

CLAW PATHOLOGIES, DAIRY COW GAIT AND CLAW SIGNATURE

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SUMMARY

In order to assess associations between claw pathologies, claw signature and cow gait, 24 dairy cows were examined during six weeks. The health of the claws was not extremely bad and only few cows had a gait score resulting in classification as lame. More detailed individual associations between claw pathologies, claw signature and cow gait will be presented at the conference. Results indicate that there is an association between gait scores and the duty cycles of different legs. Further research is needed to support these findings.

Keywords: dairy cow, lameness, gait, claw

OBJECTIVE

For dairy cows, claw disorders are amongst the most important health problems during their active life. Research shows that claw problems are responsible for 90% of the lameness cases on dairy farms (Weaver, 2000). It has furthermore been demonstrated that the early detection of the affected animals is of paramount importance to reduce pain suffering and to enhance the chance of healing. In this context, the search for associations between claw disorders and gait abnormalities has already had some attention but major difficulties due to the subjective nature of claw and gait scoring still remain. To examine the association between manifestly and subclinically present claw disorders on the one hand and cow gait parameters and claw signature on the other hand, the following experiment was carried out.

MATERIALS AND METHODS

Animals and experimental setup

Between 25th of October and 29th of November 2006, 24 lactating Holstein cows of mixed parity were examined at the Ghent University Research Farm (AgriVet). During these six weeks, three groups of eight cows were guided to the test arena after milking once a week. This test arena was situated in a nearby empty stable and consisted of three different experimental zones (fig. 1; C, D and E).

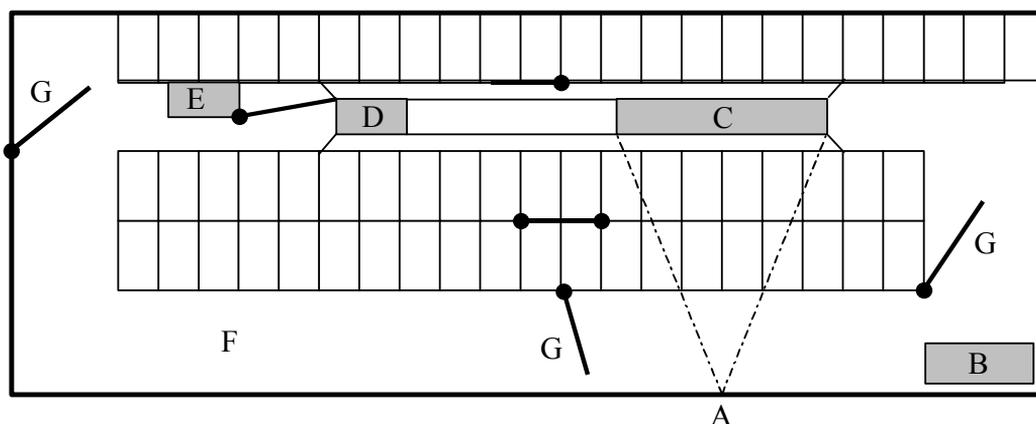


Figure 1. Scheme of test arena (30 x 11 m²) and experimental setup: (A) digital video camera, (B) cow balance, (C) walking corridor (6m), (D) cow box with pressure plate, (E) trimming chute, (F) waiting area, (G) separation fences. Cows circulate anti-clockwise.

To give the cows the opportunity to adjust to the new environment, they were guided several times through the experimental setup. Subsequently, each cow was tested individually according to the following protocol: First, cows were guided to walk through a six meter long corridor, on a recently roughened slatted concrete floor (fig 1;C) while their gait was filmed with a digital video-camera (fig. 1;A). Secondly, the cows were guided into a box of 1 * 2 m² (fig. 1;D), the hind legs were positioned on top of the RSscan[®] pressure mat and the pressure signature of the claws of both hind legs was recorded. Finally, the cows were guided into a trimming chute (fig. 1; E) to examine the claws of both hind legs for any kind of disorder. Photographic pictures of the claws were taken from several sides and the claw angle was measured using a goniometer (fig. 2). The cow's weight was measured in a cow balance (fig. 1;B) during week six.



Figure 2. Measurement of the claw angle with a goniometer

Claw Pathologies and claw angle

During this period of six weeks, the claws were weekly scored for the presence of specific lesions. Both hind legs were examined (first the right, then the left) in the trimming chute by the same veterinarian for the following clinical disorders: digital dermatitis (DD), interdigital dermatitis (ID), sole ulcer (SU), white line disease (WL), laminitis (LA), interdigital necrobacillosis (IN), interdigital skin hyperplasia (IH) and overgrowth of the sole horn (SH). To do so, the claws were cleaned with a small brush and superficial horn was gently scraped off to remove all the dirt and manure. In this way, superficial lesions could be visualized and identified using the Dutch identification system (GD Ltd., 2006). If present, lesions were scored based a four-point scale (score 0 = no visible lesions, score 3 = severe lesions). The relevancy of the claw lesions in relation to the lameness of dairy cows has been confirmed by Alban (1995); Manske (2002); Somers et al (2003) and Flower and Weary (2006). The claw angle of each hind claw (claw angle, CA) was measured using a goniometer (Fig. 2). As a claw angle of 45° is regarded as optimal, the following angle scores were used: 0: [43°–47°]; 1: [41°–42°, 48°–49°]; 2: [36°–40°, 50°–54°]; 3: [$\leq 35^\circ$, $\geq 55^\circ$].

Dairy Cow Gait

Based on the video material of the cows walking through the six meter long corridor, five observers scored the gait of the cows according to the method described in Winckler and Willen (2001). Manual frame by frame analysis and identification of claw strike (claw contacting the ground at end of swing) and claw-off (claw leaving the ground at end of stance) events in relation to (longitudinal) position and time were performed on these images with ad hoc written software. Based on this data, the variables summarised in table 1 were estimated.

Claw Signature

The pressure between the claws and a Rsscan pressure mat (0.96 * 0.32 m², covered with a 5 mm rubber mat) was measured for 30 s. The pressure mat consists of a left and a right side, so the measurement was repeated with the left and the right side of the pressure mat exchanged. Frames within a steady state pressure distribution were selected for further processing.

RESULTS

Cow parameters

Mean weight of the cows was 621 ± 56 kg. Most cows (70%) were in their first lactation stage (day 28 to 366), the remaining cows had lactation stages of 2 (day 72 to 305), 4 (day 96 to 362) or 5 (day 426 to 468).

Claw scores (pathologies and claw dimensions)

The medial and lateral claws of both hind hooves were examined. No presence of laminitis or interdigital necrobacillosis was detected at any of the claws. Only 4% of the claw lengths were normal, 92% of the claws were long (> 7 cm) but without curved dorsal wall. Finally, 4% of the claws were extremely long with most of them showing a curved dorsal wall. The claw scores

(relative frequency of pathologies and claw angle scores) are summarised in figure 3. No analyses are performed on the photographic pictures of the claws yet.

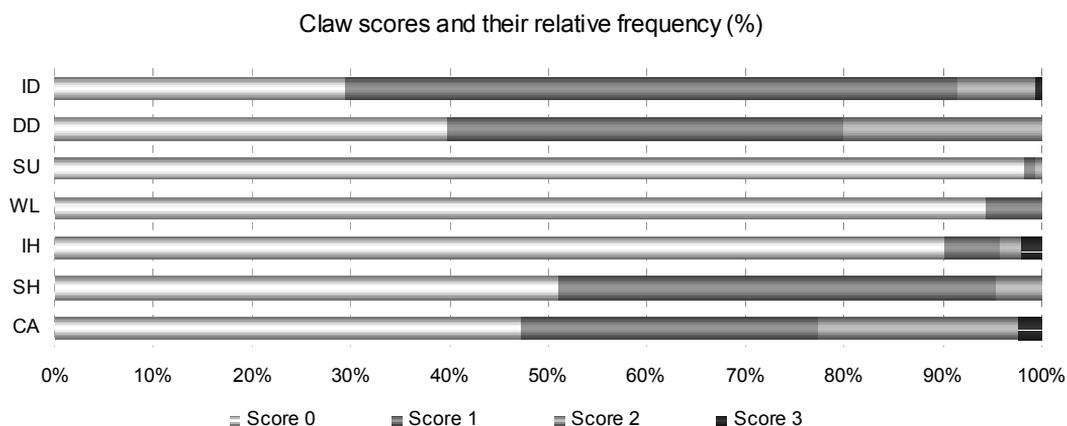


Figure 3. Relative frequency distribution of the scores of following claw disorders: interdigital dermatitis (ID), digital dermatitis (DD), sole ulcer (SU), white line disease (WL), interdigital skin hyperplasia (IH), overgrowth of the sole horn (SH) and claw angle (CA). No laminitis (LA) or interdigital necrobacillosis (IN) were detected and therefore they are not included in the figure.

Dairy Cow Gait

As the gait scoring based on the digital images was performed by 5 observers, an overall gait score was given to the cows by taking the modus of the 5 different scores. 89% was classified as sound (63% score 1 and 26% score 2). 11% of the assessed gaits was classified as lame with 8%, 2% and 1% for score 3, 4 and 5 respectively.

A set of basic cow gait variables is presented in table 1. An overall mean value (n = 156) and standard deviation of these variables is shown. Other variables determined from the manual frame by frame analysis on the digital images (e.g. on individual hooves, pairs of hooves, deducted variables, etc.) and their relation to the gait and claw scores still need to be investigated.

Table 1. Estimated cow gait variables and their description

Variable		Estimated value	
Stride time	Time between the sequential steps of one individual hoof	1.20 ± 0.23	s
Stance time	Time during one stride, at which the hoof is on the floor	0.77 ± 0.17	s
Swing time	Time during one stride, at which the hoof is in the air	0.43 ± 0.08	s
Duty cycle	Stance time relative to stride time	0.64 ± 0.03	%
Double support	Relative time, during walking, that the cow is on 2 hooves*	0.47 ± 0.10	%
Triple support	Relative time, during walking, that the cow is on 3 hooves*	0.55 ± 0.10	%
Stride length	Distance between the sequential steps of one individual hoof	1.56 ± 0.08	m
Tracking length	Distance between a front hoof and a subsequent hind hoof imprint	-0.01 ± 0.07	m
Speed	Stride length divided by stride time	1.34 ± 0.22	Ms ⁻¹

* During a walking gait, the cow supports on 2 or 3 different hooves alternately.

Claw Signature

Due to a rather short measuring time (maximum 30 s) and some agitation of the cows due to the presence of flies, it was not possible to consider the number of times that a hoof was lifted as a useful variable. In between, the pressure distribution remained fairly constant over time. It seemed difficult to achieve a good “square stance” on the mat, so even more repetitions to account for this variation might have been desirable. The results of the claw signatures from the RScan[®] pressure mat are not yet available.

CONCLUSIONS

The claw health of the cows in our study seemed to be not extremely bad. Only the prevalence of ID and DD was rather high (94% and 67% of the cows had at least one claw with a non-zero score for one of these pathologies respectively). Only 13% and 3% of the cows suffered from IH and SU respectively, often resulting in severe lameness. The prevalence of WL was 19%. As the cows needed to be trimmed in the near future, the high presence of cows with some overgrown sole horn (98%) or with long claws (97%) could be expected. 47% of the claws had claw angles near 45° (scored 0), but only 17% of the cows had 4 of these claws.

The mean speed of our cows was 1.35 ms^{-1} which is higher than the speed found in literature (0.8 ms^{-1} – Philips and Morris, 2000; 1.1 ms^{-1} – Flower and Weary, 2005; 1.0 ms^{-1} – Telezhenko, 2005). In 4 cows, significant differences could be found between duty cycles of different legs which imply that the gait of these cows was irregular. The gait scores of 2 of these cows were indeed 3 and 4 but the gait scores of the other cows were 1 and 2. Further research is needed to explain these results. Average double and triple support time was 47% and 55% respectively.

As Winckler and Willen (2001) only consider cows with gait score 3, 4 or 5 as lame, only 11% of the cows in our experiment were classified as lame. Literature however shows that the prevalence of lameness in dairy herds is around 26% (Barkema, 1994), or between 4% and 25% (Booth, 2004). These results show that the claw health of the cows in our study was rather good. Individual associations between gait scores, hoof pathologies will be determined and presented during the conference.

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