the milk-feeding period compared with calves conventionally introduced at 5 d of age. Sixty Holstein calves (heifers and bulls) were assigned at birth to either early introduction (<24 h after birth) or conventional introduction (at 5 d of age) to the group pen with AMF. After birth, calves were housed in individual pens and then introduced, based on assigned treatment, to the group pen with an AMF and a continuous flow stocking approach. Calves were fed milk replacer and gradually weaned from d 47 to 60 of age. Calves had access to starter from 5 d of age, and to water and straw right after colostrum feeding. We measured the time between first training to use the AMF and first unassisted visit to the AMF with milk intake, the number of assisted visits until the calf was independent in its use of the AMF (successful learning), and the total time required for milk feeding (labor) until successful learning. Calves were weighed at birth, 30, 46, and 61 d of age, and were monitored daily for signs of disease. Daily milk and starter intake per calf were automatically recorded. Early-introduced calves took longer to successfully learn to use the AMF {64.9 h [95% confidence interval (CI) = 59.1 to 77.9] vs. 31.4 h (95% CI = 22.8 to 47.9)} and tended to require more assisted visits [7.8 visits (95% CI = 6.2 to 9.7) vs. 5.9 visits (95% CI = 4.8 to 7.5)] compared with conventionally introduced calves. Labor for milk feeding was greater for conventionally introduced calves relative to early-introduced calves [145.6 min (95% CI = 125.1 to 169.4) vs. 39.9 min (95% CI= 33.5 to 47.6)]. Disease risk was similar between treatments but the risk of severe versus mild diarrhea was greater for early- compared with conventionally introduced calves (odds ratio = 4.7; 95% CI 1.01 to 31.1). Early-introduced calves consumed less milk during the first days of life compared with conventionally introduced calves (d 2 = 5.5 vs. 6.4 L; d 3 = 7.0 vs. 8.2 L; d 4 = 7.0 vs. 8.4 L; d 6 = 6.4 vs. 7.9 L; d 7 = 6.0 vs. 7.0 L, respectively), with no differences after 8 d. We found no effect of treatment on average daily gain. Although introducing calves <24 h after birth required more assistance to use the AMF, farm labor for milk feeding tasks was less for early-introduced calves. Thus, with early introduction to AMF, a trade-off may exist between reduced labor per calf, with no effect on weight gain, but potentially a higher risk of severe diarrhea (vs. mild).

Key words: dairy calf, automated feeding, group housing, introduction

INTRODUCTION

Labor requirements, calf health and performance, and the adaptation of calves to an automated milk feeder (**AMF**) are factors influencing the decisions around the age of introduction of calves to the group pen with an AMF. Jensen (2007) found that calves that were introduced at 6 d old had 2.3 times greater odds of needing guidance to drink from the AMF than calves introduced at 14 d of age, and spent significantly less time at the feeder and ingested less milk. Fujiwara et al. (2014) found that the more guidance given to a calf to drink from an AMF, the longer it took for that

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calf to drink independently from the feeder. Fujiwara et al. (2014) also showed heavier calves at introduction to the AMF (at 6 d of age) had a shorter latency to first voluntary drink. Svensson and Liberg (2006) found that the odds of respiratory disease increased as age of introduction to the group pen decreased.

Although research (Svensson and Liberg, 2006; Jensen, 2007) suggests that later introduction (i.e., >2 wk of age) to the group pen may be preferable in terms of calf health and farm labor, recent data on commercial dairy farms in North America indicate that the median age of introduction to group pens with AMF is 5 d and ranges from <1 to 14 d (Jorgensen et al., 2017; Medrano-Galarza et al., 2017a; mean group size was 17 calves and ranged from 6 to 60). This may stem from producers seeking to minimize the labor required for manually feeding milk to calves when using AMF. In addition, there may be some longer-term advantages of providing calves with social contact at an earlier age (Duve and Jensen, 2011). Currently, insufficient research exists on the implications of introducing very young calves to a group pen with AMF. Therefore, our objectives were to evaluate the effects of early introduction (within 24 h after birth) to a group pen on calf latency to learn to use the AMF, number of assisted visits until successful learning, ADG, and farm personnel labor requirements regarding milk feeding chores, and compare this early introduction with the average age of introduction in the North America industry. We hypothesized that calves introduced at an early age would take longer to learn to drink from the AMF and need more guidance (i.e., more assisted visits), but would require less labor for feeding milk compared with calves introduced at the conventional age. Additionally, it was hypothesized that age of introduction would not have an effect on ADG.

MATERIALS AND METHODS

This controlled trial was carried out at the University of Guelph Livestock Research and Innovation Centre – Elora Dairy Facility (Elora, ON, Canada) from January 12 (birth date of the first calf enrolled in the study) to July 23, 2017 (1 d after last calf enrolled in the study was weaned). Procedures were reviewed and approved by the University of Guelph Animal Care Committee (AUP no. 3477).

Animals and Treatments

All calves (bulls and heifers) that were born on the research center were eligible for the study unless other ongoing trials requested animals, which resulted in 11 calves being excluded from the current study. A total of 60 calves were enrolled (30 per treatment group). This sample size would allow for detection of a 24-h (SD = 32) difference in the latency to learn to use the AMF, a difference of 3 assisted visits (SD = 4), a 22-min (SD = 30) difference in labor regarding milk feeding tasks, and a 0.15-kg/d (SD = 0.2) difference in ADG between treatment groups, with 95% confidence and 80% power (WINPEPI version 11.62; Abramson, 2011).

Calves were randomly allocated at birth, based on a randomization table (using random number generator in Excel, Microsoft Corp., Redmond, WA), to 1 of the 2 treatments: early introduction (<24 h after birth) or conventional introduction (at 5 d of age) to the group pen with AMF. As calves were born, they were enrolled in the study after their second colostrum feeding. Calves from both treatments were commingled in each pen. Calves were offered 3 L of their dam's colostrum within 2 h of birth (or first thing in the morning if the calf was born between 2100 and 0500 h), and another 3 L was provided 6 to 12 h after the first feeding. The total volume of colostrum consumed varied between calves, mainly dependent on calf size and vigor. Colostrum was always fed through a teat-bottle, unless the calf totally refused to suck, in which case an esophageal tube was used. Calves were allowed to be dried by the dam (first colostrum feeding was usually done in the maternity pen) and separation took place within 2 to 3 h after birth (except for calves born overnight, where separation occurred between 0500 and 0700 h). All calves were placed in an individual pen (described below), where navel disinfection was performed, and vitamin E and selenium (Dystosel, 1.5 mL/45 kg of BW s.c.; Zoetis, Kirkland, QC, Canada) and the second colostrum feeding were administered. From January to the end of March, all calves wore a jacket (Calf Jacket, Spectrum Nasco, Newmarket, ON, Canada) for the first 3 wk of life, approximately.

Housing and Management of Pens

Similar to the most common setup of AMF on commercial dairy farms in Canada (Medrano-Galarza et al., 2017a), 1 AMF was used to deliver milk replacer into 2 feeding stations, each located in a separate pen (group pen 1 and 2; Figure 1). The AMF (DeLaval calf feeder CF1000+, DeLaval Canada, Peterborough, ON, Canada) had an extra pump to allow for the simultaneous feeding of calves in both pens. Although 1 AMF supplied milk to 2 pens, these 2 pens were located in 2 separate nursery rooms (room A and B; Figure 1), which were isolated from the cow barn. Two AMF machines were located at the research center, for a total of 4 nursery rooms (Figure 1). The nursery rooms were artificially ventilated through an automatic positive-