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Effects of lameness treatment for claw horn lesions on lying behaviour in dairy cows

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ABSTRACT

Lameness affects lying behaviour in dairy cattle, increasing total lying time and the number of lying bouts. However, there is limited information about the effect of lameness treatment on dairy cow behaviour. This study investigated the effect of four lameness treatments on lying behaviour (total lying time, number of bouts, average bout duration and laterality of lying) in dairy cows. Forty-four newly lame cows were treated randomly with one of four treatment protocols: trim only, trim + block, trim + NSAID, and trim + block + NSAID. Thirty-four non-lame control cows were matched by parity, days in milk, and farm-pen. Each cow had an accelerometer attached to the hind leg, lying behaviour data was collected over 5 days immediately after treatment and analysed using multilevel regression models.

Lame cows in three of the four treatment groups demonstrated no increase in lying time compared to non-lame controls. This finding is contrary to previous work and may reflect the enrolment criteria which favoured the selection of cows with mild disease i.e. before the behavioural impacts of lameness had manifested. Only cows in the treatment group which received a therapeutic trim and a foot block saw higher lying times post treatment. As this effect was not apparent in the group which received a NSAID in addition to a trim and a foot block, we hypothesise that this effect is caused by discomfort associated with the block. Where foot blocks are administered as part of treatment protocols, we propose that NSAIDs should be administered concurrently to alleviate the behavioural changes and likely discomfort associated with this treatment.

1. Introduction

Prompt recognition and early treatment of lameness may increase the chances of a faster recovery, bringing less economic losses to farmers and improving the welfare of lame cows (Leach et al., 2012). Some of the main causes of lameness are lesions of claw horn disruption, particularly sole ulcers (Green et al., 2014); recommended treatments vary according to the type of lesions. Overall hoof trimming is applied as a herd management tool for lameness prevention and treatment, it helps with gait smoothness and rhythmicity (Van der Tol et al., 2004; Tanida et al., 2011). In the case of claw horn disruption lesions, the application of a foot block to the healthy claw is widely recommended (Horseman et al., 2013). This allows some reduction in pressure on the affected claw, gives time for the lesion to heal and promotes the comfort of the cow (Shearer et al., 2013). The use of Non-Steroidal Anti-inflammatory Drugs (NSAIDs) is recommended as part of lameness treatment; the use of analgesics can help with the healing process, reduce pain and inflammation, and improve locomotion sooner (Whay et al., 1998; Flower et al., 2008). A recent study on the treatment of claw horn lesions demonstrated the highest recovery rates were in animals treated with both foot blocks and NSAIDs in addition to a therapeutic trim (Thomas et al., 2015).Despite their value, when questioned, only 17% of UK farmers (n = 84) used injectable analgesics when treating claw horn lesions (Horseman et al., 2013).

Lying behaviour is considered very important for the well-being of cattle; when deprived of the opportunity to lie down cattle showed signs of distress and physical exhaustion (Munksgaard et al., 1999). Lying behaviour is an expression of cow-comfort as it can be affected by the type of bedding (Tucker et al., 2003), stocking density and design of the stalls (Tucker et al., 2004; Ito et al., 2014). Lameness can also affect the time cows spent lying (Thomsen et al., 2012). Lame cows increase their lying time due

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to an increase in bout duration; these changes were observed particularly in severely lame cows (Thomsen et al., 2012) and during the evening (16:01–23:00) (Blackie et al., 2011). Lesions that cause the greatest increase in lying behaviour are digital dermatitis followed by sole ulcers (Chapinal et al., 2009; Thomsen et al., 2012). Lameness does not appear to affect the laterality of lying behaviour (Yunta et al., 2012).

There is very limited published research in the area of lameness treatment and its effect on lying behaviour. Cutler et al. (2015) investigated the effects of the application of wooden blocks on the behaviour and milk production of healthy cows (n = 10). The authors observed that animals reduced their activity in comparison to the period before block application and in comparison to control cows (no block applied), although blocks did not affect lying time or milk production. On the contrary, O'Callaghan (2003) observed that lameness treatment (NSAID, blocks or antibiotics) caused changes in the activity (steps) of lame cows immediately after treatment but the results varied (increased or decreased) depending on the type of claw horn lesion (sole ulcer or white line disease) identified and their severity.

In order to recommend lameness treatments, it is important to understand their impact on cow behaviour and welfare. The aim of the present study was to determine the effect of differing lameness treatments on the lying behaviour patterns of newly lame dairy cows.

2. Materials and methods

2.1. Experimental design

Lameness treatment was applied as part of a randomised controlled partially blinded clinical trial investigating the individual treatment of lame cows with claw horn lesions. Lying behaviour of lame treated cows was compared to the behaviours of non-lame cows. The null hypothesis was that lameness treatment did not affect lying behaviour. Prior to commencing the study, trial protocols were reviewed and approved by the University of Nottingham's School of Veterinary Medicine and Science Ethical Review Committee.

2.2. Animals, housing and diet

The study used cows from two automatic milking farms from the east midlands area in the United Kingdom. Both farms had approximately 200 Holstein dairy cows with an average milk yield per cow of 11,500 L per 305 days adjusted lactation. Farms undertook routine foot trimming every 4–5 months.

2.3. Animal selection

Cows were mobility scored every 2 weeks on both farms using a modified UK industry standard four-point scoring system, as explained by Thomas et al. (2015). In brief, on both farms cows were moved to one end of the pen and then walked quietly in front of the observer over a firm, level surface. Cows with mobility score 0 or 1 were considered as non-lame, any cow with a score of 2 or 3 was considered as lame. Cows were selected for treatment if they had two non-lame mobility scores followed by a lame mobility score, and only presented with one of the hind limbs lame. Once a cow was selected, a qualified veterinarian carried out foot trimming and diagnosed the lesions. Cows were eligible for inclusion in the study if they were diagnosed with claw horn lesions (Sole Haemorrhage (SH) or Sole Ulcer (SU), White Line Disease (WLD) or Other (claw horn lesion that could not be classified as any of the previous or a combination of lesions)) on one claw.

Cows were selected as non-lame controls if they had 3 consecutive mobility scores as non-lame (0 or 1) prior to the treatment day of their matched enrolled pair animal and had no disease events in the last month (e.g. no mastitis). Control cows were matched by pen (housed in the same pen), parity (same parity) and days in milk (DIM; ±20 days) to the enrolled cows.

2.4. Lameness treatment

Lame cows that were accepted for the study (after therapeutic foot trimming and diagnosis) were allocated to one of 4 treatments. Random allocation to a treatment was blocked by farm and diagnosis (Thomas et al., 2015); the same veterinarian administered all treatments. The treatments were as follows: Treatment 1: Therapeutic trim only (Standard Dutch foot trim followed by trim and investigation of lesions then removal of diseased horn (Toussaint-Raven et al., 1985). Treatment 2: Therapeutic trim and foot block (applied to the healthy claw). Treatment 3: Therapeutic trim and NSAID (3 mg/kg bodyweight of Ketoprofen IM once per day for 3 days). Treatment 4: Therapeutic trim, foot block and NSAID (as described above).

2.5. Lying behaviour data

Lying behaviour data was collected continuously and included total lying time per day, number of lying bouts per day, average time of each lying bout and total minutes per day spent lying on each side. An accelerometer (Onset Pendant G data loggers, Onset Computer Corporation Pocasset, MA) was attached immediately after treatment and recorded y (lying behaviour) and z (laterality of lying behaviour) axis at 1-min intervals, and started recording at 23:59, approximately 14 h after treatment. Observations were recorded from 00:01–24:00 h on each observation day. Accelerometers were attached on the non-lame hind leg of enrolled cows; for control cows the accelerometer was attached to a leg chosen at random by tossing a coin. Accelerometers remained attached for a total of 7 days, the first 5 days after attachment were selected for analysis.

2.6. Production and health status data

Daily milk production, DIM and parity data were collected using the on farm management system T4C software (Lely, Netherlands).

2.7. Database and statistical analysis

Descriptive and statistical analyses were carried out using Stata/SE 12.0 (Stata Corp 2011, USA). Multilevel regression models were built using MLwiN version 2.27 (Rasbash et al., 2009). Level of significance was set as $P \leq 0.05$ for all the experiments. One-way ANOVA was used to compare milk production variables between groups (Petrie and Watson, 2006). Lying behaviour was downloaded from the accelerometers using Hoboware®Lite Software Version 3 (Onset Computer Corporation, Pocasset, MA) and then transformed and modified using the Software Macro Hobo 3D Microsoft Excel® (Gibbons et al., 2012).

Total lying time was defined as a total of minutes spent lying down per day. Number of bouts per day was defined as the number of times a cow lay down and average bout duration was calculated by dividing the total lying time between the numbers of bouts per day. Average bout duration (min/bout) was right skewed, so was transformed (squared root) to achieve normality. Total lying time and average bout duration were analysed independently using multilevel linear regression models. Number of bouts per day followed a Poisson distribution and therefore was analysed with a multilevel Poisson regression model. Laterality of lying behaviour