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The effects on claw health of supplement feeding grazing dairy cows on feed pads



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ABSTRACT

The effects of feeding and management systems on the health and welfare of grazing dairy cows were investigated by comparing the claw health of cows fed grain during milking and pasture silage in the paddock (Control), with cows fed a grain-based partial mixed ration (PMR) on a concrete feed pad. Cows were assessed on three occasions during lactation: (1) early lactation (20–81 days in milk [DIM]) before allocation to feeding treatments; (2) mid-lactation (97–158 DIM) immediately following an intensive feeding experiment, and (3) late lactation (173–243 DIM) several months after return to initial management groups. At the final examination, claw puncture resistance was measured.

The results showed that for the most prevalent lesions (white line disease, paintbrush haemorrhage and traumatic bruising), there was no effect of feeding system or amount of supplement on the presence of the moderate to severe forms in early lactation, but cows were more likely to have a particular lesion at the second assessment if it was present in early lactation. Puncture resistance of the claw was not related to presence of a lesion for any of the most prevalent lesion types. It was concluded for this herd that for most indicators of claw health, there was no overall effect of different feeding systems (supplement fed during milking or on a feed pad) or amount of supplement.

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Introduction

Variable rainfall in pasture-based dairying regions can reduce pasture availability and lead to the feeding of increased cereal-based supplements. Traditionally these supplements were fed in the milking parlour, but increasing numbers of farmers are now using feed pads to deliver the supplement as a partial mixed ration (PMR) containing grain and forage, whilst still using grazed pasture for the rest of the time.

One risk with increased grain feeding in dairy cows is sub-acute ruminal acidosis (SARA) and its sequelae, including laminitis (Nocek, 1997; Kleen et al., 2003; Plaizier et al., 2008). Laminitis can involve changes in the mechanical properties of the claw horn, and it has been suggested that this may be analysed by assessing the puncture resistance of the claw horn tissue (Winkler and Margerison, 2012).

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There have been few studies examining the effects of grain feeding on claw health in grazing cows. Bramley et al. (2005) described increased risks to claw health through laminitis in grazing cows fed supplement as a 'slug' in the parlour. If grain can be fed in a manner (such as in a PMR) that reduces the risk of SARA, farmers could increase the amount of supplement fed without adversely affecting their cows' health and welfare (Moran and McDonald, 2010).

Alternatively, the use of a PMR and feed pad system for feeding high amounts of supplement, while reducing the risk of nutrition-mediated claw lesions, may increase the time cows spend standing and moving on concrete surfaces, so exacerbating the risk of traumatic lesions. To investigate the effect of feeding supplement using different systems, an experiment was conducted to evaluate claw health and lesion prevalence in grazing cows supplemented with either a PMR on a feed pad or fed grain during milking and forage in the paddock. The aim was to assess cows at strategic times throughout lactation in order to establish whether the method or rate of feeding had an effect on claw health.

Our hypotheses were that there would be no overall difference in locomotion score or presence of common claw lesions between

treatment groups, that there would be a positive correlation between locomotion score and claw lesion score and that there would be a negative correlation between claw puncture resistance and the presence of the more common lesions.

Materials and methods

Cows and treatments

The experiment was conducted at the Department of Primary Industries (DPI) Victoria, Ellinbank Centre (38°14'S, 145°56'E) with the approval of the DPI Agricultural Research and Extension Animal Ethics Committee. A herd of 160 multiparous (between 3 and 7 years old) Holstein–Friesian cows (mean \pm s.d.) 4.7 \pm 1.5 years, of bodyweight (BW) 561 \pm 54 kg and 50 \pm 16 days in milk (DIM), were managed as two overall treatment groups. The Control group (64 cows) were fed 12 kg DM/cow/day total supplement consisting of 75% wheat grain twice daily in the dairy during milking and 25% pasture silage in the paddock. The PMR group (96 cows) were offered a 12 kg/cow/day PMR comprising approximately 39% wheat grain, 20% maize grain, 30% maize silage and 12% lucerne on a dry matter (DM) basis. The PMR was isoenergetic with the supplement fed to the Control group, and was offered on a feed pad where the PMR cows were confined for 1–1.5 h after morning and afternoon milking (until all feed was cleared) before being moved to a paddock to graze for the rest of the day or night.

The feed pad consisted of two concrete areas, each measuring 10 m \times 50 m and was divided by concrete feeding troughs. In addition to receiving their supplement, all cows also grazed a pasture allowance of 14 kg DM/cow/day of perennial ryegrass (*Lolium perenne*) pasture, of which they consumed approximately 8 kg DM/cow/day.

For a 28-day period during spring, the cows were further divided within their overall treatment groups into sub groups allocated to a different level of total supplement (8, 10, 12 or 14 kg DM/cow/day). The groups were balanced for DIM, age, BW and production of milk, milk protein and milk fat in the previous lactation by allocating animals to groups from among those having a covariate efficiency factor in the top 1% of 10,000 randomly generated allocations (Harville, 1974). The PMR cows were drafted into their subgroups twice a day on the feed pad, which was subdivided using electric fence tape (Auldust et al., 2012). Following the 28-day experiment, the cows returned to the original 12 kg DM/cow/day of the Control and PMR diets.

Measurements

Three claw health assessments were carried out during the lactation. The aim of assessment 1, performed in October, in early lactation (mean 50, range 20–81 DIM) in which the cows had only been in the Control or PMR groups for 7–10 days, was to conduct a baseline measurement in order to determine the type, prevalence, and distribution of claw lesions in the herd. The aim of assessment 2, performed in December, 7 weeks after the start of the short term feeding study (mean 127, range 97–158 DIM), was to repeat the measurements during a period that was most likely to coincide with lesions associated with SARA-induced claw horn damage following increased grain feeding (Livsey and Fleming, 1984). The aim of assessment 3, performed in March, 18 weeks after completion of the short-term feeding study (mean 212, range 173–243 DIM) was to assess whether there were long-term differences in claw health between the feeding systems.

At each assessment, all cows were locomotion scored according to the system developed by Sprecher et al. (1997) using a 5 point scale, with 1 being normal.

The locomotion scoring was performed by a veterinarian with experience in the examination of lame cows. The cows were observed one at a time as they exited the dairy, and walked at their own pace along the side of the holding yards. The timing of the assessments is shown in Fig. 1.

Within 24 h of locomotion scoring, each cow was assessed for hind claw lesions. The cows were restrained using a claw treatment crush (WOPA), and each hind foot was elevated in turn. The claw was cleaned with water, and the surface layer of the sole (approximately 1 mm) removed using an electric angle grinder fitted with a claw trimming disc (Roto-clip). A different veterinarian from the one who assessed locomotion assessed the presence of lesions and graded for severity those lesions likely to be most common in Victorian conditions, namely, paintbrush haemorrhage (PBH), white line disease (WLD) and traumatic bruising.

The chart developed for the recording of each assessment is shown in Fig. 2. Both PBH and bruising were given a grade 1–3. What was classified as PBH was differentiated from what was classified as traumatic bruising by the presence of flecks of blood, with a fine 'paintbrush stroke' appearance, compared with the solid pattern of bleeding for bruising. Grade 1 described mild discoloration, which was just visible. Grade 2 described moderate discoloration, and Grade 3 described severe (dark) discoloration. The location of each lesion was recorded according to the zones of the sole, as used by Greenough and Vermunt (1994) and Leach et al. (1998), and originally reported at the Sixth Symposium on Diseases of the Ruminant Digit, Liverpool (1990). When more than one zone was affected these were recorded individually with the grade affecting each zone.

Ulcers were graded 1 for haemorrhage and 2 for an open ulcer. The presence of yellow horn, where the sole had a diffuse yellow discoloration, as described by Nock (1997) was noted (Y). WLD was not characterised by zone (as by definition the white line occupies zones 1 and 2), but was graded 1–4, where grade 1 was a white line defect without impacted debris, grade 2 was a defect in the white line with impacted debris, grade 3 was moderate WLD (signs of infection tracking up the white line) and grade 4 was severe WLD, with drainage at the coronary band or the development of abscesses at the coronary band or under run heel. The lesions that were not graded for severity were just marked as present or absent, as shown in Fig. 2. Where abscess/under run sole, abaxial/axial wall cracks or hardship grooves were present, the claw affected was also noted. All cows were tested for pain with hoof testers and graded as no pain, moderate pain or severe pain.

At the third assessment, 62 cows (selected at random) had a small shaving of the sole (zone 4) and white line (zone 2) removed with a sharp hoof knife. These shavings were frozen at -22 °C for 21 days and then analysed for puncture resistance as described by Winkler and Margerison (2012).

Statistical analysis

For assessment 1, the data were summarised as the percentage of cows with the different categories of claw lesions. The prevalence of WLD, PBH and traumatic bruising was calculated. The percentage of cows with these lesions in a lateral claw compared with a medial claw was assessed using McNemar's test for paired proportions. A total lesion score for each cow was calculated, by adding the scores for each lesion recorded for a cow. For subsequent assessments, only cows that had been present at assessment 1 were included in the analysis; 158 cows at assessment 2 and 145 cows at assessment 3.

For assessments 2 and 3, the data were analysed using logistic regression for differences between feeding method (and linear feed rates at assessment 2) for the presence of the WLD, PBH and bruising (\geq grade 2). Differences between groups for the presence of heel erosion and yellowing of claw horn were also assessed. A covariate using these outcomes (at assessment 1) was included. For assessment 3, differences in puncture resistance of cows with or without the presence of the

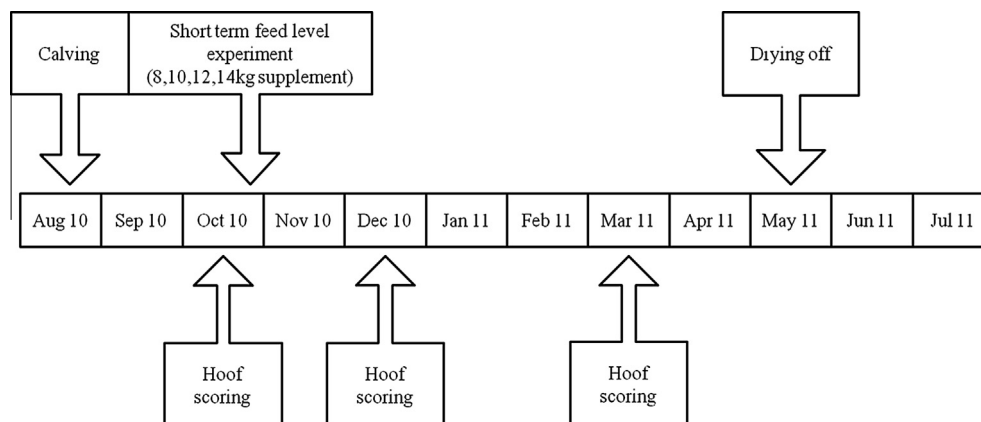


Fig. 1. Timing of assessments of claw health across lactation.

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