

Relationship Between Barn Hygiene and Lameness Prevalence in Thirty-Five Transylvanian Dairy Farms

Silvana POPESCU, Razvan STEFAN, Eva-Andrea DIUGAN, Cristin BORDA, Marina SPINU, Carmen Dana SANDRU

Faculty of Veterinary Medicine, University of Agricultural Sciences and Veterinary Medicine, Manastur street, no. 3-5, 400372, Cluj - Napoca, Romania; popescusilvana@yahoo.com

Abstract. The aim of this work was to study the relationship between hygiene and lameness prevalence in dairy cattle kept in tie-stall barns in Transylvania (Romania). The barns' hygiene was assessed based on the body hygiene of the housed cattle. The prevalence of lameness was determined and the cleanliness of the two body areas of the cows in 35 dairy farms with tie-stall housing was assessed over the period of November – December 2009. A total number of 2028 dairy cows were evaluated. The percentage of hygiene scores of 3 and 4 for the upper leg and flank with a mean value of 41.35% and for the lower leg with a mean value of 33.12% showed statistically significant differences (Mann-Whitney Test, $p < 0.01$) between the hygiene of the two body areas. The prevalence of lameness varied between 3.57% and 58.33% with a mean value of 20.79%. We found a positive correlation between leg hygiene and lameness prevalence, both with respect to lower leg hygiene ($r_s = 0.63$, $p < 0.0001$) and upper leg and flank hygiene ($r_s = 0.65$, $p < 0.0001$), respectively. The obtained results showed that the poor hygiene of barn represents a risk factor associated to lameness prevalence in tied dairy cattle.

Keywords: dairy cow, hygiene score, cleanliness, body hygiene, dirtiness, locomotion score.

INTRODUCTION

For dairy cows, lameness represents a severe welfare problem decreasing the mobility and impairing the normal behaviour (Whay *et al.*, 2003). Lamé cows are more restless at milking, spend more time lying down and eat more slowly (O'Callaghan *et al.*, 2003; Cook *et al.*, 2004). Lameness reduces the milk production (Green *et al.*, 2002), fertility (Garbarino *et al.*, 2004), voluntary visits to a robotic milking machine (Klaas *et al.*, 2003) and increases culling rates (Booth *et al.*, 2004). Lameness also produces high economic costs through lost milk production (Green *et al.*, 2002). In addition to the economic impact, the lame animal is in a condition of pain (Whay 1997).

The lameness assessment in a herd represents the first step in its investigation. Several locomotion assessment systems for dairy cows were devised (Manson and Leaver 1988; Sprecher *et al.*, 1997; Whay 2002). In field use, important practical differences between these systems exist (Whay 2002). Locomotion assessment proved to be a useful tool not just in lameness prevalence determination within a farm but also in sensitizing the farmers with regard to the cows with lameness problems. The evaluation system helps early detection of lame cows, prevention of severe injuries endangering the lives of animals which represent a major problem of dairy cows welfare (Nordlund *et al.*, 2004).

The lameness causes are multiple: genetic (Green *et al.*, 2002), environmental conditions (Cook 2003; Espejo *et al.*, 2006), nutrition (Amory *et al.*, 2006; Cook and Nordlund 2009), and management practices (Barker *et al.*, 2007). The increase in lameness

prevalence is associated with solid concrete flooring, decreased lying times due to the discomfort, slippery walking alleys, uncomfortable and dirty barns. Increased degree of dirtiness in cows' legs, free-stall sheltering and the lack of biotin supplementation in lactating cows (Cook 2002; Zurbrigg *et al.*, 2005; Hedges *et al.*, 2001). Also, several researches showed that those cows housed in wet, manure contaminated conditions are more likely to suffer infectious diseases of the foot, such as interdigital necrobacillosis (foot rot), heel horn erosion and papillomatous digital dermatitis (heel warts) (Cook 2002).

Taking into consideration all these aspects, the aim of this work was to study the relationship between hygiene and lameness prevalence in dairy cows housed in tie-stall barns in Transylvania (Romania).

MATERIALS AND METHODS

Investigations were made in 35 dairy farms (20-113 cows/barn), with tie-stall housing system, in Transylvania (Romania) over November - December 2009. Tie stalls are the most common style of housing used on Romanian dairy farms. All of the barns were closed, with solid floors. The cows were confined in short stalls (1.6 -1.8 m length) in 60% of the barns and on medium sized stalls (1.8 - 2.2 m length) in 35% of the barns. In 50% of the barns small amounts of bedding (straw, sawdust, wood shavings) was used. Only one farm had mechanical ventilation system, the others had natural ventilation. In 70% of the investigated farms the manure removal was done manually (once or twice a day). In the majority of the studied farms, the cows were housed (tied) in the cold season (with a few hours per day in outside paddocks, in the less cold days) and pasturing (over daytime) in the rest of the year. Only in 20% of the barns the cows were confined permanently, without outdoor access. Each farm was visited once. All the cows in the 35 barns were assessed, i.e. a total number of 2028 dairy cows.

The hygiene degree of the farms was appreciated based on the cows' body hygiene, using the assessment system (hygiene scoring system) elaborated by Cook (2002) and modified by us. The modification consisted in the fact that we evaluated only two body regions instead of three as it is suggested by Cook (2002). Previous studies indicated that the assessment of two body regions is sufficient for the appraisal of the hygiene level in the farms. We evaluated the regions of the lower leg and upper leg and flank, awarding points (from 1 to 4) depending on the degree of manure contamination in the respective areas. A separate score for each body zone was established. Finally, the proportion of 3 and 4 scores (indicating "too dirty") in the two body regions (lower leg and upper leg and flank) for each cow in every farm, and the mean percentage of these cows in the investigated barns were calculated.

Lameness was assessed based on the locomotion score, devised by Sprecher *et al.*, (1997), considering as lame cows those ones obtaining scores between 3 and 5. For the locomotion score, the cows were untied and led out from the barns.

The results were statistically processed with the software GraphPad InStat version 3 (GraphPad Software Inc. USA). Lameness prevalence in each farm, the mean prevalence and the Spearman's rank correlation coefficient (r_s) between the barn hygiene (lower leg and upper leg and flank) and lameness were determined. The prevalence of lameness was calculated as the proportion of cows with scores of 3 or more. The Tukey-Kramer Multiple Comparisons Test-One-way ANOVA was used to compare the data.

RESULTS AND DISCUSSION

The proportion of cows with too dirty legs (scores of 3 and 4) in the 35 barns is shown in Figure 1. The proportion of scores of 3 and 4 for the upper leg and flank varied between 14.28% and 75%, with a mean value of 41.35% and for the lower leg ranged from 10.71% to 66.67% and had a mean value of 33.12% (Tab. 1). The differences between the hygiene of upper leg and flank and lower leg were statistically significant (Mann-Whitney Test, $p < 0.01$). The lameness prevalence varied extensively among the farms (Fig. 2), ranging from 3.57% to 58.33%, with a mean value of 20.79 % (Tab. 1). A significant positive correlation was demonstrated between the hygiene of the legs and lameness prevalence, both in the case of the lower legs hygiene ($r_s = 0.63$, $p < 0.0001$) and in the case of upper legs and flank hygiene ($r_s = 0.65$, $p < 0.0001$) (Tab. 2).

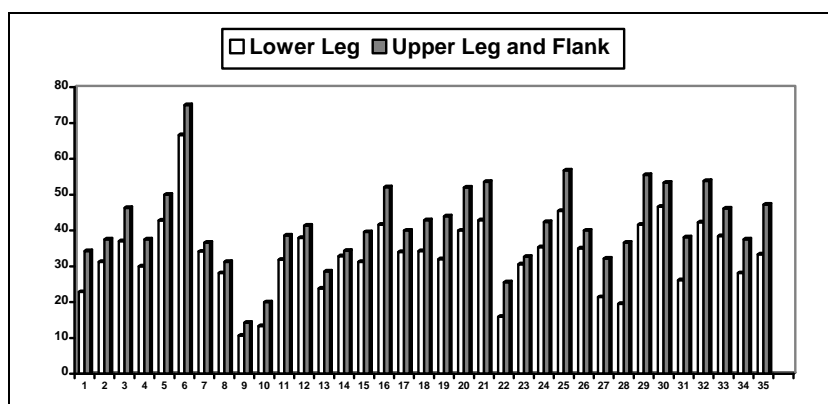


Fig. 1. The proportion (%) of cows with too dirty legs (scores 3 and 4) in the 35 tie-stall barns in Transylvania

Descriptive statistical parameters for the lameness prevalence and the proportion of 3 and 4 scores for lower leg and upper leg and flank areas in the 35 dairy tie-stall barns

Tab. 1

Statistical parameter	Lameness (%)	Hygiene Scores 3 and 4 (%)	
		Lower Leg	Upper Leg and Flank
Mean	20.79	33.12	41.35
Standard deviation	10.65	10.61	11.50
Median	23.65	33.33	40.00
Maximum	58.33	66.67	75.00
Minimum	3.57	10.71	14.28

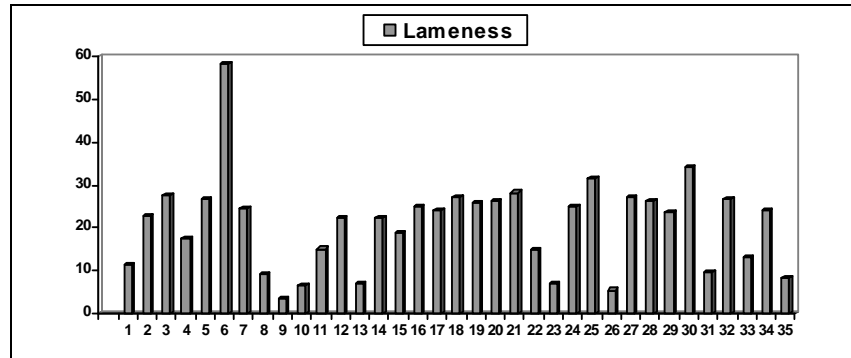


Fig. 2. The lameness prevalence in the 35 investigated dairy tie-stall barns in Transylvania

Tab. 2

Correlation between leg hygiene (barn hygiene) and lameness prevalence in dairy cows from 35 tie-stall barns in Transylvania

Correlation	n	Spearman's rank correlation coefficient	95% CI
Upper leg - flank and lameness	35	0.65***	0.4076 to 0.8165
Lower leg and lameness	35	0.63***	0.3765 to 0.8039

n = number of barns

CI = confidence interval

*** = $p < 0.0001$, considered extremely significant

The hygiene of legs was evaluated using the system proposed by Cook (2002) and modified by us. Because a mean score of the hygiene level of each area does not present any importance for the farmer, only the proportion of scores indicating „too dirty”, namely the scores 3 and 4, was taken into consideration. An elevated percentage of 3 and 4 scores indicate poor barn hygiene, unacceptable, with severe consequences on cows' health and welfare (Cook 2002). The proportion of scores of 3 and 4, both for the lower leg and for upper leg and flank, varied in the investigated barns (Fig. 1), with significantly higher values for the upper leg and flank area (Mann-Whitney Test, $p < 0.01$). Our results are in agreement with the data in scientific literature which stated that the cows kept in tie-stall system had higher hygiene scores in the region of upper leg and flank than in the region of lower leg, due to lying down in the dejections deposited in the stalls (Cook 2002, Zurbrigg *et al.*, 2005). This body region can also get soiled in poorly maintained stalls presenting elements splashed with dejections or through the movements of the dirty tail around the hind section. In 70% of the investigated farms the manure removal was done manually, leading to a deficient barn hygiene and vitiated air. The mean proportion of the 3 and 4 scores in the two body regions (Tab. 1) is higher than Cook's findings (2002) in his assessment of 20 dairy cattle farms in Wisconsin, with tie-stall and free-stall housing. He found that, on average the proportion of cows in tie-stalls considered to be “too dirty” was, by zone, as follows: 25% for lower leg zone, 30% for upper leg and flank zone.

The prevalence of lameness varies in the studies done in different countries of the world. Recent figures for the prevalence of lameness in European countries range from 22%

(Whay *et al.*, 2003) to 45% (Winckler and Brill 2004) for loose-housing systems and from almost 1% to 21% for systems in which cows are tied for at least part of the time (Bielfeldt *et al.*, 2005; Sogstad *et al.*, 2005; Zurbrigg *et al.*, 2005). Prevalence of lameness in US cows, in commercial free-stall housing, is approximately 25% and in tie-stalls 21% (Cook 2003; Espejo *et al.*, 2006), but varies greatly from farm to farm. It is possible that the great variation, both regional and national, in lameness prevalence estimation appeared due to the evaluation system and to the observations being done by different operators (Amory *et al.*, 2006). Lameness evaluation in cattle and the evaluation of gait abnormalities are subjective. The locomotion assessment system suggested by Sprecher *et al.*, (1997) was used because it presents clear and objective descriptions which differentiate between scores. The scores from 3 to 5 were grouped thus allowing a great number of cows to be assessed over a short time, using just the observation of the position of the back of the cow, in standing and in walking. Another reason was that the scores of 4 and 5 identify the obviously lame cows. Not all cows that arch their back are apparently lame, but for our study these cattle were assumed to have poor locomotion. The conditions which cause arched back are rare, leading thus to only a few errors. Some cows that were lame did not arch their backs, but again these were a negligible proportion and were scored as being lame. Using a simple objective scoring system could improve assessment of lameness through its ease of use, and allow quick training of evaluators.

The mean prevalence of lameness found in the farms we investigated is comparable with the results of the study done by Cook (2003) in tie-stall farms in Wisconsin (21.7%). Regula *et al.*, (2004) found a lameness prevalence of 21% (in 1999) and 17% (in 2000) in Swiss dairy cows kept in tie-stalls with minimal outdoor access during winter; in the same time in tie-stalls with regular outdoor exercise throughout the year the prevalence of lameness was lower. Also, Bielfeldt *et al.*, (2005) observed that lameness was more frequent in cows housed in tie-stall barns without exercise (13.2%) than in tie-stall barns with exercise (9.6%). This aspect was observed in our study too, but it did not represent an objective of our research. For Romanian dairy farms, no recent data on the prevalence of lameness were available in the scientific literature.

The positive correlation between the hygiene of legs and lameness prevalence proved in our study is highlighted in literature. Several researches showed that dirty legs are correlated with the increased number of lame cows (Cook 2002, Zurbrigg *et al.*, 2005). There are several possible explanations for these correlations. To relieve the pain, lame cows may spend more time lying down and thus have a greater chance of lying in manure (Kloosterman, 1997). Severely lame cows may find it difficult to rise once they have lain down, and may urinate or defecate while lying (Herlin, 1997). Both situations will result in a wet and dirty back of the stall, increasing the risk for those cows to have dirty legs and udders. A third possible explanation could be linked to management problems (Amory *et al.*, 2006; Cook 2002; Manske *et al.*, 2002; Zurbrigg *et al.*, 2005). Stall cleaning, periodic trimming and, generally, the periodic care of the claws can be seen by some farmers as lower priorities.

Most lame cows are not treated by a veterinarian (Murray *et al.*, 1996), and therefore prevention is very important. One precondition for an effective prevention is the knowledge of risk factors associated with lameness (Wells *et al.*, 1995). Some of the risk factors (Hirst *et al.*, 2002) are long term and difficult to change, such as the genetic predisposition of certain animals and breeds to lameness or the design of the barns forcing the indoor-housed cows to stand on hard and wet surfaces (Borderas *et al.*, 2004). Other factors can be changed in the farms, improving management and/or housing. Among these, the proper hygiene of the cows is easy to achieve respecting the barn cleaning recommendations and bedding changing on a

daily basis. The exposure of cows to dirt, mud and dejections constitutes the premise for an increased percentage of lameness (Cook 2002).

CONCLUSIONS

The obtained results showed that the poor hygiene of barn represents a risk factor associated to lameness prevalence in tied dairy cows.

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