J. Dairy Sci. 101:1–15
https://doi.org/10.3168/jds.2017-14232

Relationship between herd size and measures of animal welfare on dairy cattle farms with freestall housing in Germany

Daniel Gieseke,*[1] Christian Lambertz,† and Matthias Gauly†
*Department of Animal Sciences, Georg-August-University of Goettingen, 37075 Göttingen, Germany
†Faculty of Science and Technology, Free University of Bolzano, 39100 Bolzano, Italy

ABSTRACT

The objective of this study was to examine the association of herd size with animal welfare in dairy cattle herds. Therefore, 80 conventional dairy cattle farms were classified by the number of cows into 4 herd size classes, C1 (<100 cows), C2 (100–299 cows), C3 (300–499 cows), and C4 (≥500 cows), and assessed using multiple animal-based measures of the Welfare Quality Assessment protocol for dairy cattle. Data were recorded from April 2014 to September 2016 by an experienced single assessor in Northern Germany. Each farm was visited 2 times at an interval of 6 mo (summer period and winter period) to avoid seasonal effects on the outcome. The average herd size was 383 ± 356 Holstein-Friesian cows (range 45 to 1,629). Only farms with freestall (cubicle) housing and a maximum of 6 h access to pasture per day were included in the study. Data were statistically analyzed using a generalized linear mixed model. None of the farms reached the highest overall rating of "excellent." The majority of the farms were classified as "enhanced" (30%) or "acceptable" (66%), and at 6 assessments the farms were rated as "not classified" (4%). Regarding single indicators, mean trough length per cow, percentage of cows with nasal discharge, and vulvar discharge increased with increasing herd size, whereas it was vice versa for displacements of cows. Percentage of lean cows, percentage of dirty lower legs, and duration of the process of lying down showed a curvilinear relationship with the number of cows per farm. Herd size was not associated with any other measures of the Welfare Quality protocol. In conclusion, herd size effects were small, and consequently herd size cannot be considered as a feasible indicator of the on-farm animal welfare level. Housing conditions and management practices seem to have a greater effect on animal welfare than the number of dairy cows per farm.

Key words: animal welfare, herd size, dairy cow, welfare quality protocol for cattle

INTRODUCTION

Over the last decades, milk production has intensified continuously in Europe. The number of dairy cattle farms in the member states of the European Union-10 (Belgium, Denmark, Germany, Ireland, Greece, France, Italy, Luxembourg, the Netherlands, and United Kingdom) decreased from 1,514,441 to 288,600 farms between 1983 and 2013 (−81%). During this period the dairy cattle population declined by 31% from 25,143,828 to 15,460,770 animals, whereas average milk production remained stable (100 million t). This indicates a significant improvement of the milk yield per cow (Eurostat, 2015), which might affect the welfare of dairy cows especially because of increasing health disorders (Coignard et al., 2014). Driven by this development, the average herd size in the stated European Union countries increased from 17 to 54 dairy cows per farm (Eurostat, 2015). A similar herd size development is noted on a global scale. Between 1970 and 2006, herd sizes increased from 19 to 120 animals in the United States (MacDonald et al., 2007), from 93 to 284 in Australia (Dairy Australia, 2015), and from 140 to 413 in New Zealand (Dairy New Zealand, 2014). During the same period, public awareness of animal welfare issues in livestock farming has increased (European Commission, 2016) and many consumers are concerned about the enduring intensification of livestock production (Spooner et al., 2014). The so-called factory farms are perceived as having serious animal health and welfare problems (Prickett et al., 2010; Vanhonacker and Verbeke, 2014). From the consumers' perspective, natural housing conditions are essential for animal welfare and these would only be provided in small-scale family farms (Krystallis et al., 2009; Spooner et al., 2014). Contrastingly, farmers do not seem to associate herd size with welfare-related issues. Performance and health of the animals are from their point of view more suitable indicators of animal welfare and can be

Received December 1, 2017.
Accepted April 4, 2018.
[1] Corresponding author: dgiesek1@gwdg.de

maintained independent of the herd size (Vanhonacker et al., 2008; Sorensen and Fraser, 2010). However, little scientific evidence is available about whether there is a direct correlation between herd size and farm animal welfare status. Larger herds are associated with increasing stock per labor unit, increasing stocking density, and less access to pasture. Furthermore, better-trained staff, routine veterinary herd health visits, and monitoring systems are more likely in large herds (Beggs et al., 2015; Robbins et al., 2016). Numerous studies have considered herd size as an influencing factor for animal welfare issues with inconsistent results. For example, increasing herd size was reported as detrimental factor for lameness (Alban, 1995; de Vries et al., 2014) or mastitis (Archer et al., 2013; Lievaart et al., 2007), whereas in other studies a protective effect of increasing herd sizes was found for lameness (Dippel et al., 2009; Solano et al., 2015) or mastitis (Oleggini et al., 2001; Simensen et al., 2010). Others, however, did not observe any relationship between herd size and lameness (Barker et al., 2010; Fabian et al., 2014) or mastitis (Whitaker et al., 2004; Ivemeyer et al., 2011). Robbins et al. (2016) pointed out in their comprehensive review about farm size and animal welfare that study designs in the existing literature differ considerably and the definition of large and small herd sizes are country specific. Moreover, herd size has only been taken into account as a risk factor for single animal welfare indicators. Due to the multidimensional character of animal welfare, a holistic approach considering various health and behavior parameters is necessary to investigate the overall effect of herd size on animal welfare (Robbins et al., 2016). Therefore, the objective of this study was to examine the relationship between herd size and animal welfare and to analyze whether herd size could be used as an indicator of animal welfare at the herd level. A total of 80 conventional dairy cattle farms with different herd sizes (small: <100; medium: 100–299; large: 300–499; very large: ≥500 cows) were assessed using multiple animal-based measures of the Welfare Quality Assessment protocol (**WQP**) for dairy cattle (Welfare Quality, 2012).

MATERIALS AND METHODS

Study Design

The data collection was conducted from April 2014 to September 2016 by a single assessor on 80 conventional dairy farms located in Northern Germany. Each farm was visited 2 times at an interval of 6 mo (summer period and winter period) to avoid seasonal effects on the animal welfare assessment. At both visits the animal welfare was assessed using the WQP. This is a standardized indicator system for on-farm animal welfare assessment. It focuses mainly on animal-based measures, which directly reflect the actual welfare state of the animals. More than 30 animal welfare indicators covering aspects of feeding, housing, health, and behavior were measured and aggregated to 12 welfare criteria and 4 welfare principles (Welfare Quality, 2012). Finally, farms were assigned to 1 of 4 overall welfare categories, representing an "excellent," "enhanced," or "acceptable" animal welfare state. In cases where minimum requirements could not be achieved, the farms were rated as "not classified." The assessor was trained intensively by a member of the Welfare Quality Network (Christoph Winckler, University of Natural Resources and Life Sciences, Vienna, Austria) to ensure the correct application of the dairy-cattle-specific indicators of the WQP. The official 4-d training course at the University of Natural Resources and Life Sciences in Vienna (Austria) consisted of theoretical exercises with photos and videos as well as practical applications of the WQP on different dairy cattle farms. Data collection of this study was conducted by this assessor only.

Farm Selection

Farm acquisition was organized with the support of different agricultural stakeholders (e.g., chamber of agriculture, milk recording association, and research facilities). For participation in the study, some specific requirements had to be fulfilled to guarantee the comparability of the housing environment. All lactating dairy cows in the sample had to be kept in loose housing barns with deep bedded or rubber mat-equipped cubicles. The dominant breed was Holstein Friesian so that genetic effects could be excluded. Farms with access to pasture for more than 6 h per day were omitted from the study because this resource-based indicator has a high weighting within the aggregation system of the WQP and an inclusion would lead to a substantial confounding effect. Nine farms provided access to pasture for less than 6 h per day without significant feed intake ("outdoor loafing areas"). There were no other limitations regarding housing conditions, milking techniques, or feeding systems (for further characterizations of the farms see Table 1). The 80 dairy cattle farms were classified based on the herd sizes according to the classification of the federal statistical office in Germany (Destatis, 2017). The first class had <100 dairy cows (**C1**), the second 100 to 299 dairy cows (**C2**), the third 300 to 499 dairy cows (**C3**), and the fourth ≥500 cows (**C4**). Each class consisted of 20 farms. Maximum group sizes were documented, defined as the maximum