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Effects of weaning age and milk feeding frequency on dairy calf growth, health and rumen parameters ☆

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Abstract

Various methods can be used to feed dairy calves that may influence calf performance and these include changing frequency of feeding or age at weaning. Two trials were conducted to determine effects of feeding frequency and weaning age on calf growth, health and rumen development, where 124 Holstein heifer and bull calves were weaned at 3, 4, 5 or 6 weeks of age. During Trial 1, milk replacer (12.5% DM; 22% CP, 15.6% fat) was fed at 10% BW twice per day until 1 week prior to weaning when intake was reduced to 5% BW. During Trial 2 calves were fed at 10% BW in two feedings until 14 days, then at 10% BW once daily until 1 week prior to weaning when milk replacer was reduced to 5% BW. Blood glucose and urea nitrogen, BW 4 h post-feeding, heart girth, hip height, and withers height 4 h post-feeding were obtained weekly. Growth and structural measurements were similar for all treatments up to 8 weeks of age in both trials. Blood constituents and health observations were not different between trials. Similar growth and performance between treatments in both trials through 8 weeks of age indicate that calf performance is not affected by weaning early and feeding once daily.
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Keywords: Calf growth; Feeding frequency; Weaning

1. Introduction

Weaning calves as early as 3 to 5 weeks from milk or milk replacer saves labor, time and feed costs (Owen and Larson, 1982). However, in the United States, dairy calves are commonly fed milk twice daily and average weaning age is 8.4 weeks (USDA, 2002).

Calves are able to utilize VFA prior to weaning at 3 weeks of age, thereby allowing earlier weaning (Martin et al., 1959) than is often accomplished on dairy farms. Calves having early access to solid feed and weaned as early as 4 weeks of age increased starter feed intake as well as plasma VFA, indicating successful adaptation to weaning (Quigley et al., 1991). Other work reported adequate rumen bacterial populations starting at 3 weeks of age, resulting in higher ruminal metabolic activity when compared with conventionally weaned calves (Anderson et al., 1987). Winter (1985) weaned calves at 3, 5, and 7 weeks of age and reported no differences in average daily gain (ADG) and dry matter intake (DMI) pre and post-weaning. Other research showed calves

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weaned earlier were not different from calves weaned conventionally in feed intake, ADG and feed efficiency (FE); however, early weaning reduced feed and labor costs (Winter, 1985).

An alternative method to improve calf management is feeding milk replacer once daily. For example, calves may be fed twice daily from birth until 10 to 14 days of age, then both feedings consolidated into one feeding. Feed intake and FE were similar between calves fed once or twice daily. Feeding once daily also reduced labor spent on feeding calves by 30% (Galton and Brakel, 1976). In another study, no differences were detected in withers height and heart girth between calves fed once or twice daily (Willett et al., 1969).

Although the use of once daily feeding and early weaning result in similar calf performance compared to conventional strategies, little research has incorporated both options into one management system. Therefore, the objective of these studies was to determine the effect of different weaning ages and 2 milk replacer feeding strategies on rumen, blood, growth, and health parameters.

2. Materials and methods

2.1. Animals, housing, and diet

Holstein heifer and bull calves from the Pennsylvania State University dairy herd were separated from their dams 0.5 to 1 h after birth and housed in 1.2-×2.4-m individual pens in a naturally and mechanically ventilated barn bedded with wood shavings. Nose to nose contact was eliminated by pen arrangement. All calves received 4 L of colostrum within 6 h of birth followed by 4 feedings (over 2 days) of transition milk before feeding of milk replacer. Calves were assigned to treatments at birth in a randomized complete block design and maintained on the study until 8 weeks of age. Milk replacer fed was 22% CP (all milk protein), 15% fat (lard; Akey, Inc., Lewisburg, OH), and contained no additional additives or medication and was mixed at 12.5% DM for feeding. Fresh calf starter feed (Purina Mills, Camp Hill, PA; textured starter with rolled corn, rolled oats and a protein/supplemented pellet) was offered ad libitum and intake was recorded daily. Water was offered free choice daily. Calves were kept in individual pens from birth until 1 week after weaning when they were moved to a group pen (4×5 m^2) with a maximum of 5 animals per pen and group fed through 8 weeks of age. Treatments consisted of weaning calves at 3, 4, 5 or 6 weeks of age (treatments 3, 4, 5 and 6). Although average weaning is 8.4 weeks of age, 30% of US farms wean at 6 weeks or less (USDA, 2002). Research has shown no differences in growth and health of calves weaned at 6 or 8 weeks of age; therefore, 6 week weaning age was chosen as an upper limit (Appleman and Owen, 1974).

For Trial 1, 34 heifer and 30 bull calves (16 calves/ treatment) were fed at 5% of birth BW in the morning and 5% of birth BW in the afternoon from birth until 1 week prior to their respective weaning age; during the final week, milk replacer was fed at 5% of birth BW for the morning feeding only. For Trial 2 which began immediately after Trial 1, 36 heifer and 24 bull calves (15 calves/ treatment) were fed at 5% of birth BW in the morning and 5% of birth BW in the afternoon from birth until 14 days of age. Beginning on day 15, calves were fed 10% of birth BW in the morning until 1 week prior to their respective weaning age, at which time milk replacer was reduced to 5% of birth BW fed in the morning. Both trials shared one common treatment (treatment 3) where calves were fed exactly the same format. All experimental procedures were approved by the Pennsylvania State University Animal Care and Use Committee.

2.2. Feed nutrient composition

Composition of calf starter used throughout the study and milk replacer used for both trials is presented in Table 1. Milk replacer and calf starter samples were taken twice monthly and stored at −20 °C until further

Table 1
Composition of calf starter and milk replacer used for weaning age and feeding frequency experiments[a]

Item	Calf starter[b]	SE	Milk replacer	SE
Crude protein, %	22.75	1.53	22.79	0.05
Fat, %[c]	1.71	.	15.64	1.11
Acid detergent fiber, %	6.70	0.14	.	.
Neutral detergent fiber, %	14.50	0.98	.	.
Ash, %	10.25	0.82	7.48	0.04
Non-fiber carbohydrate, %[d]	49.53	1.49	.	.
Calcium, %	1.25	0.04	0.81	0.01
Phosphorus, %	0.61	0.03	0.63	0.03
Magnesium, %	0.27	0.02	0.10	0.01
Potassium, %	1.28	0.05	1.69	0.19
Sodium, %	1.37	0.05	0.69	0.05
Manganese, ppm	87.50	12.89	0.42	0.03
Zinc, ppm	116.75	19.31	0.53	0.01
Copper, ppm	26.25	1.5	0.11	0.02
Vitamin A, IU/kg[c]	6,600	.	35,140	198
Vitamin D, IU/kg[c]	2,200	.	7,780	311
Vitamin E, IU/kg[c]	22	.	151	0

[a] All values are expressed on a DM basis.
[b] Purina Mills, Inc., Camp Hill, PA.
[c] Starter values based on manufacturer's tag.
[d] Calculated.

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