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Effect of following recommendations for tiestall configuration on neck and leg lesions, lameness, cleanliness, and lying time in dairy cows

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ABSTRACT

Cow comfort in tiestalls is directly affected by stall dimensions, for which some recommendations exist. To evaluate how well Canadian dairy farms with tiestalls complied with recommendations for stall dimensions, as well as the effect of compliance on cow comfort and cleanliness, we assessed lactating Holstein cows (n = 3,485) on 100 tiestall dairy farms for neck and leg lesions, lameness, and cleanliness and measured time spent lying down. Data on stall dimensions (width and length of the stall, position and height of the tie rail, length of the chain, and height of the manger curb) were recorded for each cow. The majority of cows were housed in stalls smaller than recommended. The prevalence of lesions and lameness was high (neck, 33%; knee, 44%; hock; 58%, lameness, 25%) and the prevalence of dirtiness was low (udder, 4%; flank, 11%; legs, 4%). Chains shorter than recommended increased the risk of neck, knee, and hock lesions. A tie rail further back in the stall than recommended increased the risk of neck, knee, and hock lesions and reduced the frequency of lying bouts and the risk of a dirty udder. A tie rail set lower than recommended decreased the risk of neck lesions and lameness and increased lying time and lying bout frequency. Stalls narrower in width than recommended increased the risk of neck injuries and lameness and reduced the daily duration of lying time and the risk of a dirty flank and legs. Stalls shorter in length than recommended increased the risk of knee lesions and reduced lying bout frequency and the risk of a dirty udder. The majority of farms do not follow recommendations for stall dimensions (with the exception of tie rail height), and the lack of compliance is associated with increased risk of lesions and lameness and can affect lying time. Recommended stall dimensions tend to reduce cleanliness, but the prevalence of dirty cows remains very low.

Key words: dairy cow, tiestall, stall dimensions, cow comfort, welfare

INTRODUCTION

Due to the increasing need to assure consumers and food retailers that animal welfare is being respected on commercial dairy farms, several animal welfare-assurance schemes have been developed. These often contain recommendations or requirements for the dimensions and configuration of stalls. However, although these recommendations are often loosely based on the results of experimental research, the assumption that farms that follow these recommendations will have measurable improvements in cow welfare is not often verified. Many dairy cows are still kept in tiestalls; for example, in the United States nearly 40% of dairy farms use tiestalls for lactating cows (USDA, 2016). However, the use of this method of housing dairy cattle is being increasingly questioned (e.g., European Food Safety Authority, 2009). The comfort and welfare of dairy cows kept in tiestalls is likely to be affected by the dimensions of the stall, and recommendations for stall design have been proposed, often based on observations of cows′ movements when standing up or lying down (e.g., Anderson, 2008; Table 1). Some recommendations have been adopted into welfare standards for dairy cattle (e.g., Dairy Farmers of Canada, 2009). However, little is known about how well these recommendations are being followed on commercial dairy farms, or if they do improve cow comfort.

Although much research has been done on the comfort of cows in loose housing, a dearth of information exists regarding cow comfort in tiestalls (Rushen et al., 2008). Among the rare studies done on tiestall systems, 3 epidemiological studies found high prevalence of neck and leg lesions and that the great majority of farms had stalls that were too small compared with recommendations (Zurbrigg et al., 2005a; Lapointe et al., 2010;

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Nash et al., 2016); one study found that narrow stalls and short chains were risk factors for leg lesions (Nash et al., 2016). A fourth study found a high prevalence of lameness among cows in tiestalls, but did not relate these to stall dimensions (Charlton et al., 2016). Those authors also found a large variation in lying times between farms, and in freestall systems lying time is affected by the dimensions of the stalls (e.g., Tucker et al., 2004).

Considerably more research has been done on stall design in freestall herds, and stall dimensions reportedly have an effect on several measures of cow comfort, such as the presence of leg lesions, lameness, and time spent lying down (reviewed in Rushen et al., 2008); for example, narrow stalls increase the risk of lameness (Westin et al., 2016). Unfortunately, we know little about how stall dimensions affect these measures for cows in tiestall systems. Thus, our objectives were to describe the extent that Canadian dairy farms do follow recommendations for tiestall dimensions (Dairy Farmers of Canada, 2009) and examine whether meeting these recommendations results in measurable improvements in cow comfort by reducing neck and leg lesions and lameness and increasing time spent lying down.

MATERIALS AND METHODS

The Institutional Animal Care Committees of the Universities of Laval and of Guelph approved the study following the guidelines of the Canadian Council for Animal Care (2009).

Herd and Cow Selection

We visited 100 commercial tiestall dairy farms in the Canadian provinces of Quebec (n = 60) and Ontario (n = 40), using criteria and methods described by Vasseur et al. (2015). To be included in the study, the herds had to be on the dairy recording system of either Valacta Inc. (Sainte-Anne-de-Bellevue, QC, Canada) or CanWest DHI (Guelph, ON, Canada), have Holstein cows, and a mean annual milk production of at least 7,000 kg/cow. Letters were sent to farms meeting these criteria, inviting them to participate in the study. The number of letters sent was calculated assuming a positive response of 20 to 25%. Those interested and willing to participate in the study were then contacted by telephone and interviewed to determine whether they met further study criteria, including a herd size of at least 40 lactating cows, barns that had been in use for a minimum of 1 yr, and lactating cows reported as not having access to pasture or a loafing area during the course of the study. Furthermore, the herds were selected to have variation in average cow longevity as measured by the percentage of cows in third lactation or higher (mean ± SD; 39.7 ± 8.5%, range = 15–59%) and the annual farm turnover rate (36.5 ± 10.9%, range = 17–79%).

We found that a variety of stall types were used on the farms (Nash et al., 2016); however, the majority of stalls (n = 3485; 88%) had a single horizontal tie rail with a chain, and so we restricted our analysis to these stalls. The current paper describes this subset of farms described by Nash et al., (2016).

A purposive sample of 40 lactating Holstein-Friesian cows (Ito et al., 2009) between 10 and 120 DIM was selected on each farm. If the herd had <40 cows between 10 and 120 DIM, cows were first selected by continuously increasing the DIM until reaching 40 cows. In contrast, if >40 cows between 10 and 120 DIM, the sample of study cows was balanced to reflect the distribution over parities in the herd and cows were randomly selected within the 3 parity groups, 1, 2, and 3+. The characteristics of the cows are shown in Table 2.

Table 1. Recommendations for tiestall dimensions

Dimension	Recommendation[1]
Stall width	2× width of the cow at the hook bone
Bed length	1.2× height of cow at rump
Tie rail height	0.80× height of cow at rump
Tie rail position	35 cm more than stall length, from the back of the stall
Chain length	Height of tie rail = 20 cm
Manger wall height	<20 cm

[1]From Anderson (2008).

Data Collection

All measures were collected using standard operating procedures described previously (Gibbons et al., 2014; Vasseur et al., 2015; www.dairyresearch.ca/animal-comfort-tool.php). Each farm was visited twice at an interval of 5 to 10 d. During the first visit, data were collected on the cows and on the stall in which each cow was housed. During the second visit, equipment was removed and the farmers were debriefed. Personnel responsible for data collection underwent an intensive 2-wk training program, and the repeatability for each trainee was assessed as described in Gibbons et al. (2012). Only those who attained the target Kendall's W ≥0.6 during training were used. There were never more than 2 observers per farm, and each observer would take the same measure on all cows on a farm.

Lesion Scoring. Cows were scored for lesions on the tarsus (hock) and carpus joints (knee) and neck according to the method described by Gibbons et al. (2012; Table 3). Nash et al. (2016) provides descriptive data