

# Lameness in Dairy Cattle: A Debilitating Disease or a Disease of Debilitated Cattle? A Cross-sectional Study of Lameness Prevalence and Thickness of the Digital Cushion

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## Introduction

Lameness is the most significant challenge for the dairy industry to overcome given its obvious disruption of animal welfare and severe economic losses. Sole ulcers and white line abscesses are ubiquitous diseases with chronic nature and with the highest associated economic losses amongst all foot lesions. Their underlying causes are still not fully understood. The objectives of the study were to assess the association of digital cushion thickness (DCT), the risk of claw horn disruption lesions, and to assess the dynamics of DCT by stage of lactation and body condition score (BCS). It was hypothesized that DCT would be negatively associated with the risk of digital lesions and that DCT would be positively associated with BCS.

## Materials and Methods

A total of 501 lactating Holstein dairy cows from a commercial herd were enrolled in the study. Lameness was defined by presence of a painful sole ulcer or white line disease and by visual locomotion scores (VLS). The cows were housed in free-stall barns with concrete stalls covered with mattresses and bedded with waste paper-pulp. Cows were scheduled for hoof trimming twice a year and at dry off. BCS, cow height and VLS were observed before cows were trimmed. After trimming, DCT was evaluated by ultrasonographic examination of the sole at the typical ulcer site. Factors such as parity number, stage of lactation, and parturition date were obtained from the farm's data base. Digital cushion thickness data were analyzed by a general linear model fitted to the data using the MIXED procedure of SAS (SAS Inst., Inc., Cary, NC). The outcome variable was mean DCT (MDCT) in centimeters of all hind digits, which was modeled as a Gaussian (normally distributed data) variable. To assess the association of DCT and the risk of painful claw horn lesions (sole ulcers and white

line disease), a logistic regression model was fitted in Stata (StataCorp LP, Texas, USA); the dependent variable of this model was claw horn lesion (1 = present and 0 = absent).

## Results

The prevalence of sole ulcers was 4.2% and 27.8% ( $P < 0.001$ ) for parity = 1 and parity > 1, respectively. The prevalence of white line disease was 1.0% and 6.5% for parity = 1 and > 1, respectively. The prevalence of lameness (visual locomotion score  $\geq 3$ ) was 19.8% and 48.2% ( $P < 0.001$ ) for parity = 1 and > 1, respectively. The prevalence of sole ulcers and white line diseases was significantly associated with DCT; cows in the upper quartile of DCT had an adjusted prevalence of lameness which was 15% lower than the lower quartile. Body condition scores were positively associated with DCT. Furthermore, DCT decreased steadily from the first month of lactation and reached a nadir 120 d after parturition.

## Significance

The prevalence of sole ulcers and white line diseases was significantly associated with DCT; cows with low DCT were at a higher risk of claw horn lesions. Body condition scores were positively associated with DCT. Furthermore, digital cushion thickness decreased steadily from parturition reaching a nadir 120 d after parturition. These findings gave support to the concept that sole ulcers and white line diseases are related to contusions within the claw horn capsule and such contusions are at least in part a consequence of the lower capacity of the digital cushion to dampen the pressure exerted by the third phalanx on the soft tissue beneath. Creation of a system that predicts lameness occurrence based on simple visual signs would allow farmers to target high risk animals with preventive strategies.