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Growth, behavior, and economics of group-fed dairy calves fed once or twice daily in an organic production system

M. J. Kienitz, B. J. Heins,[1] and H. Chester-Jones
Department of Animal Science, University of Minnesota, St. Paul 55108

ABSTRACT

Heifer calves (n = 102) were used to evaluate the effect of once- or twice-daily feeding on growth, behavior, and economics of calves in an organic group management system. Calves were assigned to replicate feeding groups of 10 in superhutches by birth order, during 2 seasons from September to December 2013 and March to May 2014 at the University of Minnesota West Central Research and Outreach Center, Morris. Calves in groups were the experimental unit. Breed groups of calves were Holsteins (n = 26), crossbreds (n = 45) including combinations Holsteins, Montbéliarde, and Viking Red (selected for high production), and crossbreds (n = 31) including combinations of Holsteins, Jersey, Normande, and Viking Red (selected for robustness). Treatment groups were once-daily feeding (1×) or twice-daily feeding (2×). Calves in both groups were fed 6 L per calf/daily of organic milk with 13% total solids and then weaned at 60 d when the group consumption averaged 0.91 kg/d of starter per calf. Body weight and hip height were recorded at birth, once a week, at weaning, and at 90 and 120 d of age. Hobo Pendant G loggers (Onset Computer Corp., Bourne, MA) were applied to the right rear leg of calves to measure total lying and standing time. Data were analyzed using PROC MIXED of SAS (SAS Institute Inc., Cary, NC). Independent variables for analyses were the fixed effects of birth weight (co-variable), season of birth, and treatment group, along with replicate as a random effect. No significant differences were found between feeding groups for body weight, weight gain, average daily gain, hip height, or heart girth. For calves in 1× and 2× groups, respectively, weaning group performance was as follows: gain per day was 0.79 and 0.81 kg, weaning weight was 92.7 and 93.3 kg, and weaning hip height was 95.2 and 95.3 cm. Daily gain to 90 d was 0.85 and 0.85 kg, and daily gain to 120 d was 0.85 and 0.83 kg for 1× and 2× calves, respectively. For lying time, calves in groups 1× (988 min/d) and 2× (995 min/d) did not differ. During the evening hours, 2× calves had lesser lying times (34 min/h for 1×; 28 min/h for 2×) because they were fed at 1800 h every evening. The average cost per kilogram of gain for the 2× ($4.03/kg) calves was greater than that for the 1× ($3.56/kg) calves. In summary, group-fed calves fed once a day in an organic production system had similar average daily gains and body dimensions compared with calves fed twice a day. Our results indicated that there is no need for twice-daily milk feeding under the conditions of the present study.

Key words: group housing, organic dairy, profitability

INTRODUCTION

Organic dairy production has gained more attention because of increased demand for organic products, which in turn has offered farmers a higher milk premium for organic milk. Organic dairy production accounts for the second largest category in organic food production and produces $5.5 billion a year in sales in the United States, with milk sales leading organic commodities at $1.1 billion in sales (USDA, 2016a). This growth in organic dairy has slowed economic losses of smaller dairy operations in the Upper Midwest. In the United States, the number of certified-organic dairy cows increased 271% from 2002 to 2008, and totaled 228,116 in 2014 (USDA, 2016a).

Dairy heifers are an important and expensive aspect of dairy farming and starting these heifers on a balanced diet is critical to their future efficiency, productivity, and longevity (Soberon et al., 2012). After feed costs, replacement heifers represent the second largest expense on a dairy farm and, with increased production, the need for replacements has increased (Akins et al., 2015). The cost of raising these heifers depends on the amount of nonsalable or saleable milk fed to calves. The US National Organic Program states that organic dairy farms are required to feed only whole milk to dairy calves (UDSA, 2016b) and this milk can be either nonsalable or saleable.

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[1]Corresponding author: hein0106@umn.edu

Group housing of dairy calves is gaining in popularity with producers over individually housed calves. Group housing has been shown to have many benefits, including reduced labor and bedding costs and improved gain (Costa et al., 2016). For organic dairy farms in the United States, many farms are exploring the benefits of group housing of calves (Bjorklund et al., 2013). Along with group housing, an increasing number of organic dairy producers are feeding calves once daily or exploring this practice because of high labor costs or a reduced labor force on smaller organic dairy farms.

Galton and Brakel (1976) reported that calves fed once daily did not differ in ADG or rumen development compared with calves fed twice daily. Furthermore, those authors reported a significant increase in labor hours and cost of calves fed twice daily (Galton and Brakel, 1976). Hopkins (1997) found that calves fed once daily were able to achieve acceptable growth by 6 mo of age. Additionally, Gleeson et al. (2007) reported that group-fed calves could be fed once per day and have adequate gains with reduced labor.

There remain many questions in regards to costs, performance, and behavior of calves fed once daily, especially in group-housed calves in an organic production system. The cost effectiveness of feeding calves once daily and productivity of calves take precedence for organic farmers because, with a healthy start to life, their calves will become productive grazing animals in the future. Therefore, the objective of this study was to investigate the effect of feeding frequency on growth, profitability, and behavior of group-fed dairy calves in an organic dairy production system. We hypothesized that calves fed once versus twice daily would have similar growth rates and reduced costs to 90 d of age, as well as similar behavior compared with calves fed twice daily.

MATERIALS AND METHODS

Experimental Design and Collection of Data

This study was conducted at the University of Minnesota West Central Research and Outreach Center (**WCROC**; Morris, MN), and all the animal procedures involving animal care and management were approved by the University of Minnesota Institutional Animal Care and Use Committee (#1305-30661A). The research dairy at WCROC is a 250-head low-input and organic grazing system. The research herd has applied a crossbreeding approach since 2000, and details are described in Heins et al. (2010); the 1964 Holstein control population design is described in Hansen (2000). Data were collected for 102 organic dairy heifer calves born in 2 calving seasons: 35 heifer calves were born from September 18 to November 30, 2013, and 67 heifer calves were born from March 24 to May 31, 2014. Breed groups of calves were Holsteins (n = 26), including both 1964 genetics and contemporary genetics; crossbreds (n = 45) including combinations of Holstein, Montbéliarde, and Viking Red; and crossbreds (n = 31) including combinations of Jersey, Viking Red, and Normande. The distribution of calves by breed group and feeding group is presented in Table 1. The Viking Red breed was formed by combining the genetic improvement programs for the Swedish Red, Finnish Ayrshire, and Danish Red breeds, which have historically shared ancestry and similar selection criteria with emphasis on the fertility, survival, and health of cows.

Table 1. Distribution of organic dairy calves by breed group and feeding group

Breed group[1]	Once-daily feeding	Twice-daily feeding
Holstein	13	13
HMS	22	23
HJS	17	14
Total calves	52	50

[1]HMS = crossbreds of Holstein, Montbéliarde, and Viking Red; HJS = crossbreds of Holstein, Jersey, Normande, and Viking Red.

Calves were separated from their dams at birth, moved to indoor housing in individual pens, and fed 1.9 L (2 quarts) of colostrum per 41 kg of BW twice daily for 3 d. Healthy calves that showed aggressive suckling ability were moved to groups in superhutches by d 4 after the morning feeding. For this study, all calves were healthy and moved to group housing. The superhutches used for group housing had an indoor area (3.66 × 6.10 m) bedded with organic wheat straw and access to an outdoor area that measured 3.66 × 6.10 m (7.32 m^2 per calf inside and outside area). Twenty-four hours after birth, a single blood sample was taken via jugular venipuncture and collected in 10-mL serum Vacutainer tubes (Becton Dickinson and Co., Franklin Lakes, NJ). Samples were centrifuged at 1,800 × *g* for 20 min to separate the serum and immediately analyzed for total serum protein using a digital refractometer (Misco digital dairy refractometer, model PA203X, Misco, Cleveland, OH; Deelen et al., 2014).

Heifer calves were randomly allocated to 1 of 2 replicated feeding groups of 10 calves per superhutch based on birth order. A group of 10 calves was formed before the next group of 10 calves was formed. The time for group formation ranged from 7 to 19 d in fall 2013 and from 5 to 15 d in spring 2014. For the 1× calf groups, 1 group during the fall of 2013 had 5 calves and 1 group during the spring of 2014 had 7 calves. Most calves are