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Assessing herd health of dairy cattle in different housing systems using systematic clinical examinations

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Introduction

Herd sizes as well as productivity have increased considerably over the past years. In Denmark, the average number of dairy cows in a farm increased from 36 in 1990 to 81 in 2003 (Danish Cattle Federation 2004). Approximately 48% of the herds participating in the milk recording scheme are kept in loose housing systems. In larger herds the time to monitor the individual cow's health is limited and even less time is available for treatment of individual cows. At the same time, selection for high milk production predisposes cows for diseases such as mastitis, metabolic disorders and lameness (Rauw et al., 1998). Parallel to increasing herd size and productivity, an increased mortality risk from 2% in 1990 to 3.5% in 1999 has been observed (Thomsen et al., 2004), mainly explained by an increasing proportion of cows that are euthanised. This may be due to the deterioration of an existing health problem beyond an acceptable level because diseases are discovered at a later stage or less often than before or alternatively the high costs for veterinary treatment and labour costs at farm etc. have lowered the threshold for culling a cow. The changes in farming obviously have led to changes in health management that may compromise the cows' health and welfare.

Herd health in dairy farms is often assessed using farm records of veterinary treatments. Treatment records are highly dependent on the farmer's decision if and when to initiate a treatment. The detection of clinical diseases can differ widely among farmers. In the case of clinical mastitis, a great variation of the farmer's threshold when to initiate veterinary treatment has been demonstrated (Vaarst et al., 2002). Depending on the type and severity of a disease, a proportion of cows may not be detected by the farmer and/or not be treated by a veterinarian. Alternative strategies to handle diseased cows, e.g. treatment without prescription medicine or drying off single mastitic quarters may alter the risk of diseases and the spread of diseases in a farm. Bennedsgaard (2002) has shown that the conversion from conventional to organic farming changed treatment patterns and treatment frequency.

In order to survey animal health and welfare, the level of diseases on farm must be known. Animal based observations reveal directly how the system and management affect the animal's health. In contrast to treatment records, where we often surmise the diagnosis from the applied treatment (Dohoo and Sørensen, 2000), clinical examinations reveal signs of diseases. Systematic clinical examinations are especially useful to detect chronic diseases such as chronic mastitis, lameness, and diseases related to loss of body condition. Applied on herd level, clinical examinations of a representative sample of cows may identify herd specific diseases at an earlier stage. Different types of clinical protocols for dairy cows have been developed at the Danish Institute of Agricultural Sciences and applied in commercial dairy herds.

The objective of this paper is to discuss the results from applying three clinical protocols in different housing systems with focus on their ability to identify and quantify farm specific health risks. Furthermore, the potentials of systematic clinical examinations (SCE) in herd health management will be discussed.

The three research projects

Table 1 shows the herd characteristics and the study design in three research projects at DIAS where SCE were applied. In the EU-project 'Welfare assessment of dairy cows in automatic milking systems' (AMS-project) we developed and applied a clinical protocol as a part of an assessment system where also behavioural indicators and management practices were included. Six times during the study year 40-50 randomly selected cows per farm were examined. The protocol included general health condition, body condition score, lameness score, skin condition, udder and teat condition, pressure sore score and soiling score.

Table 1. Farm characteristics and study design in three different projects

	AMS project	Loser-cow-project	AB-reduction-project
No. of herds	8	40	23
No. of cows	60-130	100-300	30-150
Breed	Danish Holsteins	Danish Holsteins	Danish Holsteins, Jersey
Housing type[1]	FS	FS, SY	FS, SY
Milking parlour[2]	AMU	AMU Rapid exit Rotary Herringbone	AMU Rapid exit Rotary Herringbone
No. of farm visits	6	3	2
Sample size	40-50	all	All, at least 50
Time of SCE[3]	At feeding	After feeding	During and after milking
Duration of SCE	30 cows/hour	40-50 cows/hour	Milking duration plus 15-30 min; 30-45 min in the barn
Type of SCE	Visual inspection and palpation	Visual inspection	Visual inspection and palpation

[1]FS = free stall housing with concrete or slatted floor, SY = straw yards
[2]AMU=automatic milking unit
[3] Systematic clinical examination

The project 'Phasing out anitibiotics in organic farms' (AB-reduction-project) has been launched this year. The aim of the project is to reduce antibiotic treatments in organic farms by improving preventive measures to ensure animal health. Methods to assess and monitor animal health and

welfare under a 'non-antibiotic policy' will be developed. In the ongoing project, the results of the introductory systematic clinical examinations have been reported immediately to the 23 participating farmers and were subject for discussion in their farmer field schools. Because mastitis and lameness were stated as the most relevant diseases demanding antibiotic treatment in organic cows, the clinical protocol focussed mainly on udder and teat characteristics, lameness score and general condition.

The loser-cow project aims at estimating the herd prevalence of loser cows, reveal the risk factors and develop strategies to prevent the occurrence of loser cows as well as strategies to handle loser cows. A loser cow is a cow that has a generally lowered health, e.g. lower body condition score, lameness and other diseases that can be detected by clinical observation. Often the generally lowered health is combined with lowered milk production.

The clinical protocols

According to the purpose of the projects, different clinical features were included in the clinical protocol. Leg disorders, poor body condition and skin injuries, especially those at the hock, can be regarded as important welfare problems (Fregonesi and Leaver, 2001; Weary and Taszkun, 2000) and were included in all protocols (Table 2).

Table 2. Clinical features included in the protocols from three research projects

	AMS-project	Loser-cow-project	AB-reduction-project
BCS	Yes, halfpoint scale	Yes	Yes, thin, normal, fat
Lameness score	Yes, own definition	Yes, Sprecher et. al. 1997	Yes, Sprecher et. al. 1997
Claw length	Yes	No	No
Skin condition	Yes	Yes	No
Skin injuries	Yes	Yes	Hock lesions
Skin parasites	Yes	No	No
Vaginal discharge	No	Yes	No
General condition	Yes	Yes	No
Udder			
Morphology	No	No	Yes
Clinical signs of mastitis/teat lesions	Yes		Yes
Teat end callosity	Yes	No	Yes
Hygiene scoring (body, udder, teats)	Yes	Yes	Yes

SCE can serve different purposes and include different clinical features according to their purpose.

- Assessing the general health status on farm
- Integrated in welfare assessment
- Assessing the interaction between housing system and animal health
- Assessing the association between health status and treatment frequency
- Assessing specific diseases or disease complexes on farms

The main purpose of the AMS-project was to assess welfare of cows living in robotic systems. Therefore, clinical parameters indicating welfare problems were chosen focusing on chronic health problems and lesions caused by the barn fixtures, the milking system and poor management (Table 2). In the AB-reduction-project the clinical protocol aimed at identifying mastitis and lameness because these two disease complexes were regarded as key problems demanding antibiotic treatment. Morphology of udders and teats, teat condition after milking, and hygiene scoring were included to identify relevant risk factors for mastitis as well as poor management (hygiene, low body condition, hock lesions).

Practical considerations

Several considerations have to be made when SCE should be carried out. To increase the compliance of the farmers, disturbances of daily routines of the cows under SCE should be avoided. This is especially relevant for herds in automatic milking systems (AMS) where cows should have access to the automatic milking unit (AMU) at all times. In the AMS-project SCE was carried out at feeding time when most cows were standing at the feeding table. The clinical features observed in the loser-cow project fulfilled the following conditions: observation should be easy, quick, only disease indicators that can be seen from two meters distance. When a protocol includes palpation, e.g. of udder and teats, cows can be examined in the free stalls or should be restrained otherwise. In deep litter systems without a possibility to restrain the cows, palpation of the udder can only be carried out in the milking parlour or in the AMU. One AMU milks about 10 cows/hour, increasing the duration of the SCE considerably in order to obtain a sufficient sample size. This seems to be unfeasible under practical conditions. The clinical examination itself takes less than a minute per cow. The most time consuming part of the SCE usually concerns difficulties in identifying cows in loose housing systems, especially when ear tags are missing and light conditions are poor.

Accuracy of clinical observations

SCE are carried out to detect diseases and to assess the severity of diseases with quantitative measures. Regular SCEs should provide reliable information about changes over time to evaluate treatment effects and changes in management. At DIAS several studies have been carried out to analyse the effect of the observer. Baadsgaard and Jørgensen (2003) tested sensitivity and specificity of 4 clinicians examining the same pigs in three herds. They concluded that accuracy differed for the four observers and for different clinical signs. To improve accuracy, the authors suggested that the definitions for the clinical findings should be more precise. (Houe et al., 2002) tested a protocol for SCE of udders including 22 variables. High inter-observer agreement was only found in 5 variables: nodes in the udder, dry quarter, wounds on teat, pain reaction, and udder oedema. The authors found a training effect of the clinicians during the project towards a better inter-observer agreement. Three veterinarians tested the initial clinical protocol for the AMS-project in three farms with regard to inter-and intra-observer agreement (Pedersen 2001). The protocol was adjusted and description of clinical features, e.g. the criteria for lameness scoring, scoring of teat end callosity and hygiene scoring were redefined more precisely before application in the AMS-project.

Examples for monitoring health with systemtic clinical examinations

The utility of clinical observations will be demonstrated with the example of leg disorders, i.e. the results from lameness scoring and the prevalence of pressure sores at the hock. Despite similar housing system in the AMS-project, the prevalence of lame cows varied considerably within and between herds. A lame cow was defined as a cow tripping while standing and walking cautiously and stiff. A cow with uneven gait that avoided putting the full weight on one leg as defined as having a localized lameness (definition AMS-protocol). The other two projects, applied the scoring system after Sprecher et al. (1997) that includes posture of the back in gait evaluation. Figure 1 shows typical fluctuations in the prevalence of lame cows observed in five AMS-herds. Apart from visit 1 in herd 3, lame cows were observed in all herds at all visits and ranged from 0 up to 89%. Across herds, the mean prevalence of lame cows was 17.1±8.0.

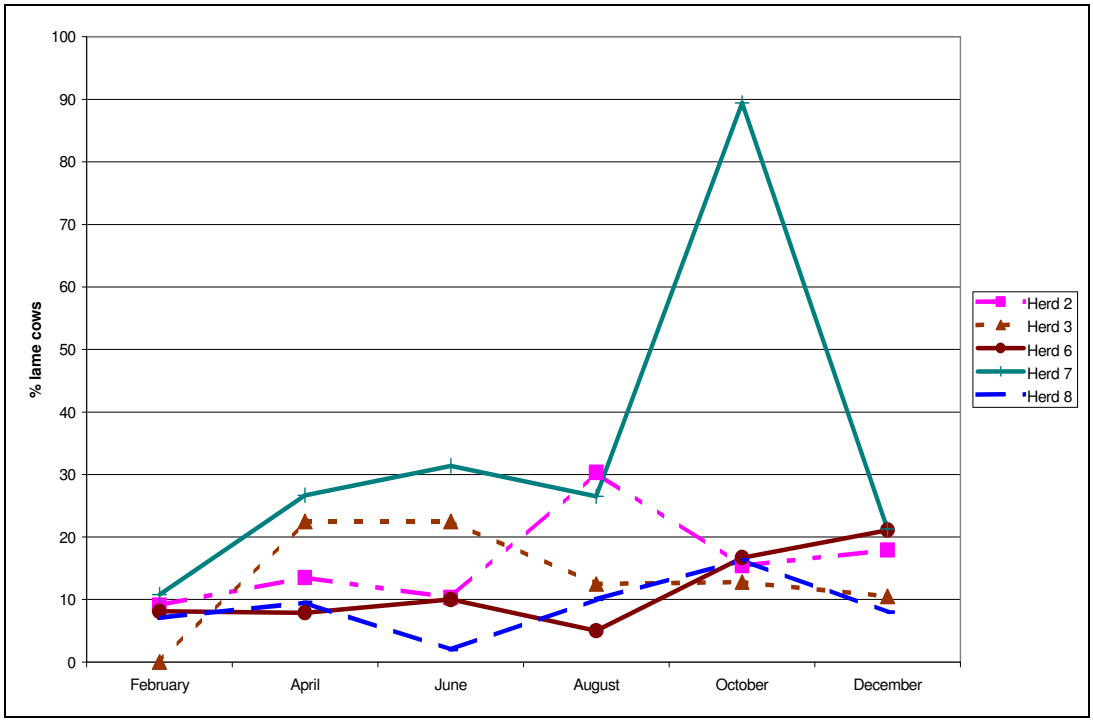

Figure 1. Prevalence of lame cows in 5 herds operating with AMS in the year 2002.

Preliminary results from 23 herds in the 'AB-reduction-project' indicate a higher prevalence of lame cows in free stall systems with slatted or concrete floor in comparison to deep litter systems (10.5% vs. 5.2%). In five farms no lame cows were observed, four of these farms had deep litter systems. When comparing these results to the AMS-project it has to be considered that lameness in the 'AB-reduction-project' was scored only once during spring 2004.
There were considerable differences in the occurrence and severity of pressure sores at the hock between the farms in the AMS-project and the organic farms in the 'AB-reduction-project' as shown in Table 3.

Table 3. Occurrence and severity of pressure sores at the hock

	AMS-project		AB-reduction-project	
	Mean	Range	Mean	Range
% No lesions	36.2	15.3 – 80.6	89.1	63.0 – 100.0
% cows with hairloss	56.7	16.9 – 68.8	10.8	0 – 48.2
% cows with crusty skin	5.9	2.1 – 12.4	0.3	0 – 3.0
% cows with suppurative lesion	1.2	0 – 3.6	0	
% cows with swelling > 1cm	6.5	0 – 24.9	0.3	0 – 3.0

In the farms in the 'AB-reduction-project' only 10.9% of cows showed hairloss, lesions or swelling at the hock whereas a mean of 73.8% of the cows in the AMS-project farm showed hairloss, lesions or swelling. The farm with the highest prevalence of cows with lesions was not identical with the farm that had the highest prevalence of cows with swollen hocks.

Assessment of udder health

Preliminary results from the SCE show that there is a variation between herds regarding the prevalence of three teated cows and cows with lumps in at least one udder quarter (Table 4). Acute mastitis was rarely observed during SCE.

Table 4. Udder health assessment with SCE

	AMS-Project		AB-reduction-project	
	Mean	Range	Mean	Range
% cows that are three-teated	6.7	1.3 - 12.5	8.5	0 - 18.9
% cows with lumps in at least one udder quarter	1.8	0.9 - 3.5	7.4	0 - 18.0
% cows with acute mastitis	1.3	0 - 2.4	0.3	0 - 2.6

Presentation of results

The feedback to the farmer and demonstration of results is important for the acceptance of SCE. Farmers participating in the AMS-project received a detailed welfare report after the study period. This report was discussed with the farmer and the staff. The results show that farmers appreciated the external evaluation via animal based observations (Hindhede et al. 2004).

In the 'AB-reduction-project' the results of the SCE were delivered immediately as a short report, pointing out the most relevant problems of the specific farm. The reports were discussed by the project farmers at regular meetings on their own farms, where health status of the specific farm was in focus and a plan to improve the situation was worked out.

Discussion

Lameness was a common welfare problem in most of the AMS-farms and to a lesser extent in the organic farms with free-stall systems. Lameness scoring is an effective method to quantify those cows with signs of pain, and to monitor the development on individual farms. Because lame cows in AMS have a reduced milking frequency in comparison to sound cows (Klaas et al., 2003) a regular monitoring of lame cows will be essential to ensure that cows can attend the milking unit. Especially in robotic systems where the regular close contact between cow and farmer is missing, surveillance with SCE will reveal health disorders at an earlier stage. Management practices can be changed and the efficacy of changed practices evaluated.

Most of the organic farmers participating in the 'AB-reduction-project' already have succeeded in reducing veterinary treatments of clinical mastitis and are highly interested in preventive measures and animal welfare issues. They may not be representative for organic farms in general, but they may set a standard for several health conditions, e.g. prevalence of lame cows and pressure lesions. Udder inspection and palpation will be a necessity in these herds to evaluate udder health and udder treatment practices. Blinding of mastitic quarters was a common practice in some farms whereas three farms did not have any cows that were three teated.

One important issue when monitoring health status by SCE is the threshold when to initiate treatments or changes in management practices. Preliminary results show a great variation between farms and between the projects regarding several health disorders and that these conditions are dynamic during the year. Further statistical modelling on risk factors for the diseases observed and the influence of system and management practices on the level of diseases is necessary to propose acceptible thresholds for adjustments.

Perspectives

The increasing herd sizes demand a systematic approach in herd specific health monitoring. To ensure herd health and welfare under these developments the surveillance with existing data sources, mainly veterinary treatment records, may be insufficient to assess the herd health state. SCE help to detect system and management induced disorders, in paricular those of longer duration. The results are quickly available and solutions can be recommended and implemented within a short period of time. SCE may be an important tool in herd health assessment and are easy to implement in herds, where the practising veterinarian already performs herd health surveillance in a regular manner.

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