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Short communication

Effects of milk feeding volume and frequency on body weight and health of dairy heifer calves

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ABSTRACT

The objective of the study was to determine the effect of feeding volume and frequency of feeding on the body weight (BW) of dairy heifer calves, with access to pasture, during the preweaning and postweaning periods, as well as their health status during the preweaning period. Ninety-six dairy heifer calves were offered milk at a rate of (i) 10% of birth BW, once daily from three weeks of age (10% OD) (ii) 15% of birth BW, once daily from three weeks of age (15% OD) and (iii) 15% of birth BW in two equal feeds daily (15% TD) from birth until weaning. Calf BW was recorded at 5, 7, 9, 11, 21, 25 and 30 weeks of age. The number of days taken for each calf to reach a target weaning weight was recorded, as were all episodes of disease. At 5 weeks of age, calves on the 10% OD treatment were lighter (46.7 kg) than calves on the 15% OD treatment (50.6 kg) and 15% TD treatment (50.0 kg). At 11 weeks of age, calves on the 10% OD treatment were still lighter (75.2 kg; $P<0.05$) than calves on the 15% TD treatment (78.6 kg) and tended ($P=0.08$) to be lighter than calves on the 15% OD treatment (80.1 kg). Calves fed 15% of BW tended ($P=0.1$) to reach a target weaning weight 4 days earlier than the calves fed 10% of BW. Experimental treatment had no effect on the probability of a calf experiencing a disease a greater number of times. There was no effect of experimental treatment on BW measured postweaning.

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1. Introduction

Good nutrition is fundamental to animal health, welfare and productivity. Traditional milk feeding systems for dairy calves have been based on daily feeding rates of 8–10% of body weight (BW; Jasper and Weary, 2002). These 'restricted' feeding systems were intended to encourage the calf to eat a greater quantity of concentrate feed from an earlier age; however, they seriously limit growth potential as they only allow 20–30% of biologically normal growth (Appleby et al., 2001) and are detrimental to calf health and welfare (SVC, 1995). A higher plane of nutrition will facilitate physiologically appropriate growth rates (Jasper and Weary, 2002), better immune function (Drackley, 2005), and a lower incidence of disease and mortality (Godden et al., 2005).

Once rather than twice a day feeding of milk does not affect calf performance when calves are raised on a restricted feeding system (Gleeson et al., 2007). Feeding the calf to normal biological requirements (20% of BW) presents problems as this may exceed the abomasal capacity of the calf if fed in one feed. An intermediate volume of milk (approximately 15% of BW) will allow calves to reach

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over 50% of their growth capacity (NRC, 2001) and may be an acceptable compromise in terms of meeting the calf's demand for normal biological growth. This intermediate volume of milk may also be more suitable for feeding in a single feed once daily. There is, however, a lack of data at present to support this. Furthermore, limited studies to date have examined the effects of different milk feeding regimes for calves with pasture access.

The objective, therefore, of this study was to determine the effect of feeding volume and frequency of feeding on the BW and health of dairy heifer calves with access to pasture.

2. Materials and methods

The study was conducted from 10 January to 20 September 2012 at Teagasc Moorepark Research Farm located in County Cork, in southern Ireland (52°9′N, 8°16′W). The study population consisted of 96 dairy heifer calves; 66 Holstein-Friesian (HF), 18 Jersey-cross (JEX) and 12 HF x Norwegian Red (NRX). The mean date of birth was 1 February, standard deviation (SD 7.21) days; mean body weight at birth of calves was 34.8 (SD 4.98) kg.

2.1. Experimental treatments and milk feeding

Calves were stratified based on breed and BW at birth and randomly assigned to one of the three experimental treatment groups: fed milk at a rate of (i) 10% of birth BW, once daily from three weeks of age (10% OD) (ii) 15% of birth BW, once daily from three weeks of age (15% OD) and (iii) 15% of birth BW in two equal feeds daily (15% TD) from birth until weaning.

The individual daily milk requirement of each calf was calculated based on its BW at birth and the total daily milk requirement for the group of calves was calculated by summing these together. Unpasteurised whole milk, produced by the Moorepark milking herd, was fed via a group calf nipple feeder. Calves on the TD treatment were fed at 09:00 and 16:00 h. Calves on the OD treatments were fed milk at 09:00 h only; their concentrate feed was given at 16:00 h, such that all calves on the trial were fed and checked twice a day.

2.2. Management of calves

Following birth, each calf was weighed (TruTest XR 3000, Tru-test Limited, Auckland, New Zealand), fed 8.5% of its BW in colostrum and placed in an individual pen within the first hour of life. After 3 days the calf was then moved to a group pen where it was fed according to its experimental treatment group. Fresh water was available at all times. Concentrate (dry matter and crude protein content of 88% and 18%, respectively) and hay (dry matter and crude protein content of 87% and 12%, respectively) were offered for ad-libitum consumption from three days of age. Up to three weeks of age, all calves were fed their respective milk volumes in two equal feeds twice daily.

Calves were turned out to grass at 4 weeks of age and were fed milk according to their experimental treatments until they had reached or exceeded the minimum target weaning weight (95 kg for HF and NRX, 80 kg for JEX). Calves at target weaning weight were removed from their group and gradually weaned during the following week. Postweaning, all calves had full-time access to pasture and were offered 1 kg of supplementary concentrate feed per calf per day.

2.3. Data collection and analysis

Each calf was weighed at birth and subsequently every two weeks from three weeks of age and weekly from nine weeks of age (TruTest XR 3000, Tru-test Limited, Auckland, New Zealand) until weaning. Postweaning, each calf was weighed at 21, 25 and 30 weeks of age to monitor any carry over effects of preweaning experimental treatment. The number of days taken to reach the target weaning weight was recorded for each calf.

All calves were examined twice a day by an on-farm veterinarian. Faecal consistency, respiratory rate and general demeanour were assessed. Calves were examined to determine the presence of a cough, nasal and/or ocular discharge. All incidences of disease and treatments were recorded.

2.4. Data editing

A total of 1537 BW records were available for the 96 calves. Because weighing of all calves took place on a fixed calendar date and dates of birth differed, variation existed in the actual age of calves at each weighing event. Therefore, prior to weaning, the BW of each calf recorded closest to 5, 7, 9, and 11 weeks of age was determined. Because of the spread in weaning ages for each calf, postweaning BWs were available for all calves from 21 weeks only. Therefore, postweaning, the BW recorded closest to 21, 25 and 30 weeks of age was used.

Calf diseases recorded were divided into three separate categories: (1) pneumonia, (2) diarrhoea, and (3) other. Disease frequency for each calf was recorded as follows: never, once, twice, three, four, or five times.

2.5. Statistical analysis

Mixed models in PROC MIXED (SAS Institute Inc., Cary, NC, Version 9.1) were used to determine the effect of experimental treatment on the BW of calves; separate analyses were undertaken for the preweaning and postweaning periods. Models included experimental treatment, week of age, and week of age $\times$ treatment. A fixed effects model in PROC GLM (SAS Institute Inc., Cary, NC, Version 9.1) was used to determine the effect of experimental treatment on days to weaning. For each disease separately, the probability of a calf experiencing the disease a greater number of times within the study period was modelled with ordinal regression in PROC GENMOD (SAS Institute Inc., Cary, NC, Version 9.1). Orthogonal contrasts were also used to compare (1) the two 15% of BW treatments combined, with the 10% of BW treatment and (2) the two OD treatments combined, with the TD treatment, for each analysis described above.

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