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Prevalence and distribution of foot lesions in dairy cattle in Alberta, Canada

L. Solano,*1 H. W. Barkema,* S. Mason,* E. A. Pajor,* S. J. LeBlanc,† and K. Orsel*
*Department of Production Animal Health, University of Calgary, Calgary, Alberta, Canada, T2N 4N1
†Department of Population Medicine, University of Guelph, Guelph, Ontario, Canada, N1G 2W1

ABSTRACT

The objectives of this cross-sectional study were to determine the prevalence and distribution of foot lesions and associated cow- and herd-level risk factors in dairy cows in Alberta, Canada. Foot lesion data were recorded electronically by 7 hoof trimmers on 28,607 cows in 156 dairy farms from June 2009 to November 2012. Foot lesion prevalence estimates differed between farms that had the whole herd trimmed at once (≥80% of lactating cows were trimmed; n = 69 farms and 8,020 cows) and farms on which part of the herd was trimmed (selection of cows was determined by farmer and <80% of lactating cows were trimmed; n = 87 and 20,587 cows). Estimates were consistently higher for the latter likely because farmers presumably prioritized lame cows in partial-herd trims. On farms with whole-herd trims, digital dermatitis was the most common lesion among all housing types, present in 15% of cows and 94% of herds. Sole ulcers and white line disease were detected in 6 and 4% of the cows and 92 and 93% of herds, respectively. Other infectious and claw horn lesions each affected 1 to 2% of cows and 62 to 78% of herds. Intraclass correlation coefficients for hoof trimmers ranged from 0.01 to 0.20 for all lesions, indicating some clustering of recorded lesions by trimmer. Multilevel mixed logistic regression models were constructed (including hoof trimmer as fixed and farm as random effects) for the 3 most frequently identified lesions. Prevalence of digital dermatitis decreased with increasing parity, but this effect interacted with days in milk (DIM); primiparous cows had higher odds of digital dermatitis in mid lactation (100–199 DIM) and late lactation (≥200 DIM) compared with cows at other stages of lactation. In contrast, prevalence of sole ulcers and white line disease increased with increasing parity; compared with cows in parity 1, those in parity 4 had 5 or 7 times higher odds of having these lesions, respectively. Cows in mid lactation and late lactation had higher odds of sole ulcers and white line disease than cows at other stages of lactation, regardless of parity. Digital dermatitis prevalence was 2 times higher in herds housed in barns with access to an exercise area. The odds of sole ulcers and white line disease were ≥2 times higher in cows housed in freestalls than those housed in deep-bedded packs. Therefore, preventive measures for control of digital dermatitis merit emphasis, especially in primiparous cows and on farms with exercise areas. In addition, improving housing environment by providing a deep-bedded area for older cows in mid lactation or late lactation could reduce prevalence of claw horn lesions. We inferred that foot lesion data recorded by hoof trimmers can provide useful information not only to develop effective foot health programs at herd level, but also for disease surveillance and genetic improvement at regional and national levels.
Key words: claw zone, hoof health, claw trimming, lameness

INTRODUCTION

Lameness is a severe welfare problem in cattle and has a detrimental effect on longevity (Cramer et al., 2009a), productivity (Green et al., 2002), and reproductive performance (Barkema et al., 1994; Garbarino et al., 2004). Consequently, it is among disorders causing the largest economic losses in the dairy industry (Ettema and Ostergaard, 2006). Approximately 90% of the causes of lameness involve foot lesions (Murray et al., 1996; Shearer and Van Amstel, 2013), although foot lesions do not necessarily result in lameness (Manske et al., 2002b). Regardless of whether foot lesions cause lameness, they have a high impact on animal welfare (Bruijnis et al., 2012) and farm economics. Foot disorders that result in lameness are estimated to cost $95 on average, whereas foot disorders that do not cause lameness cost $18 per case on average (Bruijnis et al., 2010). In addition, lameness prevalence is often underestimated by dairy producers (Espejo et al., 2006). Therefore, inspection of foot lesions as a routine management practice facilitates earlier identification

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[1]Corresponding author: laurasolanoquesada@gmail.com

and treatment of lesions, plausibly enhancing herd productivity and welfare (Cramer et al., 2008; Chapinal et al., 2009).

Prevalence of foot lesions varies considerably among farms, regions, and housing systems. For example, when cows are housed in tiestall barns, prevalence of foot lesions is lower than when cows are housed in freestalls (21% lower in Ontario and 37% lower in Norway, respectively; Fjeldaas et al., 2006; Cramer et al., 2008). In addition, cow-level prevalence of digital dermatitis ranged from 8% in Chile to 23% in Ontario (Cramer et al., 2008; Tadich et al., 2010). Herd-level prevalence of digital dermatitis ranged from 92 to 100% when cows were housed on concrete flooring, whereas when cows were housed in deep-bedded straw yards, 65% of herds were free of digital dermatitis (Somers et al., 2003; Cramer et al., 2008).

Each type of lesion has its own pathophysiology and specific risk factors. Foot lesions are commonly categorized according to their etiology into infectious and noninfectious lesions (International Lameness Committee, 2008; Potterton et al., 2012). Infectious lesions include digital dermatitis, interdigital dermatitis, heel horn erosion, and foot rot, whereas the most common noninfectious lesions are sole ulcer, toe ulcer, sole hemorrhage, and white line disease. Infectious lesions usually affect foot skin and are influenced by herd-level factors such as wet and unhygienic floor conditions (Bell et al., 2009), scraping frequency (Cramer et al., 2009b), introduction of dry cows into the milking herd, pasture access, and footbathing frequency (Somers et al., 2005a,b). Noninfectious lesions affect the claw horn, and their occurrence is associated with metabolic and hormonal events around calving that weaken the foot suspensory apparatus (Tarlton et al., 2002), low BCS (Green et al., 2014), toe overgrowth, exposure to hard flooring (Manske et al., 2002a; Somers et al., 2003), and thickness of the digital cushion (Bicalho et al., 2009).

Despite increased awareness of lameness as a problem in North America, we are only aware of 1 epidemiological study to identify prevalence and distribution of foot lesions and associated risk factors (Cramer et al., 2008, 2009b). Understanding the type, frequency, and distribution of foot lesions will provide insight into their epidemiological background and potentially lead to the identification of trends in the presence of foot lesions and whether they change over time. Therefore, objectives of this study were to determine (1) the prevalence and distribution of foot lesions using observations recorded electronically by hoof trimmers, and (2) the association between herd- and cow-level factors and the prevalence of the most frequently identified foot lesions.

MATERIALS AND METHODS

Data Recording

Seven of 17 hoof trimmers in Alberta, Canada, agreed to participate in the Alberta Dairy Hoof Health Project, a project developed by Alberta Milk (Edmonton, AB, Canada). The Alberta Dairy Hoof Health Project was designed to collect foot lesion data using a computerized lesion recording system that facilitated routine and consistent data collection. In short, the 7 participating hoof trimmers attended an on-farm workshop demonstration of Hoof Supervisor lesion recording software (KS Dairy Consulting, Dresser, WI). The software was installed on damage-resistant touch screen personal computers with a Microsoft Windows XP operating system. The recording method of Hoof Supervisor enabled differentiation between front and back and left and right feet and between lateral and medial claws. This system also captured the location of lesions in 12 claw and foot zones, using the Claw Lesion Identification in the Dairy Cattle Brochure developed by Zinpro Corporation (D40-08-08-30-07, Zinpro Corporation, Eden Prairie, MN) in cooperation with the International Lameness Committee (2008).

To assist in accurate and consistent identification, Hoof Supervisor permits identification of the cow, foot, and claw (in that order). Once the affected claw is selected, the type of foot lesion can be selected from a list of possible lesions specific to each claw zone. Hoof trimmers received a financial incentive of Can$1 per cow for submitted trim data.

Two veterinarians with experience in lameness trained the hoof trimmers to identify foot lesions in a uniform manner during a 1-d hoof health clinic. Digital, colored photographs were used to identify each foot lesion according to the international classification system adopted during the 15th International Conference on Lameness held in Finland (International Lameness Committee, 2008). A guide containing photographs of different levels of foot lesion severity was developed to assist hoof trimmers in consistently scoring lesions. One year after field data collection was in progress, another 1-d hoof health clinic was carried out to review and reinforce identification of foot lesions.

Herd and Cow Selection

A total of 156 dairy farms located in south and central Alberta, Canada, were enrolled. Data were collected between June 2009 and November 2012. Hoof trimmers recruited their client farms to participate in the study, regardless of foot lesion status. Participa-