Slovak J. Anim. Sci., 43, 2010 (2): 95 - 99

ISSN 1337-9984

INFLUENCE OF HYGIENIC CONDITION ON PREVALENCE OF MASTITIS AND LAMENESS IN DAIRY COWS

P. TONGEĽ*, J. BROUČEK

Animal Production Research Centre Nitra, Slovak Republic

ABSTRACT

The objective of the study was to determine the relationship between udder and leg hygiene scores of lactating dairy cows and prevalence of subclinical mastitis and lameness in Slovak farms. We assumed that dirty cow has higher probability to become ill than the clean one. 17 dairy farms were monitored in this study. Fifty cows were chosen randomly on each of the farm and SCC (somatic cell count), lameness, udder and leg hygiene scores were assessed. Five-point system for scoring lameness, cleanliness of feet and cleanliness of udders was used. The samples for SCC analysis were taken on the same day as the assessments of udder and leg hygiene scores. The occurrence of mastitis and lameness varied from 22 to 58 % (31 $\pm$ 6 %) and from 12 to 47 % (26 $\pm$ 8 %), respectively. Coefficients of correlation between udder hygiene scores and mastitis were 0.77 and between leg hygiene scores and lameness 0.63. We confirmed that udder cleanliness influences prevalence of mastitis in the herd but the influence of leg cleanliness was not evident.

Key words: mastitis; lameness; cleanliness

INTRODUCTION

Improper management practices may cause production diseases - mastitis and lameness being major two of those. Mastitis, or inflammation of the mammary gland, is the most common and the most expensive disease of dairy cows throughout the world (Bigras-Poulin et al., 1990; Rajala and Grohn, 1998). Inflammatory response is initiated when bacteria enter the mammary gland through the teat canal and multiply in the udder (Eberhart et al., 1987). One of the early events of an infection is the movement of white blood cells into the udder to fight the infection (Harmon, 1994). The causative bacteria can be categorized as major or minor pathogens. Mastitis caused by the major pathogens results in the greatest compositional changes of milk, including increases in SCC (somatic cell count), and has the most economic impact of all causative organisms (Harmon and Langlois, 1986; Eberhart et al., 1987). Higher SCC is a very important trait to the dairy producer because of the well-documented relationship between subclinical mastitis, milk yield and its quality.

Lameness in dairy cattle is painful for cows and very costly for dairy producers. It is a common problem and can greatly affect the welfare and productivity of cows. Lameness affects the cow's ability to interact both socially and within its physical environment, too. There are a large number of factors contributing to lameness in cattle. Some risk factors for feet diseases have been identified in previous studies. For example, floor type, cubicle dimension, stage of lactation and milk production has been demonstrated to be associated with lameness in cattle (Faull et al., 1996; Leach et al, 1997; Green et al, 2002; Webster, 2002). It has also been suggested

***Correspondence:** E-mail: tongel@cvzv.sk
Peter Tongeľ, Animal Production Research Centre Nitra,
Hlohovecká 2, 954 41 Lužianky, Slovak Republic.
Tel.: +421 37 6546 349 Fax: +421 37 6546 483

Received: March 23, 2010
Accepted: April 8, 2010

that heavier cows are more prone to clinical lameness (Boettcher et al., 1998).

Clinical lameness is are associated with pain (Clarkson et al., 1996; Whay et al., 1997), other diseases (Lucey et al., 1986; Barkema et al., 1994) and economic losses (Enting et al., 1997; Kossaibati and Esslemont, 1997). Milk production may be strongly reduced (FAWC, 1997; Warwick et.al., 2001). Fertility can be negatively affected, too (Sprecher et.al., 1997).

A posture scoring system has been developed to assess overall locomotion based on a number of factors including spinal arching, head carriage and ease of gait. Five point system ranges from good/normal (score 1) to severely abnormal (score 5). It was found that decreased activity levels and abnormal postures were associated with lameness (O'Callaghan et al., 2003). Chronic foot lesions tended to be associated with higher posture scores (more abnormal) when compared to acute foot lesions. Same authors concluded that both daily activity levels and posture scoring are useful indicators of the pain and discomfort associated with lameness in dairy cattle.

MATERIAL AND METHODS

Our working hypothesis was that unsuitable hygienic conditions on farm influence the prevalence of mastitis and lameness. We visited 17 dairy farms in Slovakia. Fifty cows were chosen randomly on each of them. Following traits were assessed: SCC, lameness, cleanliness of the udders, and cleanliness of the feet.

Five-point system developed by O'Callaghan et al., (2003) was used for LS (lameness score) assessment. The 5-point ordinal lameness scoring system for dairy cows was recently refined by Thomsen et al. (2008) as described below:

1 (Normal) - The cow walks normally, the back is flat when the cow is standing and walking. There are no visible signs of lameness. Cow's back is flat when the cow is standing and walking. There is no visible sign of head bob when cow walks.

2 (Uneven gait) - The cow walks normally and the back is flat, when the cow is standing, but arched when walking. There is no visible sign of head bob when cow walks. The gait might be slightly uneven and the cow walks with short strides, but there is no evident sign of lameness.

3 (Mild lameness) – The cow has abnormal gait with short strides on one or more legs, the back is arched both when the cow is standing and walking. There is no visible sign of head bob when walking. It is not obvious which leg is affected.

4 (Lameness) - The cow is evidently lame on one or more legs. An observer can tell which leg is affected. The back is arched both when the cow is standing and walking. Head bob is evident when caw is walking.

5 (Severe lameness) - The cow is obviously lame on one or more legs. The cow is unable, unwilling, or very reluctant to bear weight on the affected leg. The back is arched both when the cow is standing and walking. Head bob is evident when cow is walking.

The locomotion score (LS) assessment was done before milking in the plain and straight 10 - 15 m long and 1.2 – 1.5 m wide lines, which lead to milking parlours. The prevalence of lameness was calculated as the proportion of cows with scores 2 or more.

The five point scoring system (scale from 1 to 5) for assessment of leg hygiene score (LHS) and udder hygiene score (UHS) was selected, too. Score 1 indicates that cow is absolutely clean, while score 5 indicates a very dirty cow. The assessment of locomotion scoring was done on the same place and at the same time and by the same person.

The samples for SCC analysis were taken on the same day when the assessments of locomotion and cleanliness were performed. The cows with SCC higher than 200 000 were assumed to have mastitis.

All data were analyzed with Statistix (v.9) statistical programme. We calculated mean values, statistical differences and P- values of all measured data for each farm. The correlation coefficients between UHS and SCC, between LHS and LS, and between SCC and LS were calculated using Pearson correlations.

RESULTS

The results of the experiment showed that the cleanliness had influence on occurrence of mastitis and lameness. Prevalence of mastitis varied from 22 to 58 % (mean value 31 $\pm$ 6 %) and lameness from 12 to 47 % (mean value 26 $\pm$ 8 %) (Table 1).

Coefficient of correlation between cleanliness of udders (UHS) and mastitis (SCC) was 0.72 ($P<0.01$), and cleanliness of feet (LHS) and lameness (LS) was 0.63 ($P<0.05$). All relationships varied strongly among farms (Table 2). The mean values of correlation coefficients (Table 2) are slightly higher than enumerated ones for all farms and all animals together.

High value of correlation coefficient between UHS and prevalence of mastitis (0.72) indicates that mastitis could be caused by environmental pathogens.

It is apparent that cleanliness of the feet was not the main reason of lameness. Some other known causes are acidosis (feeding), unsuitable flooring and unsuitable claw maintenance.

Mean hygiene scores were 1.94 and 1.98 for udders (UHS) and legs (LHS), respectively. Udder hygiene scores were significantly associated with leg hygiene scores and varied among farms.

Mean lameness scores (LS) were 1.38 and varied among farms with in range 1.24 to 1.71.

Table 1: Observed traits

Farm	n	Milk	SCC	UHS	LHS	LS	% Mast	% Lam
1	50	12.33	293	1.43	1.82	1.33	28	23
2	50	8.26	612	2.31	2.29	1.69	58	47
3	50	11.56	290	1.51	1.55	1.29	27	12
4	50	10.74	352	1.78	1.76	1.24	33	15
5	50	10.68	283	1.43	1.55	1.33	30	25
6	50	9.89	310	1.84	1.98	1.37	30	33
7	50	11.42	261	1.43	1.80	1.27	27	14
8	50	9.22	333	2.02	2.06	1.25	32	24
9	50	11.89	372	1.96	2.53	1.55	26	28
10	50	12.63	237	2.27	2.57	1.29	22	14
11	50	9.49	447	2.45	2.22	1.65	44	34
12	50	8.72	365	2.14	1.65	1.45	32	26
13	50	9.64	377	2.57	1.90	1.25	42	16
14	50	11.34	221	1.94	1.76	1.27	18	20
15	50	9.15	468	1.96	2.04	1.65	40	38
16	50	11.37	312	2.06	2.22	1.71	28	36
17	50	10.83	365	1.86	2.12	1.53	32	26
mean		10.54	346.94	1.94	1.99	1.42	32.29	25.35
sd		1.11	68.53	0.27	0.25	0.15	6.53	7.67

n - number of cows enrolled in experiment; Milk – litres of milk per milking; SCC ($\times 10^3$) – somatic cell count /millilitre of milk; UHS - Udder hygiene scores ; LHS – Leg hygiene scores; LS – lameness scores; % Mast – percentage of cows with mastitis ; % Lam – percentage of lame cows

DISCUSSION

The results have shown that mastitis remains a great problem in Slovak dairy farms. Situation is same in many other countries. Ferguson et al. (2007) reported the prevalence of mastitis in Sicily (35.4 %), Tenhagen et al. (2006) in Germany (26.4 %) and Pitkälä et al. (2004) in Finland (30.6 %). Health status of cows with high production is unstable and a little mistake can cause illness.

Our findings on prevalence of lameness were in accordance with other authors. For example, Esslemont and Kossaibati (1996) reported 24 % lameness in a survey of 90 herds in 1992-1993, while in another survey (Kossaibati and Esslemont, 1999) done on 50 farms during 1995-1996 it was 38 %.

The Farm Animal Welfare Council (FAWC, 1997) reported that current levels of herd lameness in the UK are unacceptably high. Herd lameness has been estimated to 22 % by recent studies undertaken in the UK (Whay, 2002) and Wisconsin, USA (Cook, 2003).

Lameness remains to be the big problem in high producing dairy cows. An impediment to reducing lameness levels in dairy cattle is poor detection, particularly of early signs. It has been found that herd lameness estimates made by farmers tend to be lower than actual lameness detected by experts such as veterinarians and researchers from the dairy industry (Whay, 2002). In another work Whay et al. (2003) noted that farmer estimates of lameness within the herd were greater than the records for treatment of lameness.

Mean hygiene scores of 1.94 and 1.98 for udders and legs were in accordance with other authors. Schreiner and Ruegg (2003) found out mean hygiene scores of 2.09 for udders and 2.33 for legs.

CONCLUSION

In our experiment we found out that udder cleanliness influenced the prevalence of mastitis in the herd but the influence on feet cleanness was not evident.

Table 2: Correlation coefficients

Farm	n	SCC/UHS	Lam/LHS	SCC/LS
1	50	0.88**	0.72**	0.77**
2	50	0.71**	0.87**	0.88**
3	50	0.82***	0.69*	0.71**
4	50	0.86**	0.71*	0.90***
5	50	0.79**	0.75*	0.74**
6	50	0.91***	0.82**	0.82**
7	50	0.90***	0.70*	0.70*
8	50	0.76**	0.60	0.60
9	50	0.71**	0.57	0.57
10	50	0.43	0.50	0.50
11	50	0.77**	0.68*	0.68*
12	50	0.83**	0.66**	0.66**
13	50	0.68*	0.54	0.54
14	50	0.68*	0.21	0.21
15	50	0.74**	0.58*	0.58*
16	50	0.74***	0.66**	0.66**
17	50	0.73**	0.80***	0.80***
mean		0.76	0.65	0.67
sd		0.08	0.11	0.13

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; SCC - somatic cell count (x1000) /milliliter of milk;

UHS - Udder hygiene scores ; LHS – Leg hygiene scores; LS – lameness scores

ACKNOWLEDGEMENTS

This study was supported from the State Grant of the Slovak Ministry of Agriculture – Vplyv rôznych faktorov technologicko-chovateľského prostredia na welfare zvierat a životné prostredie, evid cislo: 2006 UO 27 091 05 02 091 05 16.

We would like to thank all farm managers and farm personnel for their help at monitoring the animals.

REFERENCES

BARKEMA, H. W. – WESTRIK, J. D. – VAN KEULEN, K. A. S. – SCHUKKEN, Y. H. – BRAND, A. 1994. The effects of lameness on reproductive performance, milk production and culling in Dutch Dairy Farms. *Prev. Vet. Med*., 20, 1994, p. 249-259.

BIGRAS-POULIN, M. – MEEK, A. H. – MARTIN, S. W. – MC MILLAN, I. 1990. Health problems in selected Ontario Holstein cows: frequency of occurrences, time to first diagnosis and associations. *Prev. Vet. Med*., 10, 1990, p. 79-89.

BOETTCHER, P. J. – DEKKERS, J. C. M. – WARNICK, L. D. – WELLS S. J. 1998. Genetic analysis of clinical lameness in dairy cattle. *J. of Dairy Sci*., vol. 81, 1998, p. 1148-1156.

CLARKSON, M. J. – DOWNHAM, D. Y. – FAULL, W. B. – HUGHES, J. W. – MASON, F. J. – MERRITT, J. B. – MURRAY, R. D. – RUSSELL, W. B. – SUTHERST, J. E. – WARD, W. R. 1996. Incidence and prevalence of lameness in dairy cattle. *Vet. Rec*., 138, 1996, p. 563-567.

COOK, N. B. 2003. Prevalence of lameness among dairy cattle in Wisconsin as a function of housing type and stall surface. *J. Am. Vet. Medical Assoc.,* 223, 2003, p. 1324-1328.

EBERHART, R. J. – HARMON, R. J. – JASPER, D. E. – NATZKE, R. P. – NICKERSON, S. C. – RENEAU, J. K. – ROW, E. H. – SMITH, K. L. – SPENCER, S.B.1987. Current Concepts of Bovine Mastitis. In: Proc.3rd Natl. Mastitis Counc., Inc., Arlington, VA., 1987, p. 17-19.

ENTING, H. – KOOIJ, D. – DIJKHUIZEN, A. A. – HUIRNE, R. B. M. – NOORDHUIZEN - STASSEN, E. N. 1997. Economic losses due to clinical lameness in dairy cattle. *Livestock Prod. Sci.*, vol. 49, 1997, p. 259-267.

ESSLEMONT, R. J. – KOSSAIBATI, M. A. 1996. Incidence of production diseases and other health problems in a group of dairy herds in England The Veterinary Record, vol. 139, Issue 20, 1997, p. 486-490.

FARM ANIMAL WELFARE COUNCIL 1997. *Report on the welfare of dairy cattle.* The Farm Animal Welfare Council, London.<http://www.fawc.org.uk/reports/dairycow/dcowrtoc.htm>.[cit. 2010-03-17].

FAULL, W. B. – HUGHES, J. W. – CLARKSON, M. J. – DOWNHAM, D. Y. – MANSON, F. J. – MERRIT, J. B. – MURRAY, R. D. – RUSSELL, W. B. – SUTHERST, J. E. – WARD, W. 1996. Epidemiology of lameness in dairy cattle: the influence of cubicles and indoor and outdoors walking surfaces. *Vet Rec.* vol. 139, 1996, p. 130-136.

FERGUSON, J. D. – AZZARO, G. – GAMBINA, M. – LICITRA, G. 2007. Prevalence of Mastitis Pathogens in Ragusa, Sicily, from 2000 to 2006. *J. Dairy Sci*., vol. 90, 2007, p. 5798-5813.

GREEN, L. E. – HEDGES, V. J. – SCHUKKEN, Y. H. – BLOWEY, R. W. – PACKINGTON, A. J. 2002. The impact of clinical lameness on the milk yield of dairy cows. *J. Dairy Sci.*, vol. 85, 2002, p. 2250-2256.

HARMON, R. J. – LANGLOIS, B. E. 1986. Prevalence of minor pathogens and associated somatic cell counts. In: Proc. 25th Annu. Mtg. Natl. Mastitis Counc., Columbus, OH. Natl. Mastitis Counc., Inc., Arlington, VA., 1986, p. 11-12.

HARMON, R. J. 1994. Physiology of Mastitis and Factors Affecting Somatic Cell Counts. *J. of Dairy Sci*, vol. 77, 1994, p. 2103-2012.

KOSSAIBATI, M. A. – ESSLEMONT, R. J. 1997. The costs of production diseases in dairy herds in England *Vet. J.,* 154,1997, p. 41-51.

KOSSAIBATI, M. A. – ESSLEMONT, R. J. 1999. The incidence of lameness in a group of dairy herds in England. In: Proc. British Society for Animal Science, 1999, Scarborough, UK : British Society for Animal Science, p. 221.

LEACH, K. A. – LOGUE, D. N. – KEMPSOM, S. A. – OFFER, J. E. – TERNENT, H. E. – RANDELLS, J. M. 1997. Claw lesions in dairy cattle: development of sole ulcer and white line haemorrhages during the first lactation. *Vet. Journal*., 154**,** 1997**,** p. 215-225.

LUCEY, S. – ROWLANDS, G. J. – RUSSELL, A. M. 1986. Short-term associations between disease and milk yield of

dairy cows. *J. Dairy Res.*, 53, 1998, p. 7-15.

O'CALLAGHAN, K. A. – CRIPPS, P. J. – DOWNHAM, D. Y. – MURRAY, R. D. 2003. Subjective and objective assessment of pain and discomfort due to lameness in dairy cattle. *Animal Welfare,* vol. 12, 2003, p. 605-610.

PITKÄLÄ, A. – HAVERI, M. – PYÖRÄLÄ, S. – MYLLYS, V. – HONKANEN-BUZALSKI, T. 2004. Bovine Mastitis in Finland 2001. Prevalence, Distribution of Bacteria, and Antimicrobial Resistance. *J. Dairy Sci.,* vol. 87, 2001, p. 2433-2441.

RAJALA, P. J. – GROHN, Y. T. 1998. Disease occurrence and risk factors analysis in Finnish Ayrshire cows. *Acta Vet. Scand.,* 39,1998, p. 1-13.

SCHREINER D. A. – RUEGG P. L. 2003. Relationship Between Udder and Leg Hygiene Scores and Subclinical Mastitis. *J Dairy Sci*., vol. 86, 2003, p. 3460-3465.

SPRECHER, D. J. – HOESTELER, D. E. – KANEENE, J. B. 1997. A lameness scoring system that uses posture and gait to predict dairy cattle reproductive performance. *Theriogenology,* vol. 47, 1997, p. 1179-1187.

http://www.fawc.org.uk/reports/dairycow/dcowrtoc.htm.

STATISTIX 9 USERS MANUAL. 2008. Analytical Software. <www.statistix.com>

TENHAGEN, B. A. – KÖSTER, G. – WALLMANN, J. – HEUWIESER, W. 2006. Prevalence of Mastitis Pathogens and Their Resistance Against Antimicrobial Agents in Dairy Cows in Brandenburg, Germany. *J. of Dairy Sci.,* vol. 89, 2006, p. 2542-2551.

THOMSEN, P.T. – MUNKSGAARD, L. – TOGERSEN, F. A. 2008. Evaluation of a Lameness Scoring System for Dairy Cows. *J. of Dairy Sci*., vol. 91, 2008, p. 119-126.

WARNICK, L. D. – JANSSEN, D. – GUARD, C. L. – GROHN, Y. T. 2001. The effect of lameness on milk production in dairy cows. *J. of Dairy Sci.,* vol. 84, 2001, p. 1988-1997.

WHAY, H. R. – WATERMAN, A. E. – WEBSTER, A. J. F. 1997. Associations between locomotion, claw lesions and nociceptive threshold in dairy heifers during the peri-partum period. *Vet. J.*, vol. 154, 1997, p. 155-161.

WHAY, H. R. 2002. Locomotion scoring and lameness detection in dairy cattle. *In Pract*., vol. 24, 2002, p. 444-449.

WHAY, H. R. – MAIN, D. C. J. – GREEN, L. E. – WEBSTER, A. J. F. 2003. Assessment of the welfare of dairy cattle using animal-based measurements: direct observations and investigation of farm records. *Veterinary Record,* vol. 153, 2003, p. 197-202.

WEBSTER, A. J. F. 2002. Effects of housing practices on the development of foot lesions in dairy heifer in early lactation. *Vet Rec.,* vol. 151, 2002**,** p. 9-12.