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Farm characteristics and calf management practices on dairy farms with and without diarrhea: A case-control study to investigate risk factors for calf diarrhea

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ABSTRACT

Calf diarrhea is one of the most important problems in calf rearing on dairy farms worldwide. Besides pathogens, several noninfectious management factors, especially management around birth, colostrum management, calf housing, feeding, and hygiene are important in the pathogenesis of diarrhea. To date, few data are available concerning calf rearing management on small and medium-sized dairy farms that are typical for Austria and the alpine region. Consequently, the objectives of this case-control study were to evaluate routine calf management practices on Austrian dairy farms and to examine differences in management between farms with and without the presence of calf diarrhea to identify risk factors. Overall, 100 dairy farms were visited. Of these farms, 50 were chosen based on the history and presence of calf diarrhea (case farms). Another 50 farms with no presence of calf diarrhea were chosen to serve as a standard of comparison (control farms). On farms, management was evaluated by face-to-face interview, and health status and hygiene were surveyed. Several calf rearing management procedures were similar on all of the visited farms, especially in areas regulated by national and European law. These factors include colostrum management and feeding. Consequently, no influence of these factors on the appearance of calf diarrhea could be detected. In contrast, other areas such as hygiene measures differed between farms and showed a partial association with the presence of calf diarrhea on farm. Variables related to diarrhea on farm were farm size; that is, the number of cows on farm. Farms with diarrhea cases were larger (median 40 cows, interquartile range 24.5 to 64.0) compared with farms with no presence of diarrhea (median 28 cows, interquartile range 18.8 to 44.0). Other risk factors that influenced the presence of diarrhea were the presence of other farm animal species on the farm [odds ratio (OR) 26.89, 95% confidence interval (CI): 2.64 to 273.5], frequency of cleaning of the calving area (OR 0.12, 95% CI: 0.02 to 0.79), the placement of individual calf housings (barn vs. outdoors; OR 0.02, 95% CI: 0.00 to 0.47), and the presence of respiratory tract disease (OR 52.49, 95% CI: 1.26 to 2,181.83). The possible influence of these factors on the appearance of calf diarrhea should be considered when farmers are advised.

Key words: diarrhea, dairy calf, management

INTRODUCTION

Calf management, especially calving management, care of the newborn, colostrum management, calf housing and feeding, as well as hygiene, has an important effect on calf performance and health. The most important health concern is calf diarrhea, resulting in the greatest economic loss in this age group (Torsein et al., 2011). Diarrhea is a complex, multifactorial disease with numerous infectious and noninfectious factors. Factors influencing the pathogenesis of diarrhea are pathogen exposure, environmental conditions, management, nutritional state, and immune status.

Different studies have aimed to identify risk factors for the presence of calf diarrhea, sometimes with contradictory results. Bendali et al. (1999), for example, reported that cow cleanliness and cleaning of the barns after the calving season may prevent diarrhea. Similar results were obtained in a prospective cohort study by Frank and Kaneene (1993). Pithua et al. (2009) compared the prevalence of diarrhea and other diseases in calves in regard to cleaning the calving area. In that study, the risk for diarrhea or any other calf disease was not different between groups, indicating that management factors other than the calving pen had a greater influence on calf health. Regarding colostrum supply, few authors could determine statistically significant effects. The origin of colostrum and route of colostrum feeding (nipple or bucket versus suckling) have been associated with the occurrence of diarrhea (Svensson et al., 2003; Lundborg et al., 2005). Furthermore, the

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concentration of IgG was related to diarrhea (Berge et al., 2009).

Additional factors associated with diarrhea were breed (Lundborg et al., 2005; Svensson and Liberg, 2006; Svensson et al., 2006), the placement of indoor calf pens against an outer wall compared with pens separated from outer walls (Lundborg et al., 2005), keeping grouped calves on a slatted concrete floor versus other floors, housing in freestalls compared with tiestalls, purchasing calves (Gulliksen et al., 2009), and calf stocking density (Bendali et al., 1999).

In Europe, some management and environmental factors concerning calf rearing are regulated by law (Council Directive 2008/119/EC; European Community, 2008). This European directive is specified in some areas by Austrian legislation (Tierhaltungsverordnung, 2004). Regulated areas are colostrum support within the first 6 h postpartum and some aspects of calf housing and feeding. In contrast, although the importance of hygienic measures is known (Weaver et al., 2000), they are not regulated.

Little data are available concerning calf management on small and medium-sized dairy farms as typical for Austria. Thus, the objective of the present study was to evaluate routine calf management practices on Austrian dairy farms and to define risk factors for the presence of calf diarrhea in a case-control study.

MATERIALS AND METHODS

Experimental Design

One hundred dairy farms in Austria were visited and evaluated once by the same person from September to March of 2009–2010. To recruit case farms, local veterinarians of 2 areas in Austria, Lower Austria and Styria, were asked to provide lists of dairy farms with a documented problem of calf diarrhea during the past year. A farm with diarrhea problems was defined as a farm with multiple treatments by the veterinarian for calf diarrhea. Out of these lists, farms were randomly chosen, and farmers were contacted in the week before the planned visit, asked if problems with calf diarrhea were still present on farm, and asked whether they were willing to participate in the study. Farms were only enrolled into the study when at least one calf suffered from diarrhea at the farm visit. Five farms refused to participate and another 7 of the contacted farms had no actual cases of diarrhea. To define cases of diarrhea, feces of preweaned calves was evaluated as described by Larson et al. (1977), where scores 3 (runny, spreads readily to about 6 mm depth) and 4 (watery, liquid consistency, splatters) were categorized as diarrheic.

Local veterinarians were asked to identify additional farms to serve as control farms, from the same geographical region and of similar structure but with no history of calf diarrhea problems and no current diarrhea cases. To achieve good similarity in structure, the type of farm (conventional or organic), the type of cow barn (freestall or tiestall), and the number of dairy cows were used as further criteria. The farms that best fit these criteria were contacted and visited at the same time as the farms with diarrhea. If no suitable farm was available in the same geographical region or the farms did not want to participate in the study (17 farms), the next best fitting farm was chosen. Farms were excluded as control farms if one or more calves suffered from diarrhea at the time of the visit; this was the exclusion criterion for 7 farms. Presence of other diseases did not exclude a farm from the study.

A sample size of 50 case and 50 control farms provides 95% confidence of detecting an odds ratio of $\geq$3.5 (80% statistical power), assuming a minimum of 20% of control farms exposed to the factor of interest (Thrusfield et al., 2001).

A questionnaire was used to collect data during a face-to-face interview with the farm owner or manager. Areas of interest were farm characteristics, health status of the animals, calf housing and feeding, focusing on calves within the first weeks of life, management practices around calving and birth, as well as hygienic measures. Calf rearing areas were visited and hygiene was evaluated as described by Lundborg et al. (2005). To evaluate calf hygiene, the legs, thighs, and ventral abdomen of up to 5 randomly chosen preweaned calves were scored. The percentage of the body part that was contaminated with feces was documented (0 to 100%). Furthermore, the pen walls and bedding material of up to 5 individual and group calf housings for preweaned calves were scored. A value of 0 to 5% described a clean area, 6 to 30% a mildly dirty area, 31 to 70% a moderately dirty area, and >70% a severely contaminated area.

Depending on farm size, up to 5 randomly chosen preweaned calves were examined by the same person according to the clinical examination of ruminants (Radostits et al., 2007). This examination included evaluation of behavior and general appearance, posture, body condition, body conformation, skin (including umbilicus), head (eyes, nostrils, mouth), thorax (respiratory rate, rhythm, depth, type, and noises), pulse, auscultation of the lung and heart, and abdomen. Respiratory tract disease was defined as severely increased respiratory sounds at lung auscultation or as moderately increased respiratory sounds together with additional signs, such as dyspnea, coughing, or nasal discharge. By definition, an umbilical infection was diagnosed