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Short communication: Pilot study on hormonal, metabolic, and behavioral stress response to treatment of claw horn lesions in acutely lame dairy cows

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ABSTRACT

Short-term effects of therapeutic claw trimming in acutely lame cows ($n = 21$) with nonadvanced claw horn lesions on the endocrine, metabolic, and behavioral stress responses were investigated in comparison to regular claw trimming in nonlame control cows ($n = 21$). Controls were matched to lame cows by parity and stage of lactation. Lame cows suffering from typical sole ulcers or white line disease were blinded and randomly assigned to 2 treatments, receiving 15 min before interventions either ketoprofen ($n = 11$; 3 mg/kg of BW intramuscularly; Romefen, Merial, Lyon, France) or placebo ($n = 10$; saline in equivalent amount and route of administration). All cows underwent functional claw trimming in lateral recumbency on a surgical tipping table, and claw horn lesions in lame cows were conventionally treated (removal of loose horn, block on opposing claw, bandaging of affected claw). Blood samples collected 15 min before, at the end, and 24 h after claw trimming were analyzed for concentrations of cortisol, fatty acids, lactate, and glucose, and fecal samples (collected before treatment and after 24 h) for cortisol metabolites. Behavioral stress responses during functional and therapeutic claw trimming were recorded. Concentrations of blood cortisol, fatty acids, glucose, and fecal cortisol metabolites were higher in lame than in nonlame cows after treatment. During claw treatment, more leg movements were recorded for lame cows than nonlame cows. Pre-emptive administration of ketoprofen had no obvious effects on stress responses to therapeutic claw trimming. Treatments of claw horn lesions caused a significant stress and pain reaction in acutely lame cows, demonstrating the neces-

sity of adequate pain management protocols for such interventions.

Key words: lameness, dairy, stress response, pain, animal welfare

Short Communication

With prevalence rates ranging from 25 to 40%, lameness is a frequent health disorder in dairy herds (Barker et al., 2010; Main et al., 2010). Lameness is mainly caused by claw horn lesions or inflammatory alterations of the adjacent soft tissues (Murray et al., 1996). Claw horn lesions, such as sole ulcers and white line disease, are painful (Rushen et al., 2007; Nechanitzky et al., 2016) due to inflammation and compression of the corium in the affected region (Van Amstel and Shearer, 2006). Such lesions are commonly treated in early stages by claw trimmers during regular claw trimming. The treatment includes removal of loose horn and provision of a smooth transition to the healthy horn. Only the non-pain-sensitive horn in the area of the defect is supposed to be pared off (Toussaint Raven, 2003), and the inflamed corium remains untouched. Afterward, the inflamed and sensitive corium is exposed and protected against mechanical irritation and pressure by a bandage and removing weight bearing from the afflicted claw through the application of a block to the opposing claw (Blowey, 1990).

Generally, professionals agree that major surgeries such as amputation or resection of the distal interphalangeal joint in case of advanced stages of claw horn lesions demand local anesthesia and administration of analgesics to control postoperative pain (Desrochers and St Jean, 1996; Heppelmann et al., 2009; Becker et al., 2013; Offinger et al., 2013). However, assuming that in most instances lame cows are treated by professional claw trimmers or stockmen, therapeutic claw trimming in cows with nonadvanced claw horn lesions is normally done under restraint without any sedation, anesthesia,

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Table 1. Production data (means $\pm$ SEM) of lame cows treated either with ketoprofen or placebo (saline) and of nonlame control cows

Group	n	BW (kg)	Age (yr)	Parity	DIM	Milk yield (kg/d)
Lame						
Ketoprofen	11	661 $\pm$ 17 (589–724)	6.3 $\pm$ 0.5 (4–9)	4.3 $\pm$ 0.5 (2–7)	187 $\pm$ 21 (73–296)	30.9 $\pm$ 0.4 (18.8–50.4)
Placebo	10	650 $\pm$ 15 (612–710)	5.3 $\pm$ 0.4 (4–7)	3.3 $\pm$ 0.4 (2–5)	178 $\pm$ 28 (19–277)	30.2 $\pm$ 0.4 (16.9–49.5)
Controls	21	686 $\pm$ 16 (594–819)	5.5 $\pm$ 0.3 (4–9)	3.5 $\pm$ 0.3 (2–7)	180 $\pm$ 16 (22–283)	29.9 $\pm$ 0.3 (13.1–52.9)

or analgesia (O’Callaghan et al., 2002; Whay et al., 2005; Becker et al., 2014). However, most veterinarians judge such procedures as painful for the affected cows and would clearly use anesthesia for the same intervention in horses (O’Callaghan-Lowe et al., 2004b).

In cattle, ketoprofen is a commonly used nonsteroidal anti-inflammatory drug (**NSAID**) that demonstrated analgesic properties in the posttherapeutic claw trimming period in dairy cows after claw treatment in different studies (Feist et al., 2008; Flower et al., 2008; Chapinal et al., 2010; Thomas et al., 2015).

Inadequate pain control for treatment of lame cows is a growing concern (Huxley, 2012; Potterton et al., 2012; Shearer et al., 2013). The hypothesis of this exploratory study was that claw trimming and treatment of claw horn lesions is a painful procedure for acutely and mildly lame dairy cows, and that it will induce a more pronounced hormonal, metabolic, and behavioral stress response than claw trimming alone in nonlame cows. A secondary aim was to gain information if analgesic effects of pre-surgically administered ketoprofen might attenuate stress responses in lame cows undergoing therapeutic claw trimming.

A total of 42 pluriparous German Holstein dairy cows in mid lactation of one research herd which were used to close animal-human contact were studied (Table 1;

data from daily herd recordings; BW was measured automatically after milking). Cows were kept in a free stall with cubicles and were fed a typical ration based on corn and grass silage with concentrate according to performance. Twice weekly, all cows were scored for lameness by the same person, using a scale from 0 to 5 (0 meaning no lameness, 5 meaning no weight on the affected leg; Sprecher et al., 1997).

Twenty-one cows with lameness in one hind limb, a lameness score of ≥ 2 (Table 2), and a claw horn lesion (typical sole ulcer: $n = 11$; white line disease: $n = 10$) were enrolled and matched each with a nonlame control cow ($n = 21$) from the same herd according to parity and stage of lactation. During clinical examination in all cows, no health disorders were present in lame cows other than the claw horn lesions. In blinded mode, lame cows were treated according to a randomization list either with ketoprofen ($n = 10$; Romefen, Merial, Lyon, France; 3 mg/kg of BW intramuscularly) or placebo ($n = 11$; saline, equivalent amount and route of administration) 15 min before claw trimming in lateral recumbency (**LR**) on a hydraulic surgical tipping table (Rizk et al., 2012a). The nonlame cows also received placebo treatment before claw trimming.

Claw trimming was performed according to the Dutch method (Toussaint Raven, 2003) by a veterinarian

Table 2. Frequency distribution of locomotion scores in lame cows either treated with placebo ($n = 11$) or ketoprofen ($n = 10$) before, immediately after, and 24 h after therapeutic claw trimming (score 0–5 according to Sprecher et al., 1997)¹

Treatment group	Relative to claw trimming	Locomotion score		Group effect <i>P</i> -value
		2	3	
Placebo	Before	5	6	0.67
Ketoprofen		6	4	
Placebo	After	9	2	1.0
Ketoprofen		9	1	
Placebo	24 h after	11	0	0.21
Ketoprofen		8	2	

¹Only scores 2 and 3 were observed; overall time effect: $P = 0.010$, time effect within placebo group: $P = 0.013$, time effect within ketoprofen group: $P = 0.43$.

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