The Professional Animal Scientist 28 (2012):125–130

Case Study: Effect of feeding rate and weaning age of dairy calves fed a conventional milk replacer during warm summer months

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ABSTRACT

Feeding rate of a 21% CP, 21% fat milk replacer (MR) and weaning age of Holstein dairy calves (initially 42 ± 1.1 kg of BW) were examined during summer months (averaging 24°C). In previous cool-weather (<10°C) trials, feeding more MR has reduced starter intake and not increased ADG. In trial 1, the MR was fed to provide 3 MR feeding rates (0.44 kg daily for 28 d; 0.55 kg daily for 28 d; 0.66 kg daily for 14 d followed by 0.44 kg daily for 14 d). In trial 2, the MR was fed at 2 rates (0.44 and 0.66 kg/d) and calves were weaned at 2 ages (28 and 42 d) to provide 4 treatments. Measurements were made in individual nursery pens (fed MR) until 56 d and within group pens (no MR) for 56 more days. In each trial, ADG and hip-width change increased ($P < 0.05$) with more MR fed, but there was no difference ($P > 0.05$) in postweaning performance. Starter intake did not differ ($P > 0.05$) among MR rates and was low compared with other trials in this laboratory, likely because of heat stress. Feeding 0.66 kg of DM supported more ($P < 0.05$) ADG in calves weaned at 42 d verses 28 d. Feeding 0.66 kg of DM from a 21% CP, 21% fat MR increased ADG by as much as 19% versus feeding 0.44 kg of the same MR. Therefore, feeding 0.66 kg of DM from MR can serve as a tool to overcome some of the ADG lost during heat stress in young dairy calves.

Key words: feeding rate, heat stress, milk replacer

INTRODUCTION

Heat stress reduces calf performance. Chester-Jones et al. (2008) reported reduced starter intake during May through September compared with other months of the year in southwest Minnesota. McKnight (1978) reported reduced starter intakes and lower ADG of calves in summer compared with winter or fall in southeast Ontario, Canada. Bateman et al. (2012) reported ADG to decline as environmental temperature increased (approximately 1% ADG change per °C) in southwest Ohio. Cooling calves with fans during warm weather has been shown to reduce respiration rates of calves and improve their ADG, while not changing starter intake (Hill et al., 2011). This indicates that heat stress is increasing the maintenance energy requirements of the calf. Feeding more milk replacer (**MR**) during heat stress may be a way to provide more energy for maintenance.

Increasing the feeding rate of a conventional 21% CP, 21% fat MR fed at 0.44 to 0.66 kg daily during warm summer temperatures may increase preweaning ADG but not change starter intake and postweaning ADG. These hypotheses were tested by feeding a conventional MR at different rates and weaning dairy calves at different ages during heat stress in summer months.

MATERIALS AND METHODS

Calves were cared for by acceptable practices as described in the *Guide for the Care and Use of Agricultural Animals in Agricultural Research and Teaching* (FASS, 2010). Calves were initially 2 to 3 d of age and were sourced from one dairy farm and transported approximately 3.5

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Table 1. Analyzed nutrient composition (DM basis) of the feeds in trials 1 and 2

	Trial 1				Trial 2			
Nutrient	Milk replacer	Starter	Grower	Hay	Milk replacer	Starter	Grower	Hay
DM, %	96.8	88.1	87.9	87.4	97.1	87.9	88.0	88.2
CP, %	20.7	20.5	20.7	15.9	20.8	20.7	20.6	15.4
Fat, %	20.8				20.7			
ADF, %	—	6.7	6.8	38.9	—	6.9	6.3	39.3
NDF, %	—	13.5	13.4	59.3	—	14.1	13.7	58.8
Ash, %	8.8	6.8	6.8	7.1	8.6	6.5	6.8	6.9
Ca, %	0.79	0.75	0.77	0.79	0.81	0.75	0.73	0.75
P, %	0.62	0.53	0.53	0.39	0.64	0.54	0.53	0.32
ME,[1] Mcal/kg	4.71	3.25	3.25	2.42	4.71	3.35	3.35	2.42

[1]Metabolizable energy calculated using NRC (2001) equations.

h to the Nurture Research Center in southwest Ohio, where the trials were conducted.

Trial 1

Calves (32 per treatment; initially 42.5 ± 1.11 kg of BW) were fed a 21% CP, 21% fat MR (Nurture Basic, Provimi North America, Lewisburg, OH) to provide 3 treatments (0.44 kg daily for 28 d; 0.55 kg daily for 28 d; 0.66 kg daily for 14 d followed by 0.44 kg daily for 14 d; Table 1) fed for the first 28 d of the trial. The MR powder was mixed as a 15% solution with water. On d 26, 27, and 28, calves were only fed their MR at the a.m. feeding to facilitate weaning. Calves were fed a coarse, textured, 20% CP starter consisting of 37% whole corn, 25% whole oats, 35% supplement pellets (providing 23.75% soybean meal, 5.57% wheat middlings, 1.25% Ca carbonate, 0.78% moncalcium phosphate, 0.7% alfalfa meal, 0.7% starch, 0.6% salt, and 1.65% other ingredients), and 3% molasses. During d 56 to 112, calves were fed the same starter blended with 5% chopped grass hay at the time of feeding. The dry feeds and water were offered free choice. Calves were housed through d 56 in individual pens in a curtain-sided nursery with a ridge vent that used natural ventilation. The pens were 1.2 × 2.4 m with wire mesh sides and bedded with straw. From d 56 to 112, calves were moved to group housing of 4 calves per pen. The pens provided 6.5 m^2 of outside pen space and 1.35 m^2 of inside pen space per calf. Calf groupings were randomized before d 0 to maintain groups of calves from their MR treatments. Fecal scores were assigned daily based on a 1-to-5 system through d 56 (1 = normal, thick in consistency; 2 = normal, but less thick; 3 = abnormally thin but not watery; 4 = watery; 5 = watery with abnormal coloring; modified from Kertz and Chester-Jones, 2004). Medical treatments were recorded daily. Calves were weighed initially and every 7 d through d 56 and every 28 d through d 112. Hip widths were measured with a caliper initially and every 14 d. Calf BCS were recorded initially and every 14 d through d 56 and every 28 d through d 112. A 1-to-5 system using 0.25-unit increments with 1 being emaciated and 5 being obese was used for BCS (Wildman et al., 1982).

Two blocks of 48 calves were used. The average nursery temperature during the trial was 25°C (ranged from 9 to 37°C) and average humidity was 66% (ranged from 23 to 98%) based on hourly measurements. Data were analyzed separately within 0 to 56 d and 56 to 112 d periods as a completely randomized block design using repeated measures over time by Proc Mixed in SAS (SAS Institute Inc., Cary, NC). Two preplanned contrast statements were used to separate means (0.44 kg vs. 2 greater treatments; 0.55 kg vs. 0.66 kg followed by 0.44 kg). Calf was the experimental unit from 0 to 56 d. Pen was the experimental unit from 56 to 112 d.

Trial 2

Calves (24 per treatment from one dairy farm; initially 42.3 ± 0.85 kg of BW) were fed a 21% CP, 21% fat MR (Nurture Basic as in trial 1) at 2 rates (0.44 and 0.66 kg/d) and weaned at 2 ages (28 and 42 d) to provide 4 treatments. The MR powder was mixed as a 15% solution with water. Calves were fed MR in the a.m. only on the last 3 d of the assigned MR feeding period to facilitate weaning. The dry feeds and feed management were the same as in trial 1. Dry feeds and water were offered free choice. Calves were housed and managed as in trial 1. Two blocks of 48 calves were used. The average nursery temperature during the trial was 24°C (ranged from 13 to 34°C) and average humidity was 72% (ranged from 25 to 99%) based on hourly measurements. Data were analyzed as a 2-by-2 factorial arrangement of MR feeding rate and weaning age in a completely randomized block design using repeated measures over time by Proc Mixed in SAS. In the case of interactions between rate and age, means were separated using the Student-Newman-Keuls test. Calf was the experimental unit from 0 to 56 d. Pen was the experimental unit from 56 to 112 d.