J. Dairy Sci. 98:1–10
http://dx.doi.org/10.3168/jds.2015-9759

Effects of human visitation on calf growth and performance of calves fed different milk replacer feeding levels.

N. E. Guindon,* N. T. Antaya,* R. G. Cabral,*[1] N. L. Whitehouse,* T. J. Earleywine,† and P. S. Erickson*[2]
*Department of Biological Sciences, University of New Hampshire, Durham 03824
†Land O'Lakes Animal Milk Products, Cottage Grove, WI 53527

ABSTRACT

Twenty-eight newborn Holstein heifer calves from the university herd and 8 newborn Holstein heifer calves from a commercial herd were blocked by birth and herd into 1 of 4 treatments: conventional [20% crude protein (CP), 20% fat] milk replacer (MR; treatment C) with (1) or without (0) human visitation, or a higher plane of MR nutrition (28% CP, 20% fat) regimen (treatment A) with (1) or (0) without human visitation. Calves on C MR treatments received 454 g of MR from d 2 to 41. Calves on A MR received 916 g of MR from d 2 to 8 and 1134 g of MR from d 9 to 41. Visitation with calves occurred at 1030 and 1430 h daily from d 1 to 56 and comprised verbal stimulation and stirring of starter grain. An opaque curtain divided the calf nursery, with calves in the front half assigned to visitation treatments and those in the rear half not assigned to visitation treatments. Calves were fed their MR treatment until d 43 (preweaning), after which all calves received half of their allotment of MR until d 49 (weaning). Calves were tracked for the next week until d 56 (postweaning). Starter grain and MR intakes were measured daily along with weekly body weight and skeletal measurements. One half of the calves on each treatment had blood samples taken via jugular venipuncture on d 41 (preweaning), 43, 45, 47, 49, and 51 (postweaning) to evaluate blood glucose, urea, nonesterified fatty acids, and cortisol concentrations. During the preweaning and weaning phases, calves on A0 and A1 treatments consumed more MR, less starter, and weighed more than the C0 and C1 calves. Calves on A0 and A1 had greater average daily gain (ADG), hip and withers gain, were taller at the hip, and had larger girths during the preweaning phase. Overall, body weight, withers and hip heights, and heart girths were greater in A0 andA1 calves during the weaning week. Efficiency of utilization of estimated metabolizable energy (ME) intake (ADG/ME) were similar. Glucose and nonesterified fatty acids concentrations were greater in visited calves preweaning. An interaction for glucose was observed during weaning, with A1 calves having the highest concentration and A0 calves having the lowest concentrations during weaning. Cortisol tended to be higher in visited calves during weaning. Postweaning, calves formerly fed A0 and A1 treatments had lower blood glucose and tended to have higher urea and cortisol concentrations than C0 and C1 treatments. The higher plane of nutrition fed calves tended to have higher cortisol concentrations indicating that they experienced more stress due to the removal of MR more than calves fed conventionally. Calves fed the higher plane of MR nutrition consumed more dry matter, ME, and water weighed more, had a greater ADG, and were taller than calves fed the conventional MR. These calves were more efficient (ADG/dry matter intake) when expressed on a dry matter basis, but had similar efficiency when expressed on an ME basis (ADG/ME). Visiting calves did little to reduce the stress of weaning when calves are fed the higher plane of nutrition MR feeding regimen.

Key words: calf-human interaction, higher plane of milk replacer nutrition, starter, water intake

INTRODUCTION

Growing replacement dairy heifers to breeding height and weight within 12 to 14 mo of birth is crucial for maximizing the return on the investment of heifer raising. Feeding preweaned calves large [>0.7 kg of milk replacer (**MR**) DM] or ad libitum amounts of MR has produced positive results in young calf growth (Cowles et al., 2006; Hill et al., 2013). Studies have reported gains 50% greater in calves fed ad libitum milk compared with limit-fed calves (Appleby et al., 2001; Jasper and Weary, 2002). Every 1 kg of additional ADG in calves during the preweaning period resulted in 1,113 kg more milk during their first lactation (Soberon et al., 2012).

Received April 28, 2015.
Accepted August 29, 2015.
[1]Present address: Famo Feeds, Freeport, MN 56331.
[2]Corresponding author: peter.erickson@unh.edu

Intensified (or accelerated) MR are formulated with a higher level of CP (26–28% DM) than conventional MR (20–22% DM) and fed at a higher rate than conventional MR (>0.7 vs. <0.6 kg/d of DM). Raeth-Knight et al. (2009) observed a doubling of BW by 8 wk of age in calves fed a high-protein, low-fat MR (28% CP, 16% fat). In that experiment, calves were fed the MR at either low solids (12.5%) or high solids (16.7%) until 6 wk of age; this feeding regimen is designed to maximize structural growth. Cowles et al. (2006) observed a pause in ADG in calves fed on the intensified program during weaning compared with the conventionally fed calves. In that experiment, calves were weaned beginning on d 42 and concluding on d 49 of life by only feeding half of the MR powder at the morning feeding. Postweaning, no differences were noted in ADG among treatments; this was due to the decrease in starter grain intake seen before and during weaning in calves fed an intensified program. Preweaning starter intakes were less than half of what calves fed conventional MR were eating (Cowles et al., 2006; Raeth-Knight et al., 2009). Weaning can be accomplished in several ways, including removing one of the feedings per day or removing feedings abruptly. Sweeney et al. (2010) observed BW loss in calves fed upwards of 12 kg of milk/d and weaned abruptly compared with calves weaned gradually. Hill et al. (2010) observed reduced DM and OM digestibility in the immediate 3 d postweaning with calves fed an intensified MR program. These results (Hill et al., 2010) support the results of Terre et al. (2006b), who observed reduced urinary excretion of purine derivatives from calves fed an intensified program. This same research group (Terre et al., 2007) observed reduced apparent digestibility of DM, OM, NDF, and CP the week after weaning in calves formerly fed an intensified MR regimen. Therefore, rumen development is likely limited in calves fed an intensified program. However, Davidson et al. (2013) found no differences in rumen papillae development by 84 d of age in calves fed either a control MR (20% CP, 20% fat) compared with calves fed an intensified MR feeding program (28% CP, 20% fat).

Behavioral studies provide some insight to losses in growth during the weaning period. When raised with a companion of the same age, calves were less stressed and showed no negative responses to being weaned compared with calves raised alone. The calves raised separately ate less grain and were more stressed during weaning (Chua et al., 2002). When raised with a companion heifer of the same age and an older weaned heifer, improved results were seen in calf performance before and during weaning. Calves that had an older companion began eating starter at an earlier age, consumed more starter throughout the experiment, and showed few signs of stress during weaning compared with calves raised singly. These data indicate the importance of social learning for calves (De Paula Vieira et al., 2012). Recently, Jensen et al. (2015) showed that pair-housed calves fed 9 L of milk and allowed to play consumed more concentrate than individually housed calves fed 9 L of milk, suggesting that social interaction will improve starter intake. These calves (pair-housed and fed 9 L of milk/d) also had greater ADG than calves fed 5 L of milk/d that were housed individually or in pairs, or those fed 9 L of milk but housed individually. These data indicate that social interaction can enhance growth and starter intake in calves fed a high plane of nutrition MR and possibly decrease stress during weaning.

We hypothesized that additional human attention throughout the day, by way of visitation, auditory stimulation of the calf and handling the starter grain, would help minimize weaning stress and maximize calf growth for calves fed a higher plane of nutrition feeding program. The objectives of our experiment were to compare the performance of calves fed different milk replacer feeding programs and to determine if human interaction improved performance and reduced weaning stress in calves.

MATERIALS AND METHODS

Calves, Diets and Treatments

This experiment was reviewed and approved by the University of New Hampshire Institutional Animal Care and Use Committee (protocol #120106). Thirty-six Holstein heifer calves from 2 New Hampshire farms (28 calves from the University of New Hampshire herd and 8 from a commercial herd) were randomly assigned at birth and by herd to 1 of 4 treatments in a 2 × 2 factorial arrangement of treatments in a randomized complete block design. The treatments were (1) a non-medicated, conventional MR (20% CP, 20% fat) with (**C1**) or without (**C0**) visits or (2) high-protein MR (28% CP, 20% fat) with (**A1**) or without (**A0**) visits. Both MR products were provided by Land O'Lakes Animal Milk Products (Shoreview, MN)

Calves from the university herd were removed from their dams immediately after birth and transferred to an individual calf stall (1 × 2.15 m) in a naturally ventilated, enclosed calf room. Additional cross-ventilation was added with 50.8-cm window-mounted box fans, as barn curtain dividers had some effect of natural ventilation. Dry shavings were used on top of indwelling stall mattresses. A lacteal-based colostrum replacer (1.9 L; Land O'Lakes Animal Milk Products) was fed within 1 h of birth and again between 6 and 8 h after birth.