LAMENESS IN DAIRY CATTLE DURING HOUSING: GENERAL DESCRIPTIVE RESULTS AND RISK ANALYSIS FOR DERMATITIS DIGITALIS

FRANKENA K.*, STASSEN E.N.**, NOORDHUIZEN J.P.* AND GOELEMA J.O.*

In ranking by economic loss, lameness in dairy cattle is the third health disorder, after mastitis and reproductive failures, in the Netherlands. For Dutch conditions a loss of 38 Dutch guilders (19 USA dollars) per lame cow and 2280 Dutch guilders (1140 USA dollars) per 60 cows has been calculated at an incidence rate of 25% per year (Dijkhuizen, 1987). Whitaker *et al.* (1983) estimated the economic losses due to lameness in the U.K. to be £ 30 (50 USA dollars) per lame cow and £ 1175 (2050 USA dollars) per 100 cows at a 25% incidence. Thus lameness is a serious disease from an economic point of view, but also animal welfare aspects should be considered. Therefore, a project concerning lameness has been carried out which aimed to monitor prevalences and to identify and quantify factors related to lameness. The latter should give rise to prevention and/or control measures.

A part of the total project, lameness during the housing period, is presented in this paper. Results concerning the prevalences are presented fully, while the risk analysis is restricted to dermatitis digitalis (Italian footrot).

MATERIALS AND METHODS.

Study population

59 commercial dairy farms in the province of Utrecht, the Netherlands were visited at the end of the housing period, between the 6th of March and the 11th of May 1990. Data were collected during a routine herd claw trimming visit. Usually only hind claws were trimmed. All farms were of the loose housing type. Farms were chosen from the clientele of 2 professional claw trimmers who trimmed the cows on a routine basis once or twice a year.

Diagnosis

The clinical and/or subclinical findings on hind claws were recorded during trimming according to a list of diagnoses based on the description by Espinasse *et al.* (1984). The diagnoses were carried out by 2 observers who were specifically trained for diagnosing lameness categories.

The following primary disorders were registered: dermatitis digitalis (DD), dermatitis interdigitalis (DI), laminitis (LA) and phlegmona interdigitalis (PI). The following symptoms were recorded as well: sole ulcer (SUL), specific traumatic solear contusion (SOC), white line process (WLP), white line separation (WLS), interdigital hyperplasia (HYP). For DI, DD, LA and SOC grades of severity were registered.

Data analysis

Data were entered using DBASE-IV. Descriptive statistics were done using SAS. Further analysis concerned multivariate logistic regression with herd as a random effect in the model to correct for the dependence of animals within a herd (see e.g. Goelema *et al.*, 1991).

* Department of Animal Husbandry, Animal Health section, Agricultural University, P.O. Box 338, 6700 AH Wageningen, The Netherlands.
** Department of Herd Health and Reproduction, State University, Utrecht, The Netherlands

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RESULTS AND DISCUSSION

Descriptive results

In total 3125 adult dairy cows were trimmed. Clinical signs of lameness were found in only 2% of the animals, presumably due to the immediate treatment of clinically lame animals or to the routine herd claw trimming taking away the most severe subclinical cases before these become clinical. At the contrary, 99.9% of the study population showed at least one subclinical primary disorder or symptom, most animals showing 2 subclinical findings (table 1).

Table 1. Distribution of records (%) over the number of subclinical disorders or symptoms per cow

Number of affections per cow:	0	1	2	3	4	5	6
Percentage of records:	0.1	14.9	47.9	26.7	8.2	1.8	0.4

The prevalences of the subclinical findings are presented in table 2. Dermatitis interdigitalis (DI) was the main cause of the very high overall prevalence level. Peterse (1980) found comparable percentages for DI during housing. No large differences were found between left and right feet. The fact that differences were sometimes significant is rather due to the large number of affected feet or claws (e.g. laminitis).

Table 2. Prevalences of subclinical claw disorders and distribution over affected inner and outer claws and over affected feet.

Diagnosis	% of cows affected[a]	% of outer claws[b]	% of left feet[b]
Dermatitis interdigitalis	99.6	50.1	50.0
Dermatitis digitalis	13.8	----	53.1
Laminitis	77.7	78.2*	51.9*
Phlegmona interdigitalis (cases)	6		
White line process	2.3	90.7*	56.0
White line separation	7.4	91.8*	57.7*
Solear contusion	18.6	92.1*	52.5
Sole ulcer	6.1	87.1*	45.5
Interdigital hyperplasia	7.1	----	52.5

[a] irrespective of the number of affected claws or feet per cow
[b] denominator is the total number of affected claws and feet, resp.
* differs significantly from 50%

For all diagnoses and symptoms scored at the claw level, the outer claws were most often affected. Over 85% of all claws showing white line affections, solear contusion or sole ulcers turned out to be outer claws. This finding was in line with the expectation that outer claws bear more weight and thus are at higher risk than inner claws (Peterse, 1987; Scott, 1987).

From these prevalence figures it is concluded that the professional routine herd claw trimming once or twice a year is not sufficient to prevent the disorders at the subclinical level to a high extent.

Multivariate analysis with regard to dermatitis digitalis (DD)

The between herd variation if the prevalence of dermatitis digitalis was considerable (0 to 60%), making a risk factor analysis very attractive (fig. 1). After validation, 2537 cow records were used for multivariate analysis. The main reason for deleting a record was 'missing calving date'. This resulted in a missing value for the stage of lactation.

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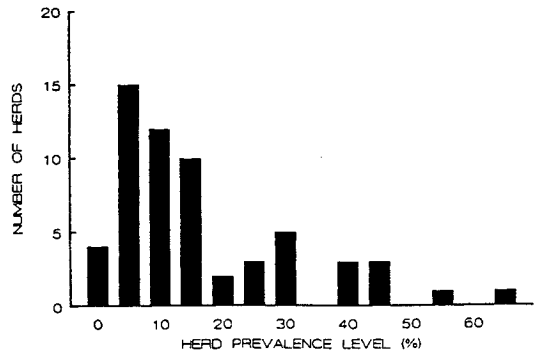

Figure 1. Distribution of herd prevalences for dermatitis digitalis at the end of the housing period.

In this paper only the analysis on animal level factors, herd size and herd milkproduction level are presented. Frequency distributions of factor classes, class specific prevalences and multivariate logistic regression coefficients of factors that were statistically related to dermatitis digitalis are shown in table 3.

Table 3. Relative frequency distributions of factor classes (Freq.), class specific prevalences of DD (Prev.) and multivariate regression coefficients (ß) and standard errors (s.e.) of factors related to DD.

Factor	Class	Freq. (%)	Prev. (%)	ß	s.e.
Parity	1	27.4	16.4	0.89*	0.17
	2	20.9	16.7	0.66*	0.17
	≥3	51.8	10.9	ref.	
Breed	>50% HF	39.5	14.9	0.17	0.17
(HF = Holstein Frisian)	>50% DF	17.8	13.3	-0.26	0.21
(DF = Dutch Frisian)	HF/DF 50%	34.6	13.2	ref.	
(MRY = Meuse Rhine Yssel)	50% MRY	4.7	15.1	-0.68*	0.34
	Other	3.3	2.4	-1.79*	0.74
Stage of lactation	Dry	18.6	13.8	0.09	0.18
(dim = days in milk)	0- 59 dim	6.0	15.9	0.41	0.27
	60-120 dim	19.9	13.6	0.19	0.18
	> 120 dim	55.5	13.3	ref.	
Footrot grade ≥2	present	52.3	17.3	0.72*	0.15
	absent	47.7	9.5	ref.	
Sole ulcer	present	94.4	10.5	-0.54⁰	0.31
	absent	5.6	13.8	ref.	
Interdigital hyperplasia	present	7.6	40.0	1.90*	0.21
	absent	92.9	11.6	ref.	
Herd size (cows)	≤ 50	32.4	14.7	-0.18	0.19
	51-69	33.9	17.2	ref.	
	≥ 70	33.7	9.0	0.25	0.25
Herd milk production	continuous			-0.20*	0.05
U[a]=500 kg; R[a]=5200-9725 kg.					
Sigma (σ)				1.13*	0.11

deviance difference compared to model with intercept only = 156.04
[a] U = units of measure; R = range; ⁰: p<0.10; *: p<0.05;

From both class-specific prevalences and regression coefficients it is clear that lower parities are more susceptible to DD, which might point to the involvement of acquired immunity. The MRY-breed seems more susceptible according to the prevalence figures, but according to the regression coefficients the opposite is true. Thus, an univariate analysis on breed would erroneously indicate the MRY-breed as a high risk group! In fact, this is the power of the multivariate regression: evaluating one factor (MRY-breed) while correcting for all the other variables in the model. Also the category 'Other breeds' (mainly Jersey and Piemontese) showed a large negative ß. Animals that were less than 60 days in milk tended to show more often DD. Fysiological or immunological changes after calving might reduce the resistance to DD. Herd size was not related to DD in the multivariate regression, although the prevalence in larger herds was lower when compared to small and medium sized herds. Herd milkproduction level is negatively associated with the disease, probably due to higher levels of overall management and care in high producing herds. Presence of other claw affections are related to DD as well, especially interdigital hyperplasia. However, a statistical relationship between factor and disease does not automatically implie a causal relationship. The cross sectional study design is not the most suitable one for evaluating causality. For example, which one was first, interdigital hyperplasia or dermatitis digitalis?

Further analysis by including other herd level factors, like hygiene measures, cubicle characteristics, slatter type, slatter condition, feed quality etc., is complicated (results not shown). The estimates of herd level parameters appear to be rather unstable when another parameter is entered or removed from the model. This is partly due to the limited number of farms and to confounding. Therefore, the variable selection algorithm is of crucial importance and is under investigation now.

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