Associations between housing and management practices and the prevalence of lameness, hock lesions, and thin cows on US dairy operations

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ABSTRACT

The objective of this study was to determine the association among different housing and management practices on the prevalence of lameness, hock lesions, and thin cows on US dairy operations. This study was conducted as part of the National Animal Health Monitoring System's Dairy 2014 study, which included dairy operations in 17 states. Size categories were assigned as follows: small (30–99 cows), medium (100–499 cows), and large (≥500 cows). Trained assessors visited 191 dairy operations from March through July 2014 and recorded locomotion and hock scores (on a 3-point scale), and the number of thin cows (body condition score ≤2.25) from a total of 22,622 cows (average 118 cows per farm). The majority of cows (90.4%) were considered to be sound (locomotion score = 1), 6.9% were mild/moderately lame (locomotion score = 2), and 2.7% were severely lame (locomotion score = 3). Similarly, most cows (87.3%) had no hock lesions (hock score = 1), 10.1% had mild lesions (hock score = 2), and 2.6% had severe hock lesions (hock score = 3). A low percentage of cows (4.2%) were thin. Univariate comparisons were performed using PROC LOGLINK, which accounts for study design and weighting. Variables meeting the univariate screening criterion of $P < 0.20$ were eligible for entry into multivariable models. Statistical significance in the multivariable models was declared at $P < 0.05$. Large operations had a lower within-herd prevalence of cows with locomotion score ≥2 and locomotion score = 3 compared with small or medium-sized operations. Operations on which cows were kept primarily on pasture had a lower percentage of locomotion score = 3 than those housed in freestall or open/dry lot operations. The use of sand bedding was associated with a lower within-herd prevalence of locomotion score ≥2 than straw/hay or dry/composted manure as the primary bedding material. Sand bedding was also associated with a lower within-herd prevalence of locomotion score = 3 than other bedding types except for rubber mats or mattresses. Operations that housed cows in an open/dry lot had a lower percentage of hock score ≥2 and hock score = 3 than other housing types. Providing sprinklers for heat abatement and having a nutritionist balance rations for cows was associated with a lower percentage of thin cows. Results from this study highlight management practices that may reduce the prevalence of lameness, hock lesions, and thin cows on dairy operations in the United States.
Key words: dairy cow, lameness, hock lesions, body condition

INTRODUCTION

Lameness is a leading welfare concern in the dairy industry, mainly because lame animals are in pain (O'Callaghan et al., 2003; Rushen et al., 2007). The mean prevalence of lameness on dairies in the United States is reported to range from 13 to 55% (von Keyserlingk et al., 2012; Hoffman et al., 2014; Cook et al., 2016), indicating that roughly a quarter to half of dairy cows in the United States are in pain. In addition to its impact on welfare, lameness has been shown to result in decreased milk production (Warnick et al., 2001; Juarez et al., 2003; Hernandez et al., 2005), reduced reproductive efficiency (Hernandez et al., 2001; Garbarino et al., 2004), and increased culling (Sprecher et al., 1997; Booth et al., 2004). Dairy characteristics, such as housing type, bedding material, and flooring design, have been shown to affect dairy cow lameness. Cows in compost barns have been shown to have a lower prevalence of lameness compared with cows in freestall barns (Lobeck et al., 2011). Similarly, cows that were housed in freestall barns with access to pasture had a lower prevalence of lameness compared with those housed in freestall barns with no access to pasture (17 vs. 39%;

Haskell et al., 2006). Herds using deep sand bedding had a lower prevalence of lameness than herds using mattress-bedded stalls (Cook, 2013) or those using sawdust-bedded stalls (Chapinal et al., 2013). Housing cows on concrete has also been associated with dairy cow lameness; a study by Vanegas et al. (2006) found that cows housed on concrete were 5 times more likely to be diagnosed as lame as those housed on rubber mats over concrete.

Hock lesions are a common leg injury and welfare concern for dairy cattle (Whay et al., 2003). Housing characteristics can affect the occurrence of hock lesions in dairy cows. In a study of dairy cows on farms in New York, Oregon, and Wisconsin, cows that had access to pasture had fewer hock lesions compared with cows that had no pasture access (Bergman et al., 2014). A Canadian study reported a hock lesion prevalence of 56% in cows housed in tiestall operations (Nash et al., 2016), compared with prevalences of 47 and 50% reported in freestall operations in Canada and Wisconsin, respectively (Zaffino Heyerhoff et al., 2014; Cook et al., 2016). Multiple studies have illustrated the benefits of deep sand bedding for reducing the prevalence of hock lesions. In a survey of 297 freestall operations in the United States, operations that used rubber mats or mattresses as bedding had a higher percentage of cows with severe hock lesions than operations that used sand bedding (Lombard et al., 2010). Similar results have been found in other studies, with the use of rubber mats or mattresses resulting in an increase in hock lesions compared with sand-bedded stalls (Weary and Taszkun, 2000; Fulwider et al., 2007; Lobeck et al., 2011).

Body condition scores are used to gauge the amount of muscle and fat on a dairy cow, with low values representing under-conditioned or emaciated cows, and high values representing over-conditioned or obese animals (Wildman et al., 1982; Ferguson et al., 1994). There is concern from the public that the welfare of under-conditioned dairy cows is compromised (Roche et al., 2009), whereas multiple studies suggest that the health of over-conditioned dairy cows may suffer (Markusfeld, 1985; Gillund et al., 2001). Over-conditioned cows are at an increased risk of metabolic diseases following calving, including milk fever (Roche and Berry, 2006), and ketosis (Gillund et al., 2001; Ingvartsen, 2006). In contrast, a study by Hoedemaker et al. (2009) illustrated an association between BCS and lameness, with thin animals more likely to be lame. Multiple herd-level and cow-level factors may affect the body condition of cows, including whether or not all lactating cows are fed the same ration, as well as overall production level. The stage of lactation of a cow has been shown to influence

BCS. As cows are not able to consume enough feed to meet their energy requirements during early lactation, the BCS profiles of cows after calving have been shown to be a mirror image of the milk production curve, with BCS declining as milk production increases (Roche et al., 2009).

A wide range of housing and management systems are used on dairy operations and some may negatively affect cow welfare, specifically lameness, the occurrence of hock lesions, and low BCS. The USDA's National Animal Health Monitoring System (**NAHMS**) conducts national surveys to collect information on the health and management of domestic livestock species and, in 2014, a study was conducted to collect information about the US dairy industry (USDA, 2014). The information reported here is a component of the NAHMS 2014 Dairy study. During the needs assessment phase of the 2014 study, key industry stakeholders, including university, extension, and dairy personnel, requested that the study include a national estimate of the prevalence of lameness because one was not available. In addition to providing a national estimate, it was requested that the study evaluate different management practices and housing types and their effects on lameness. Estimates generated from this national study could also be used to inform evaluation programs, such as the National Milk Producers Federation's Farmers Assuring Responsible Management (FARM) program. The objective of this study was to determine the association between different housing and management practices and estimate the prevalence of lameness, hock lesions, and thin cows on US dairy operations.

MATERIALS AND METHODS

Study Design

The USDA's National Agricultural Statistics Service (**NASS**) *Cattle Report* was used to determine states for inclusion in the NAHMS Dairy 2014 study (USDA, 2013), with the goal of including states that accounted for at least 70% of both dairy operations and dairy cattle in the United States. Seventeen states were chosen for inclusion in the study, representing 80.5% of dairy operations and 81.3% of dairy cows in the United States. The states were categorized into 2 regions (West: California, Colorado, Idaho, Texas, Washington; East: Indiana, Iowa, Kentucky, Michigan, Minnesota, Missouri, New York, Ohio, Pennsylvania, Vermont, Virginia, Wisconsin). Then, NASS used a sampling frame and selected a stratified random sample of dairy operations within each state to participate in the study. Herd sizes were defined as very small (1 to 29 cows),