RELATIONSHIP AMONG SUBCLINICAL LAMENESS AND OESTRUS EXPRESSION

Frank J. C. M. van Eerdenburg, Hester de Boer and Fernando Gómez.

Department of Farm Animal Health, Faculty of Veterinary Medicine,
University of Utrecht, Yalelaan 7, 3584 CL Utrecht, The Netherlands.
Email F.J.C.M.vanEerdenburg@vet.uu.nl

Abstract

In dairy farming, clinical lameness has been associated with impaired fertility rates. Lameness is also present subclinically and associated with poor oestrus detection rates. In order to determine the relationship between subclinical lameness and the intensity of oestrus expression, scoring methods for both were used and evaluated in this study. The animals were all the non-pregnant cows in a Holstein Friesian dairy herd of about 45 animals. All the cows were properly identified. At the start of the study there were eighteen non-pregnant cows in the herd. The herd was studied for five months, from February - June. Two persons observed the cows during this time on two different surfaces: pasture and concrete slatted floor. Estrus was detected in three daily observation periods of 30 minutes. Lameness was scored once a week.

The five different ways of measuring lameness showed a variation for the individual cows and were compared. The results showed no correlation between the five different ways of measuring subclinical lameness and intensity of oestrus expression. It is concluded that subclinical lameness does not influence oestrus expression.

INTRODUCTION

In dairy farming, lameness is one of the main clinical and economical problems (6, 8). Not only referring to those cows with a severe lameness but also to those with a subclinical problem. Herdsmen are, in general, aware of the relevance of lameness, but they substantially under-estimate the prevalence of lameness in their own herd; veterinary researchers estimated prevalences 2.5 times higher than the farmers (27). Apart from culling rate (4, 22, 26), impaired fertility (4, 16) and a decrease in milk yield (14,15), the animal welfare aspects should also be considered.

Oestrous behaviour may be impaired due to clinical lameness during the post partum period (16). This will result in low detection rates and thus low fertility indices (12, 20). In general, visual oestrus detection is getting more and more difficult (21,24). According to Britt et al. (2), the floor type is the most important factor affecting the expression of oestrous behaviour. Apart from direct influences of the floor type, indirect consequences could also be of relevance. Concrete (often slatted) floors can be hazardous for the feet of cattle. This is one of the reasons for the high prevalence of lameness in modern housing systems. However, apart from the clinically reported cases, a large number of cows has minor problems in their claws that are referred to as subclinical lameness (13) and could be responsible for the low intensity of oestrous behaviour (24). The present study is, therefore, aimed at the evaluation of the relationship between subclinical lameness and oestrus expression.

MATERIALS AND METHODS

The animals were all the non-pregnant cows in a Holstein Friesian dairy herd of about 45 animals with a rolling herd milk production of 10703 kg per cow, with 4.08 % fat and 3.39 % protein. At the start of the study there were eighteen non-pregnant cows in the herd. The cows were observed for two and a half months on each of two different surfaces: concrete slatted floor and pasture. Cows were milked three times a day at 7:15, 15:15 and 22:00 and housed in a loose housing system with a concrete slatted floor and cubicles with rubber mat and sawdust bedding for the first part of the study. During the second part, the cows were on pasture from 9:00 until 17:00.

The cows were observed three times a day according to Van Eerdenburg et al.(23). The herd was studied for five months, from February – June 2000. Two persons observed the cows during this time in shifts. Observation times were 10:15, 13:30, 18:30 and they lasted exactly thirty minutes. A total score for each observation period was calculated and a rolling 24 hours summary was computed. If the estrous score exceeded 50 points in 24 hours, the cow was considered to be in estrus (11, 23)

When oestrus was not detected visually for 30 days (if no estrus expression was shown during the observations), rectal palpation was performed in order to assure the absence of a corpus luteum. If a corpus luteum was detected the progesterone levels in milk (see below) were analyzed to determine if and when an ovulation had taken place.

Milk samples were collected from all the cows in the study, twice weekly, on Thursday and Tuesday at 15.15 h, after milking. Samples were preserved by the addition of thimerosol (10mg/ml), stored at 4° C initially for a maximum of 2 weeks. The tubes were stirred at 2135 RPM (800G), at 5 °C, during 10 minutes. The skimmed milk was stored at $^{-}$20 °C until assayed. Progesterone level was estimated by a direct radioimmunoassay using the method of Dieleman and Schoenmakers (5). The samples of the cows that did not show oestrus were all assayed. Of the cows that showed oestrous behaviour, only two samples, i.e. of the day of oestrus and 10 days later, were assayed to confirm the visual detection. The threshold to consider a cow in oestrus was a progesterone level <1 ng followed by an increase >3 ng within ten days.

In order to determine the level of (sub)clinical lameness several methods were used:

*1. Gait and posture score***:** the five point locomotion score as described by Sprecher (22) was performed once a week.

2. Claw lesions score: lifting up the feet, the lesions were counted and evaluated by one person according to Greenough and Vermunt (10). This arithmetic score was later corrected with a geometric score, from 0 to 16 (10). In this way the problem of scoring a claw with a serious ulcer in the sole similar to one with a few minor hemorrhages was avoided.

3. Foot angle: this 3-point scoring system based on the external rotation of the hind feet relative to the spinal column is commonly used in the ambulatory clinic of the veterinary faculty of Utrecht university in herd health programs. The angle is determined as the angle between the spinal column and the interdigital space of each claw of the hind legs. If the angle is < 17 ° the score is 1, between 17 ° and 24 ° the score is 2 and > 24 ° the score is 3. These scores are correlated with no or minor problems, moderate problems or severe problems with respect to (inter) digital dermatitis or other diseases/malformations of the sole (J. van Amerongen, personal communication). Every cow was scored at least once a month. To achieve a general idea of the claw health of the animal, the scores from both hind legs were summed, resulting in a feet angle scoring from 2 to 6.

4 & 5. Anatomical hoof measurements: two claw measurements were obtained once a month:

1) Diagonal, this is the distance between the tip of the toe and the rear hairline, it was measured with a ruler (1).
2) Dorsal border, it is the distance between the dorsal hairline and the tip of the toe; it was measured with a divider (1). For both of these measurements the average between the two feet was used in the statistical analysis.

To analyze the data, a regression analysis and the Pearson's correlation between the intensity of oestrus expression and the lameness scoring systems and measures were calculated using SPSS. If there was more than one estrous period observed in a cow, the average of the estrus detection scores was used to calculate the correlation. The first post partum estrous periods were not included in the analysis.

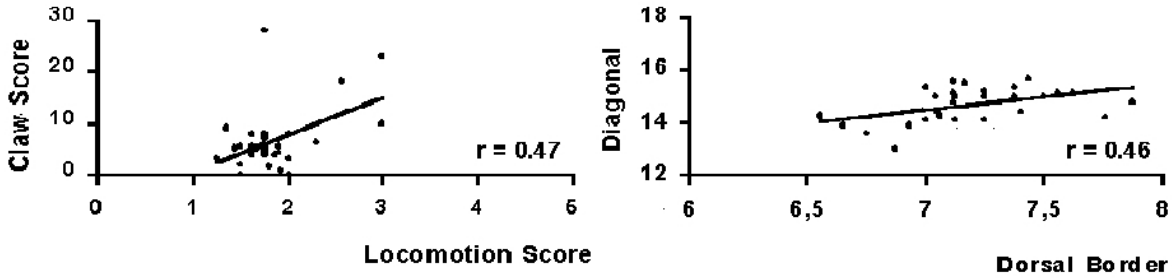

Figure 1. *Claw score versus locomotion score and diagonal versus dorsal border in cm*

RESULTS

During the five months of observations, 68 estrous periods were detected visually. In addition, 12 estrous periods were not observed but demonstrated by the progesterone levels in milk; thus resulting in a detection rate for the visual method of 85%. All visuallly detected cows were confirmed in estrus.

Thirteen estrous periods were excluded from the study because they were the first oestrus after calving. Three of these thirteen first estrous periods were only detected by analysis of the progesterone levels in milk. The cows diagnosed by the veterinarian as non-cyclic were also excluded from the study. Finally, data from 67 oestrous periods in 31 cows were analyzed.

The correlations among the lameness scores are listed in table 1. A scatterplot of the claw score and locomotion score is presented in figure 1. The anatomical measures (diagonal border and dorsal border) had a Pearson's correlation of 0.462.

There was no correlation found between the oestrus expression score and the lameness parameters as is shown in figure 2 and table 2.

DISCUSSION

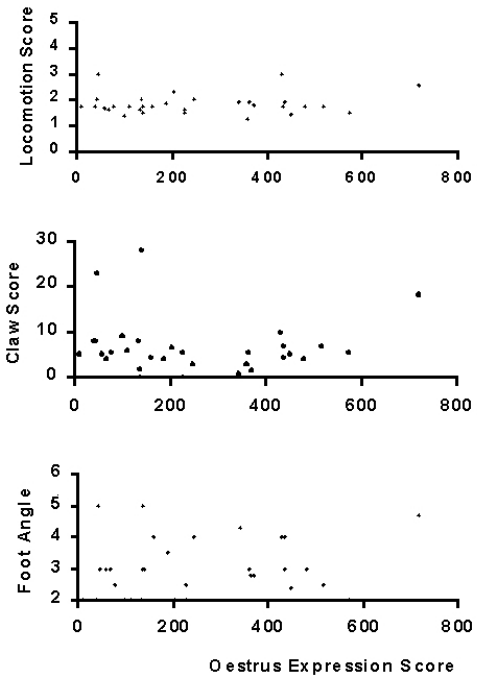

Figure 2. *Oestrus expression score versus three indicators for lameness.*

The visual oestrus detection method, doing three observations a day and a threshold of 50 points, resulted in a detection rate of 85%. If the data corresponding to the first oestrous periods after calving were excluded, the detection rate would have been 86.5%. These results are in concordance with the 77.1% as reported by Van Vliet and Van Eerdenburg (24) for three observations a day at similar observation times. All cows that were detected visually were in estrus as was confirmed by progesterone levels. As in other previous studies (11, 17, 23) it can be concluded that the visual oestrus detection method is reliable.

The present study has been conducted in a standard Dutch farm, with a healthy herd, where claw trimming is done regularly, resulting in a low incidence of infectious foot lesions (7, 19). Under these conditions there still were some claw problems but most of them in a light or subclinical degree. In agreement with Greenough and Vermunt (10), the claw lesion score proved to be a reliable method to measure subclinical lameness. As also reported by Leach et al., (13) only around 10% of the animals was lesion free. The locomotion score used in this study is a good instrument to detect clinical lameness, however, it is less efficient in detecting subclinical lameness (27). This confirms our definition of 'subclinical' lameness as not detected by the farmer. A farmer does not usually lift the claws of his cows on a frequent basis and therefore will only detect problems by watching the gait of his animals.

Boettcher et al.(3) reported a low regression coefficient with hind feet position when only mild laminitis is present. This is confirmed by the low correlation between foot angle and claw score in the present study. The correlation among foot angle and locomotion score as found by us (0.331; $p = 0.068$), indicates that measuring the foot angle could be a way of monitoring herds with respect to lameness.

Boelling and Pollott (1) referred to the diagonal measure as the best single claw trait because of its high correlation to dorsal border (0.80). In the present study a correlation of 0.46 ($p=0.009$) between the diagonal border and the dorsal border was found, which is not as high but still substantial. However, in the present study, no correlation was found between lameness scores and the anatomical measures.

The results of this study indicate that there is no correlation between subclinical lameness and intensity of oestrus expression. So far, lameness has been reported as one of the main factors responsible for the poor reproductive rates, but these reports dealt with severe lame cows. Weaver (25) stated that oestrus could be less easily detected in lame cows because they will lie for longer periods. However, Galindo et al., (9) reported that there were no differences in the mean time standing between cows that got lame and cows that did not get lame. The relation between severe lameness and oestrus expression seems quite evident. A lame cow will not express certain oestrous symptoms, especially standing to be mounted. Collick et al., (4) suggested that lameness,

when treated and not complicated by prolonged incapacity without sole ulceration, was not associated with seriously reduced fertility; they also proved that the "clinical effect score" was correlated with fertility results. The definition of lameness and its severity seems of importance in relation to oestrus detection rate as is demonstrated by Peeler et al.(18), who presented lameness before service as a risk factor to not detect oestrus, with and odds ratio of 1.42. But they referred to a lame cow as one that had been diagnosed by the farmer, being the clinical cases. Furthermore, in trying to explain the odds ratio, they mention not only the physically impediment because of the lameness but also that the lame cow could have been isolated from the herd and therefore had less opportunity to express oestrous behaviour (18).

Speculating about the reason for not finding a correlation among subclinical lameness and oestrus expression, one could imagine that through evolution cattle has been selected to mask its injuries, including sore claws, in order to avoid being a prey. Logue et al., (15), who observed that not all the cows with sole ulcers show lameness support this suggestion.

Table 1: Correlations between the lameness scores.

Correlation	r	p
Claw score – Locomotion score	0.471	0.007
Locomotion score – Foot angle	0.332	0.068
Claw Score – Foot angle	0.058	0.756
Dorsal border - diagonal	0.462	0.009

Table 2: Correlation among the oestrus expression score and the lameness parameters.

Correlation of oestrus expression score with	r	p
– Claw score	-0.018	0.922
– Locomotion score	-0.112	0.548
– Foot angle	0.173	0.350
– Dorsal border	-0.083	0.656
– Diagonal	0.057	0.761

We can conclude that subclinical lameness is not affecting the intensity of oestrus expression.

Acknowledgements

The authors thank Jan van Vliet, Wim Lensing, Jan van Amerongen, Thea Blankenstein, Maarten Pieterse, Anton Uijttewaal, Henk Obbink, Karin van de Hoek, Natasja van Leeuwen, and Francisco Rubio for their contributions to this study.

REFERENCES

1. **Boelling, D., & Pollott, G.E. (1998).** Livestock Production Science 54, 193-203.
2. **Britt, J.H., Scott, R.G., Armstrong, J.D., & Whitacre, M.D. (1986).** Journal of Dairy Science 69, 2195-2202.
3. **Boettcher, P.J., Dekkers, J.C.M., Warnick, L.D., & Wells, S.J. (1998).** Journal of Dairy Science 81, 1148-1156.
4. **Collick, D.W., Ward, W.R., & Dobson, H. (1989).** Veterinary Record 125, 103-106.
5. **Dieleman, S.J. & Schoenmakers, H.J.N. (1979).** General and Comparative Endocrinology 39, 534-542.
6. **Enting, H., Kooij, D., Dijkhuizen, A.A., Huirne, R.B.M., & Noordhuizen-Stassen, E.N. (1997).** Livestock Prod Sci 49, 259-267.
7. **Faye, B., & Lescourret, F. (1989).** Preventive Veterinary Medicine 7, 267-287.
8. **Frei, C., Frei, P.P., Stark, K.D.C., Pfeifer, D.U., & Kihm, U. (1997).** Preventive Veterinary Medicine 32, 1-21.
9. **Galindo, F., Broom, D.M., & Jackson, P.G.G. (2000).** Applied Animal Behaviour Science 67, 335-341.

10. **Greenough, P.R., & Vermunt, J.J. (1990).** Proc VI Intl Symp Diseases of the Ruminant Digit, Liverpool, pp 45-54.
11. **Heres, L., Dieleman, S.J., & van Eerdenburg, F.J.C.M. (2000).** Veterinary Quarterly 22, 50-55.
12. **Laben, R.L., Shanks, R., Berger, P.J., & Freeman, A.E. (1982).** Journal of Dairy Science 65, 1004-1015.
13. **Leach, K.A., Logue, D.N., Randall, J.M., & Kempson, S.A. (1998).** Veterinary Journal 155, 91-102.
14. **Logue, D.N., Offer, J.E. & Hyslop, J.J. (1994).** Animal Production 59, 173-181.
15. **Logue, D.N., Offer, J.E., & Kempson, S.A. (1993).** Irish Veterinary Journal 46, 47-58.
16. **Lucey, S., Rowlands, G.J., & Russell, A.M. (1986).** The Veterinary Record 118, 628-631.
17. **Lyimo, Z.C., Nielen, M., Ouweltjes, W., Kruip, T.A.M., & van Eerdenburg, F.J.C.M. (2000).** Theriogenology 53, 1783-1795.
18. **Peeler, E.J., Otte, M.J., & Esslemont, R.J. (1994).** Veterinary Record 134, 129-132.
19. **Phillips, C.J.C., Chiy, P.C., Bucktrout, M.J. et al. (2000).** Vet Rec 146, 607-609.
20. **Reimers, T.J., Smith, R.D., & Newman, S.K. (1985).** Journal of Dairy Science 68, 963-972.
21. **Senger, P.L. (1994).** Journal of Dairy Science 77, 2745-2753.
22. **Sprecher, D.J., Hostetler, D.E., & Kaneene, J.B. (1997).** Theriogenology 47, 1179-1187.
23. **Van Eerdenburg, F.J.C.M., Loeffler, H.S.H., & van Vliet, J.H. (1996).** Veterinary Quarterly 18, 52-54.
24. **Van Vliet, J.H., & van Eerdenburg, F.J.C.M. (1996).** Applied Animal Behaviour Science 50, 57-69.
25. **Weaver, A.D. (1985).** British Veterinary Journal 141, 27-33.
26. **Whitaker, D.A., Kelly, J.M. & Smith, S. (2000).** Veterinary Record 146, 363–367.
27. **Wells, S.J., Trent, A.M., Marsh, W.E., Williamson, N.B. & Robinson, R.A. (1995).** Veterinary Record 136, 537-540.