

IS LAMENESS A WELFARE PROBLEM IN DAIRY FARMS WITH AUTOMATIC MILKING SYSTEMS?

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Abstract

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Lameness, a disease often observed in loose-housed dairy cattle herds, affects animal welfare in general and reduces cow locomotion. As cow traffic may be affected by restricted locomotion, lameness may be a significant problem in herds with automatic milking systems (AMSs). Between January and August 2002, a field study was conducted to evaluate animal health in eight herds with an AMS. Herd sizes ranged from 60 (n = 5 herds with one automatic milking unit [AMU]) to 120 cows (n = 3 herds with two AMUs). Four visits were made, during which 40–50 cows were randomly assigned for clinical examination of body condition, cleanliness, claw length, disorders of claws and legs, lameness, pressure lesions, and disorders of udder and teats. Lameness was observed in 14% of cows, ranging from 5% to 28% between herds. Approximately 60% of cows had pressure lesions on the hock and 23% of cows had overgrown claws. Preliminary results show that overgrown claws, pressure sores with swellings, early stage of lactation, and high milk yield significantly increased the risk of lameness. Lameness significantly reduced the number of voluntary milkings per day.

Keywords: *animal welfare, automatic milking system, lameness, welfare*

Introduction

With the introduction of automatic milking systems (AMSs), the daily routine of the herd changes markedly. Instead of being taken to the milking parlour by the farmer at regular intervals, individual cows are expected to attend the milking system on a voluntary basis several times per day. As cows' motivation to be milked is generally weak, cows are motivated to attend the automatic milking unit (AMU) by feeding of concentrates (Prescott *et al* 1998; Van't Land *et al* 2000). High-yielding cows in particular may receive a high proportion of concentrates during milking in the AMU. If milking frequency is very low as a result of lameness, it can indicate a welfare problem in these cows: they may be hungry, but may refrain from visiting the AMU. Milking frequency may also be influenced by:

- 1) Milk yield: there is a positive correlation between milk yield and milking frequency (Caja *et al* 2000);
- 2) Herd stocking rate (cows per AMU): restricted access for the individual cow;
- 3) Palatability and amount of concentrates offered in the AMU per milking;
- 4) Social-stress: low ranking cows may hesitate to enter or queue at the AMU;
- 5) Fear of the AMU: insufficient or traumatic introduction may result in reduced milking frequency;
- 6) Other diseases inhibiting locomotion.

This field study was conducted in farms operating with an AMS, to assess the incidence and importance of lameness and pressure lesions and to investigate risk factors for lameness.

Methods

Between January and August 2002, eight dairy farms operating with one ($n = 5$ farms) or two ($n = 3$ farms) AMUs, all produced by Lely Astronaut®, participated in the study. All farms had voluntary cow traffic and cows were individually offered a maximum of 9 kg of concentrates per day during milking in the AMU. Number of cows milked per AMU ranged from 51 to 66. Cows were Holstein–Friesians. The farms were visited four times by the same veterinarian. In farms with one AMU, 40 cows were randomly assigned for clinical examination; in farms operating with two AMUs, 50 cows were randomly assigned for clinical examination. The clinical examination included body condition scoring (BCS), skin lesions, pressure lesions, parasitic infestation, disorders of the locomotion system, udder and teat characteristics, and overall condition. Examination of pressure lesions included constitution of the skin and scoring of swelling on different parts of the body. Examination of the locomotion system included claw length and visible disorders, and lameness (localised or diffuse). At each visit, AMU data including milking frequency and milk yield were collected.

Statistical analysis to investigate risk factors for lameness (lame/not lame) was carried out using logistic regression (logistic procedure, SAS 2001). Every first clinical examination of each cow was included in the model ($n = 602$ cows). To investigate the relationship between lameness and the number of milkings per day (1, 2, 3, ≥ 4) a proportional odds model with accumulated proportions was fitted.

Results

In total, 1322 cows were examined at four visits on eight farms and lameness was diagnosed in 14.4% of cows ($n = 190$). In 12.1% of these cows lameness was severe. The prevalence ranged from 7.1% to 17.8% of cows between farms. Pressure lesions were most frequently observed on the hock (63%); only 9% of cows showed lesions on other parts of the body. There was considerable variation among farms in occurrence and severity of pressure lesions on the hock (Figures 1 and 2).

Factors affecting lameness

Significant risk factors for lameness were pressure lesions and claw length (Table 1). Swollen hocks significantly increased the risk of lameness (odds ratio 5.9). Cows with overgrown claws were twice as likely to be lame as cows with normally shaped claws. Parity, days of lactation, milk yield and month of visit had no significant influence on the risk of lameness.

Factors affecting number of milkings per day

The number of milkings per day was significantly influenced by lameness, milk yield, days in milk (DIM), parity, BCS, herd, and month of visit (February, April, June, August 2002). Lameness significantly influenced milking frequency ($P < 0.05$), healthy cows being more likely to have a higher milking frequency (odds ratio 2.0, confidence interval 1.1–4.1). The tendency for higher milking frequency increased with milk yield and parity, and was higher in the middle part of lactation. There was an interaction between DIM and BCS; cows with a higher BCS in the middle part of lactation had a higher milking frequency. The milking frequency was significantly reduced in August and varied significantly between herds.

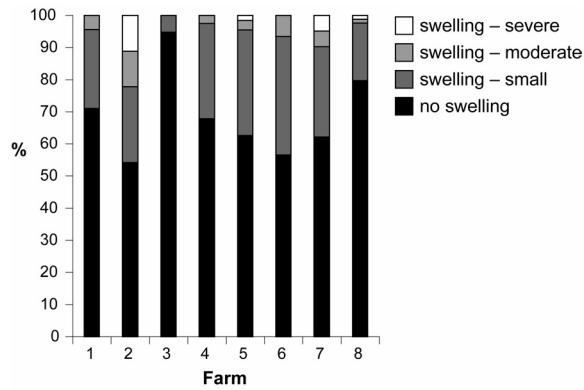


Figure 1 Pressure lesions on the hock — scoring of swelling.

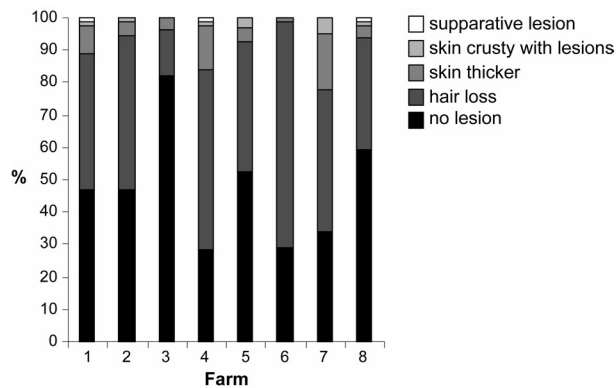


Figure 2 Pressure lesions on the hock — constitution of skin.

Table 1 Results of logistic regression of risk factors for lameness in 602 dairy cows (P = probability value from type III analysis).

Risk factor	Level	n	% of cows with lameness	P	Odds ratio*	Confidence interval
<i>Swelling of hock</i>	None	414	9.7	< 0.05	1.00 ^a	
	Moderate	156	17.3		1.77 ^a	0.95–3.31
	Severe	32	43.7		5.86 ^b	1.10–31.24
<i>Skin lesion of hock</i>	None/hair loss only	546	11.7	ns	1.00 ^a	
	Hair loss and crusty skin	45	22.2		1.13 ^a	0.42–3.01
	Suppurative lesion	11	63.6		5.11 ^b	0.95–27.36
<i>Claw length</i>	Normal shape	470	10.9	< 0.05	1.00 ^a	
	Overgrown	129	23.3		2.03 ^b	1.10–3.76

* Different superscripts indicate significant differences between levels within variable.

Discussion

Pressure lesions were associated with an increased risk of lameness, but only if clinical inflammation such as severe swelling or suppurative wounds were present. Superficial lesions such as crusty skin or dermatitis did not affect the risk of lameness. Since lameness is just a symptom, mainly a pain reaction (Whay *et al* 1997) with a variety of underlying diseases of claws, bones, joints and soft tissue, an unambiguous causal relationship between pressure lesions and lameness cannot be found. It is also possible that cows with lameness lie down more frequently than healthy cows and have difficulties in getting up or changing position, so they are more likely to develop severe pressure lesions. In the herd, it is easier to diagnose the symptom 'lameness' than to diagnose claw disorders such as digital dermatitis, because the claws are often covered with manure. The considerable variation between farms in severity and occurrence of swelling and skin lesions indicates different underlying causes. Overgrown claws were more frequent in lame cows, the underlying reason for which may be a higher frequency of sole ulcers in these cows. Manske *et al* (2002) reported a strong association between sole ulcers and lameness, as well as a correlation between sole ulcers and abnormal and overgrown claws. Further reasons for overgrown claws may be reduced abrasion of the horn, irregular claw trimming, and adverse claw, foot and leg position.

In lame cows, the milking frequency was reduced. In an AMS with voluntary cow traffic, the supply of concentrates in the feeder was reported as the main reason for cows to attend the AMU (Prescott *et al* 1998). Therefore, milking frequency may indicate hunger and a general motivation to feed. From a welfare point of view, a very low frequency combined with an inconsistent milking interval is unfavourable, especially in high-yielding cows which have a high energy demand. Usually, cows not milked for the previous 14 h were brought to the AMU by the farmer. If this had not been the case, the negative effect of lameness on milking frequency might have been more severe.

Milking frequency changed significantly during lactation. The lower milking frequency at the beginning of lactation might be due to the cows still being trained to use the system. Furthermore, changes in metabolism (reduced appetite) and increasing volume of the udder (even oedema) may lessen the cows' willingness and ability to attend the AMU. In the middle part of lactation, cows with higher BCS were more frequently milked than cows with lower BCS. Thin cows may experience (or may have experienced) metabolic insufficiency (Ruegg & Milton 1995; Gillund *et al* 2001) leading to poorer welfare and thus lessening their motivation to attend the AMU. Older cows had a higher frequency of milking than younger cows in early lactation. First-lactation cows have no experience with the AMU, and they have to be trained to use it and be integrated into the herd. Interactions between the first-lactation cows and the older and/or dominant cows may have led to social stress, resulting in lower milking frequency. Heat stress may have caused the lower milking frequency in August.

Animal welfare implications

The results of this study indicate that lameness compromises the cows' welfare in general and the cows' ability and motivation to attend the AMU. Overgrown claws and severe hock lesions are associated with lameness and differ significantly in prevalence and severity among farms. Therefore, these parameters, as well as milking frequency, should be included in on-farm welfare assessments.

References

- Caja G, Ayadi M, Conill C, M'Rad M B, Albanell E and Such X** 2000 Effects of milking frequency on milk yield and milk partitioning in the udder of dairy cows. In: Hogeveen H and Meijering A (eds) *Robotic Milking* pp 177-178. Wageningen Pers: Wageningen, The Netherlands
- Gillund P, Reksen O, Gröhn Y T and Karlberg K** 2001 Body condition related to ketosis and reproductive performance in Norwegian dairy cows. *Journal of Dairy Science* 84: 1390-1396
- Manske T, Hultgren J and Bergsten C** 2002 Prevalence and interrelationships of hoof lesions and lameness in Swedish dairy cows. *Preventive Veterinary Medicine* 54: 247-263
- Prescott N B, Mottram T T and Webster A J F** 1998 Relative motivations of dairy cows to be milked or fed in a Y-maze and an automatic milking machine. *Applied Animal Behaviour Science* 57: 23-33
- Ruegg P L and Milton R L** 1995 Body condition scores of Holstein cows on Prince Edward Island, Canada: relationships with yield, reproductive performance, and disease. *Journal of Dairy Science* 78: 522-564
- Van't Land A, van Lenteren A C, van Schooten E, Bouwmans C, Gravesteyn D J and Hink P** 2000 Effects of husbandry systems on the efficiency and optimisation of robotic milking performance and management. In: Hogeveen H and Meijering A (eds) *Robotic Milking: Proceedings of the International Symposium* pp 167-176. 17-19 August 2000, Lelystad, The Netherlands. Wageningen Pers: Wageningen, The Netherlands
- Whay H R, Watermann A E and Webster A J** 1997 Association between locomotion, claw lesions and nociceptive threshold in dairy heifers during the prepartum-period. *Veterinary Journal* 154(2): 155-161