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Risk factors for lameness and hock injuries in Holstein herds in China

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ABSTRACT

The objective was to investigate the association between herd-level management and facility design and the prevalence of lameness and hock injuries in high-producing dairy cows on commercial freestall farms in China. Housing and management measures, such as stall design, bedding type, and milking routine were collected for the high-producing pen in 34 farms in China. All cows in the pen were gait scored using a 5-point scale, and evaluated for hock injuries using a 3-point scale. Measures associated with the proportion of clinically (score ≥3) or severely (score ≥4) lame cows, and the proportion of cows having at least a minor hock injury (score ≥2) or severe injury (score = 3) at the univariable level were submitted to multivariable general linear models. The prevalence [mean ± SD (range)] of clinical and severe lameness were 31 ± 12 (7–51) and 10 ± 6% (0– 27%), respectively, and the prevalence of cows with at least a minor hock injury and with severe injuries was 40 ± 20 (6 – 95) and 5 ± 9% (0 – 50%), respectively. The prevalence of clinical lameness and severe lameness decreased with herd size (estimate = −0.35 ± 0.09% for a 100-cow increase for clinical lameness; estimate = 0.15 ± 0.06% for a 100-cow increase for severe lameness). Prevalence increased with barn age >9 yr (estimate = 12.73 ± 4.42% for clinical lameness; estimate = 5.79 ± 2.89% for severe lameness). These 2 variables combined explained 49% of the variation in clinical lameness and 30% of the variation in severe lameness. The prevalence of all hock injuries and severe hock injuries decreased with deep bedding (estimate = −20.90 ± 5.66% for all hock injuries; estimate = −3.65 ± 1.41% for severe hock injuries) and increased with barn age >9 yr (estimate = 16.68 ± 7.17% for all hock injuries; estimate = 6.95 ± 1.75% for severe injuries). These 2 variables explained 52 and 58% of the variation, respectively. In conclusion, large variation existed across farms in prevalence of lameness and hock injuries. Changes in housing and management may help control the prevalence of lameness and hock injuries in the emerging dairy industry in China.
Key words: gait, lesion, management, stall design, cow comfort

INTRODUCTION

China's dairy production has increased sharply since the mid 1990s in response to growing internal demand for dairy products, situating China among the world's top milk producers (Zhou et al., 2002; Fuller et al., 2006; Ma et al., 2012). This growth is the result of an increase in both the national dairy herd (composed of mostly Holstein cows; DAC, 2008) and milk production per cow. The growth within the Chinese dairy industry has resulted in major structural changes, including an increase in herd size and decline in the number of very small farms (milking ≤10 cows; Fuller et al., 2006; Ma et al., 2012).

The growth and intensification of China's dairy industry poses management challenges; in part, because practices implemented on larger farms often differ from traditional practices. Freestall barns are becoming common, but work from North America (Espejo and Endres, 2007; Barrientos et al., 2013; Chapinal et al., 2013) and Europe (Dippel et al., 2009; Kielland et al., 2009; Barker et al., 2010) has shown that the prevalence of lameness and leg injuries can be high in poorly managed freestall barns. Recently, Wu et al. (2012) identified lameness as the most common reason for culling in one 3,000-cow herd, suggesting that lameness is likely a major concern in China. Measuring herd prevalence of lameness and leg injuries and determining the associated risk factors may help to develop strategies for improving the health and welfare of cows in China's emerging dairy industry. The objective of the current study was to investigate the association between herd-level management and facility design and the prevalence of lameness and hock injuries in high-producing dairy cows on commercial freestall farms in China.

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MATERIALS AND METHODS

Farm Selection and Visits

A total of 34 farms in China (13 farms in the Huabei region and 21 in the Huadong region) were selected within the C.O.W.S. program, a partnership between The University of British Columbia and Novus International Inc. (http://www.novusint.com/services/cows), for this cross-sectional study. Novus sales representatives (n = 3) and distributors (n = 3) were asked to select farms among their list of clients, considering the following inclusion criteria: Holstein cows, freestall housing, provision of a TMR, and milking ≥150 cows. All methods used to collect data were approved by the University of British Columbia Animal Care Committee (Vancouver, BC, Canada), which follows the standards outlined by the Canadian Council on Animal Care (CCAC, 2009).

Farms were visited from September to December 2012. The same 2 trained observers performed all animal- and facility-based measures on all farms. One group of high-producing and primarily multiparous cows was assessed on each farm; this "high" group was identified by the producer. The group size (mean ± SD) was 111 ± 68 cows, ranging from 38 to 303 cows. Based on 14 farms with available data, the mean ± standard deviation (range) parity, DIM, and daily milk production (kg/d) of the assessment group was 2.4 ± 0.4 (1.9–3.1), 110 ± 75 (29–272) DIM, and 34.7 ± 6.6 (20.9–45.6) kg/d, respectively.

Lameness Assessment

All cows housed in the assessment group were gait scored as they exited the parlor using a 5-point numerical rating system (**NRS**), where 1 = sound and 5 = severely lame (Flower and Weary, 2006; Chapinal et al., 2009). Cows with NRS ≥3 were considered clinically lame and cows with NRS ≥4 were considered severely lame. The percentage of clinically and severely lame cows was calculated for each farm.

Hock Assessment

All cows housed in the assessment group were scored during milking for hock condition (lateral surface of the tarsal joint) on a 3-point scoring system, where 1 = healthy hock without alopecia, 2 = bald area on the hock without evident swelling, and 3 = evidently swollen or severe injury, or both, according to the Hock Assessment Chart for Cattle developed by the Cornell Cooperative Extension (http://www.ansci.cornell.edu/prodairy/pdf/hockscore.pdf). Only 1 limb per animal was considered for this assessment due to the difficulty in examining the opposite side in some type of parlors (i.e., herringbone parlor). Efforts were made to systematically score the right hock of half of the animals and the left hock of the other half within each assessment group; the only exception was on farms using rotary parlors (n = 7), where the same leg for all cows was assessed. The percentage of cows with at least a minor injury (score ≥2), and the percentage of cows with a severe injury (score = 3) was calculated for each farm.

Management and Facility Design Measures

Management and facility design measures (Table 1) considering potential risk factors for lameness and hock injuries were collected using direct observation of environment and management, an interview with the herd manager during the farm visit, bedding samples, and compilation of herd records, when available.

General Management. General herd and management factors included herd size (obtained from farm records, when available, or estimated by the herd manager), barn age (estimated by the herd manager), and access to an exercise corral (time of day and season and stage of lactation when the corral was available varied across farms).

Pen Design and Management. Thirty of the assessment pens had concrete floors, so flooring was not included as a potential risk factor due to lack of variability. Manure in the pen was removed either continuously or at a high frequency using an automatic scraper, or just a few times per day using other methods, such as a shovel or a skid steer. Therefore, a dichotomous variable was created for the presence of an automatic scraper as opposed to other methods with lower frequency of manure removal. Stall stocking density was calculated as the number of cows per available stalls (i.e., stalls with visible barriers preventing cows from lying down were excluded) multiplied by 100. The farm with the highest value for stocking density (160%) was considered an outlier and this value was not considered in the analysis. The next highest value of stocking density was 110%.

Stall Design. Stall dimensions were measured on 6 stalls per assessment pen, and included width, neck rail position (calculated as the horizontal distance between the rear edge of the neck rail and the rear curb), and neck rail height from bedding. Stalls were systematically selected based on the number and the uniformity of stalls within the pen. For example, if the pen had 100 head-to-head double-row stalls, every 16th stall was selected or if the pen had 50 head-to-head double-row stalls and 50 single-row stalls, every 16th single row was selected and every 16th double row was selected.