

Descriptive evaluation of a camera-based dairy cattle lameness detection technology

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Introduction

Lameness in dairy cattle is not a disease but a clinical sign of impaired locomotion, with the main causative agents being painful foot lesions. Lameness compromises economic, environmental, and social sustainability goals of the U.S. dairy industry. Combining technology and farm data may be a more precise and less labor-intensive tool for lameness detection, particularly with regard to early detection. The study objective was to describe the association between average weekly autonomous camera-based (AUTO) mobility scores and cows with lesion (LAME) and without lesions (TRIM) to see if this technology can detect lameness occurrence earlier.

Materials and methods

Data were collected from 3 farms from April to March 2023 and included cow ID, mobility score (0-100), and observation date and time. Historical farm hoof lesion data was used to determine cow lesion history and date of lesion diagnosis (LD). To remove the confounding impact of chronicity, the study focused on the first and second occurrence of lesions. Cows were categorized as: having a first-time LD (LAME-1; n = 131), a second-time LD (LAME-2; n = 65), or as seen by a hoof trimmer without an LD and no history of LD (TRIM-0; n = 1423) or without an LD but with 1 previous LD (TRIM-1; n = 590). These categories were compared based on when the trimming occurred: within 28 d of dry off (DOT; n = 1971) or at a recommended time based on farm staff observation (RT; n = 584). For lame cows, weekly median scores were reported for the 3 most common lesion types: digital dermatitis (DD), sole ulcer (SU), and white line disease (WLD). The AUTO scores from -28 to -1 days prior to LD were summarized into weekly scores and included if cows had at least 1 observation/wk in the 4 weeks before LD. All weekly and categorical AUTO scores were reported descriptively based on median (interquartile range).

Results

The range for DOT TRIM-0 median scores (37.14 [11.83] to 37.67 [12]) were consistently lower across the 4 weeks compared to DOT TRIM-1 (38.64 [12.65] to 39.46 [10.8]). The range for RT TRIM-0 median scores (36.77 [12.86] to 37.11 [11.91]) were consistent across the 4 weeks prior to LD compared to RT TRIM-1 (41.25 [15.66] to 43 [15.71]). The range for DOT LAME-1 median scores (43 [15.76] to 46.9 [25.58]) increased across the weeks prior to LD and these trends were similar to DOT LAME-2 (42 [7.25] to 47 [9.33]). The median scores for RT LAME-1 (41.61 [16.25] and 42.73 [18.44]) were similar across the first 2 weeks, but slightly different on weeks -2 and -1; however, RT LAME-2 had a considerable increase in AUTO scores across the 4 weeks prior to LD (45.46 [12.95] to 52.76 [13.5]). The lesion type with the highest maximum median score was WLD (53.6 [19.67]), followed by SU (51.01 [16.4]) and then DD [41.93 [15.32]]. The highest range in AUTO scores across the 4 weeks prior to LD was WLD (40.67 [16.39] to 53.6 [19.67]).

Significance

The results indicate AUTO scores may have the potential for the earlier detection of some lesion types. Considering the number of previous lesions also has an impact on AUTO scores and should be considered in future studies.

