Automated Methods to Detect Lameness, the Effects of Analgesic Drug Treatment, and the Effects of Hoof Trimming in Dairy Cows

S.A. Wagner[1], *DVM, PhD;* **N. Chapinal**[2], *PhD;* **A.M. de Pasille**[3], *PhD;* **J. Rushen**[3], *PhD*
[1]*Department of Animal Sciences, North Dakota State University, Fargo, ND 58108*
[2]*Animal Welfare Program, University of British Columbia, Vancouver, BC, Canada V6T 1Z4*
[3]*Agriculture and Agri-Food Canada, Agassiz, BC, Canada V0M 1A0*

Introduction

Lameness in dairy cows is a commonly occurring condition that causes decreased productivity and diminished well-being. Lameness has been shown to affect gait, weight distribution, and amount of time spent lying down in dairy cows. Automated methods of measuring weight distribution and standing, walking, and lying behaviors were used, in conjunction with evaluation of gait, to measure the effects of hoof trimming and systemic treatment with the non-steroidal anti-inflammatory drugs ketoprofen and flunixin meglumine in dairy cows.

Materials and Methods

First, 57 lactating Holstein cows had gait scores from 1 (completely sound) to 5 (extremely lame) assigned to each cow by a masked observer with training and experience in gait scoring, by evaluation of a videotape of each cow's gait. Cows were assigned to treatment with 1.36 mg/lb (3.0 mg/kg) body weight ketoprofen solution or an equivalent volume of sterile isotonic saline solution once daily by intramuscular injection for two consecutive days. On the day before treatment, the two days of treatment, and the day following the second treatment, cows were videotaped and gait-scored by a masked evaluator and had their weight distribution recorded by standing for 15 minutes on a scale that recorded the weight borne on each foot over time. In addition, standing, walking, and lying behaviors were recorded for each cow using an accelerometer for 10 days, beginning three days before the first treatment. In the second experiment, 66 lactating Holstein cows were treated as in the first experiment, with two differences: instead of ketoprofen, the cows were treated with 1.0 mg/lb (2.2 mg/kg) body weight flunixin meglumine solution or an equivalent volume of saline solution intravenously using the same treatment schedule, and just after the first drug treatment the cows had their feet evaluated and trimmed on a tilt table by a professional hoof trimmer. In the second experiment, 10 cows were assigned to a control group that was treated with saline solution and rested on the tilt table for five minutes. Mixed models in the statistical program SAS were used to compare outcomes between lame and non-lame cows and between treatment groups.

Results

Cows with a gait score of more than 3/5 were classified as lame. Lame cows had a higher standard deviation of leg weight over time than non-lame cows, indicating increased shifting of weight between legs ($P=0.05$ for front legs, $P=0.02$ for rear legs). Shifting of weight between the rear legs was decreased on treatment days in cows treated with ketoprofen, but not in cows treated with saline solution ($P<0.01$ for treatment*day interaction). Lame cows spent more time lying down than non-lame cows ($P=0.08$) due to longer lying bouts ($P=0.03$). In experiment 2, shifting of weight between the rear legs was positively correlated with increased gait score ($r=0.32$, $P=0.01$). Daily lying time was increased following hoof trimming in both treatment groups; the increase in lying time was continued for two days in cows treated with flunixin meglumine and for the entirety of the observation period in cows treated with saline solution.

Significance

Ketoprofen has an analgesic effect in lame dairy cows, as evidenced by decreased weight shifting after drug administration. Lying time is increased following foot trimming in dairy cows, suggesting that the procedure causes some discomfort; this period is shortened in cows treated with an anti-inflammatory drug. In these experiments, neither hoof trimming effects nor analgesic drug effects were detectable using gait scoring. Measurement of shifting weight in standing cows and recording of daily activity levels show potential as automated methods of detecting lameness and as tools for evaluation of lameness therapies such as hoof trimming and drug therapy.