Indicators for the assessment of animal welfare in a dairy cattle herd with a cubicle housing system

T. Rousing, M. Bonde & J. T. Sorensen

Danish Institute of Agricultural Sciences, Dept. of Animal Health and Welfare,P.O. Box 50, 8830 Tjele, Denmark

Summary

In recent years there has been increased focus on animal welfare in livestock production. Animal welfare assessment systems have been developed in Europe mainly focusing on the housing systems and management. Inclusion of more measures on the animals is assumed to improve the welfare assessment system. Consequently behavioral and health indicators have to be developed, which can assist the system and management parameters in the provision of a complete welfare assessment.

Development of a method for assessing animal welfare at herd level, allowing the farmer to use it as management tool, is approached by aggregating welfare indicators into a welfare protocol. This is based on evaluating the independent welfare relevance of the indicators, the marginal information value and not least applicability for on-farm use.

We suggest a welfare assessment protocol for loose housing systems for dairy caws based on four sources of information being the system, management, animal behavior and animal health. The animal behavior indicators refer to social behavior, man-animal relationship and resting/rising behavior. Health indicators focus on causes of pain and discomfort to the animal: Extreme body condition, skin injuries and disorders, udder and teat lesions, lameness, hoof disorders and systemic diseases with general affection of the animal. The listed indicators were included in a protocol, which will be tested in ten commercial dairy herds. The herds will be visited regularly during a one-year period. System and management will be described and the behavioral and health indicators will be measured on a sample of the animals. The evaluation of the indicators will include statistical analyses, expert opinion and interviews with the participating farmers.

Keywords: Welfare assessment, welfare indicators, dairy cows, loose housing systems

Introduction

The increased focus on animal welfare in commercial farms has increase of interest in loose housing systems for dairy cattle. Loose housing systems increase freedom of movement compared to tether systems, and give the animals the possibility of expressing a more natural behavior – including social behavior. In general, loose housing systems can be described as having potential for better welfare but depending on the current management. For that reason welfare problems in loose housing systems may be different compared to tether systems. Welfare problems related to physical injuries, social strain and current management are expected.

Experiences from previous studies indicate that in general there is a large variation between herds as regards animal welfare due to the effect of interactions between production system and management (Sandoe et al., 1997). Consequently, there is a need for methods for assessing animal welfare at herd level.

Welfare assessment systems, for use in commercial farms may differ according to both the definition of animal welfare, and the purpose of the welfare assessment. Thus choice of welfare indicators and methods of measurement reflects the basic considerations of how animal welfare is understood. In addition, the appearance of given welfare assessment system depends on whether the goal is to certificate or control the level of welfare on specific farms, to evaluate the

welfare in different production systems, or to serve as an advisory tool that allows the farmer to identify, prevent or solve welfare problems on his/her farm (Johnsen et al., 1999). Examples of welfare assessment systems mainly focusing on housing systems and management are the Animal Needs Index (ANI) and R.S.P.C.A. freedom Food Scheme. The ANI system is based on four important husbandry components (possibility of movement, social contact, condition of the flooring, indoor clime and stockman's care) and consist of the scoring of housing systems (Bartussek, 1999). The Freedom Food Scheme (anonymous, 1998) is based on five freedoms listed by FAWC (1993) and involves outlining a systematic picture of the standards of resources and records on the farm, but no direct animal and stockmanship indicators are included,

At the Danish Institute of Agricultural Sciences (DIAS) a prototype of a welfare assessment system, relevant as a decision support system for the farmer has been developed as part of an Ethnical Account for Livestock Farming (Sorensen et al., 2000). This system integrates behavior and health of the animals with systems description and management and relies on the animal welfare definition by Simonsen (1996) focusing on the positive and negative experiences of the animals. As the term animal welfare is based on animals' mental experiences, welfare cannot be measured directly but has to be assessed indirectly (Sandoe & Sominsen, 1992).

An evaluation relevant welfare indicator is currently developing this welfare assessment system further. The aim of this paper is to describe the welfare indicator protocol mainly focusing on behavioral and health indicators and to discuss the procedure for development and evaluation of the protocol.

The procedure for developing a welfare indicator protocol

If the farmer wants to improve animal welfare he/she needs a method to assess animal welfare at herd level. A relevant welfare assessment system should describe the welfare of the animals in the herd, and allow the farmer to assess the development over time and to respond appropriately. A welfare indicator that is relevant for inclusion in an operational welfare assessment system should have the following qualities:

1. Basis in scientific knowledge and ability to express development over time.
2. Measurable on a commercial farm within a realistic framework.
3. Relevant as decision support system for the farmer. To fulfill this requirement the welfare indicators must provide information on potential welfare problems and caused of impaired welfare.

   Aggregating relevant welfare indicators into such a welfare protocol, involves evaluating the suggested indicators step by step concerning their independent welfare relevance, their marginal welfare value and finally their applicability for "on-farm studies" (Rousing et al., 2000).

Independent welfare relevance

Many indicators may possibly be relevant for inclusion in an operational welfare assessment system. Suggestions have their sources in literature concerning animal welfare research, as well as experience of farm advisers, deduced data concerning health and productivity in the herd etc. The indicators are initially described as regards independent welfare relevance. Based on the view that welfare relates to the animal's feelings, the relevance of the indicators depends on whether and to what extent negative or positive experiences are implied for the animal.

Marginal welfare information value

Next step in developing an operational welfare protocol is to evaluate the information concerning animal welfare, provided by each single indicator in relation to all other welfare indicators. Several indicators may overlap concerning welfare relevance and therefore the marginal value will be low. The question is whether these indicators can replace each other in a welfare assessment or if their combination strengthens the validity of the welfare assessment. When overlaps are identified, the number of indicators can be reduced with only minor effect on the welfare assessment system. Selection primarily depends on the highest marginal welfare relevance. In case of indicators interacting, for which reason key indicators cannot be determined, selection should be based on whichever way indicators best complement each other.

Applicability for on-farm studies

The final step in developing an operational welfare assessment protocol is to consider the applicability of the suggested indicators for on farm studies. Evaluation of applicability relates to time and economic costs, when carrying out registrations or testing. Selection of an indicator depends on whether information is already routinely obtained, whether veterinarians and agricultural advisers can obtain information as a supplement to ordinary consultations, or whether independent registration/testing has to be carried out. The measurement of some welfare indicators might involve a level of costs (time-consuming as well as otherwise expensive) that are not realistic. Thus complicated experimental set-ups, as well as expensive tests and analyses might be not feasible. For example it is not possible to include most physiological measurements in an operational welfare assessment system. Further evaluation of applicability involves evaluating the preciseness and consistence of the registrations and test. In other words the reliability including both reproducibility ("Between observer variation") and repeatability ("within observer variation") of registrations and tests have to be considered very carefully, in order to meet the demand of applicability for on-farm studies.

The Welfare indicator protocol

A combination of welfare indicators related to production system, husbandry routines and animal behavior and health is suggested to assess the welfare level of the individual farm. In the following the indicators are presented and a general motivation on why they are included is provided.

Behavior

Behavior measurements are including in the operational welfare assessment system and the behavior performed by the animals in the housing systems is compared to known description of normal behavior patterns (behavior normally used to attain functional goals). In this way behavior measurements, and behavior tests, can reveal whether the animals are adapted to the production system or whether the animals show any sighs of strain.

The requirement for applicability for on-farm studies is met by manual monitoring and testing in the home environment. However, it is necessary to pay attention to "how" and "when" measurements and tests are carried out in order to obtain the best possible standardization of the measuring method. The choice of sample size has to be considered very carefully too, in order to test a representative sample of the animals in the herd. Proposed indicators are as follows:

Social behavior

As mentioned, loose housing systems allows the animal to express social behavior. Aggressive interactions naturally occur in relation to establishing social order in dynamic groups. Competitions for resources (food, water, resting areas etc) as well as inexpedient housing design are important causal factors leading to social stress and aggressive behavior. Furthermore, aggression could be the behavioral symptom of general stress, frustration and pain. Social stress and aggression are possible consequences. Aggression as relevant welfare indicator consists of animals being chased, injured and even being ousted form resources. Being a result of general strain, aggressions also indicate a welfare problem in the aggressive animals.

Human-animal relationship

Genetic predisposition and housing conditions as well as experience, quality and quantity of human contact, and handing procedures are factors that influence the man-animal relationship (Hemsworth et al., 1996, le Neindre et al., 1995). Fearful animals being unpleasantly affected by recurring contact with humans explain the welfare relevance of a strained man-animal relationship. Furthermore, animals showing fearful behavioral are often exposed to being handled aversively because they react inappropriately to the handling procedures. The result might be a prolonged complicated human-animal-relationship.

Behavior test in the milking parlor

Milking in loose housing systems involves cows being crowded at the collecting area waiting for individual milking in the milking parlor. Milking is mainly a technical procedure with little physical contact to the milker normally placed in a “milking pit”. As milking is a daily routine it is assumed to be a significant welfare problem if cows are unpleasantly affected by milking, either caused by fear of the milker or dislike of the technical milking procedure.

Resting and rising behavior

A very frequent physical activity among cows is “getting up” and “lying down”. Abnormal getting up and lying down behavior (regarding both appearance and the time factor) is associated with discomfort to the cows and presence of increased risk of injuries. Cows resting elsewhere than in the cubicles and cows lying in the cubicle in an abnormal way could indicate that the cows consider the cubicles uncomfortable. There might be a welfare problem related to the construction of cubicles and bedding material. Furthermore, cows slipping could be important information on how the type of floor affects the welfare, as a slippery floor type increases the risk of injuries and restrains some expressions of behavior.

Health

Disease can be regarded an important welfare indicator, because it is in many cases associated with negative experiences such as pain, discomfort or distress. The disorders, which have the greatest impact on welfare, are either acute disease process, causing suffering or long-term progressive conditions involving chronic pain (Highes & Curtis, 1997). One indicator in a welfare assessment on farm level may be the prevalence and intensity of certain health problems in the herd. It can for instance be estimated on the basis of clinical examinations. Further critical cases are included (e.g. case histories of culled animals) constructed from herd data files combined with interviews with the owner (Badsgard, et al., 1997). health indicators are listed in Table 1.

Table 1. Health indicators included in the welfare assessment protocol for dairy cows.

Body part	Clinical parameters	Welfare relevance
General appearance	Body condition score	A poor body condition may cause long-term discomfort and an increase in disease susceptibility caused by impaired immune competence. It indicates metabolic disorders, sub-optimal management or chronic coping difficulties.
Skin	Skin parasites Skin infection Pressure sores	Pruritic skin disorders result in long-term discomfort and increase the risk of secondary self-inflicted lesions to e.g. the teats. Skin injury and infection caused acute and chronic pain. Provides information about problems regarding the housing system, management, or underlying diseases.
Legs	Lameness Hoof care	Lameness indicates a painful leg condition and affects the freedom of movement and the performance of behaviors. Overgrown or deformed hooves might indicate foot disorders caused pain and discomfort. The resulting changes in leg confirmation might evolve into chronic articular damages.
Udder	Teat lesions Clinical Mastitis	Teat lesion cause acute and chronic pain, which might be aggravated by the daily milking procedure. Clinical mastitis frequently occurs involving pain and discomfort.
Systemic diseases	General condition Clinical Diseases	Clinical diseases typically involved pain and discomfort. The welfare implications vary according to the intensity and duration of the disease condition and welfare the general condition is affected.
Mortality	Case history of culled animals	The information points out specific problem areas in the herd and provides details on the tackling of serious health problems.

System and management

The welfare of farm animals is affected by the production system itself as well as the way the individual farmer applies the system. Welfare relevance is a question of how production system and management consider or restrain the physiological and behavior needs of the animals, and to what extent the health of the animals is affected. Knowledge on how system and management might affect the animals can be included in a welfare assessment system and provide information of risk of welfare problems as well as causal factors.

Any strategy requiring system and management routines to be recorded will have certain limits and pitfalls. First, although different aspects of these indicators have been studied under experimental conditions, there is still considerable ignorance of the effect on welfare of a number of minor features in different housing systems. Furthermore, interactions between different factors are currently poorly understood. The marginal welfare information value is typically low, so there is still a need for a strategy that focuses directly on the livestock response. In practice it might be necessary to focus on a limited number of key measurements. Most system indicators and some management indicators are reasonable easy to define and measure, whereas quite a number of particularly management indicators are difficult to assess but nevertheless have a serious impact on animal welfare. Surveying housing system and housing equipment as well as interviews with the farmer seem to be applicable methods of measurement. Included system and management indicators are listed below:

System

Cubicle are used both as a resting and socially protected area. Cows have a relatively considerable and constant need for rest. In loose housing systems with cubicle, cow behavior and health is primarily influenced by the following factors: Dimension and surface of cubicles, physical placing of cubicle area in the housing systems as well as cubicle partitions (Potter & Broom, 1987). Inexpediently dimensioned fixtures of cubicles may cause physical injuries.
Passages in loose housing systems are used by animals as traffic (leading to and from milking parlor and pasture) and exercise area as well as occasionally by humans in connection with cubicle maintenance and handling of animals. According to Metz & Wierenga (1987) welfare problems arise as a result of the following circumstances:

- Reduced physical and psychological space including width of passages and lack of transverse passages.
- Floor type and surface being a compromise between request for hygiene as well as durability, and the influence of the floor on cows' comfort of movement and risk of physical injuries and hoof diseases.

Collection area and milking parlor influence animal welfare: The way that cows are driven to the milking parlor, duration of stay as well as density at collecting area, floor type as regards material as well as surface and slope, dimensions and design of collecting area and passages. Hygiene of the housing system is influenced by whether or not parts of the stable are included as collecting area.

Design of feeding facilities and their placement in the housing system may influence feeding and social behavior as well as the occurrence of physical injuries. Similarly, number of drinkers, placement, performance and hygiene of the drinking facilities may influence water intake, movement in the housing system and social behavior.

Management

The purpose of management in a dairy herd is to ensure the quality and quantity of care taking and attention necessary to create and sustain good welfare. Appropriate and efficient design of stable facilities, equipment as well as inspection and handling routines are required to obtain and maintain good stockmanship in the herd. Management factors that may affect animals' welfare could be stocking density regarding, e.g. feeding, drinking and resting facilities as well as quantity and quality of bedding material, and use of disease/calving pens. Health is influenced by microbial growth in dirty and moist bedding material, or if the cows are forced to rest on slatted floor due to high housing density. Furthermore, method of feeding (restrictive or ad libitum) and quality of food affect the welfare status of the animals. Calving cycle and annual variation of different events on the farm may cause peak loads, which challenge both housing conditions and care taking. On pasture of grazing, watering, presence of shelter and shade as well as quality of passages and distance to and from the stable seem to have an impact on the welfare status.

Evaluation of the welfare assessment system as a decision support tool

The welfare assessment protocol is evaluated based on recordings during 12 months carried out in each of 10 comparable loose hosing cubicle systems. All herds are characterized by a resting area consisting of cubicles. Feeding takes place at a fodder board in a separate feeding area, and milking takes place in a milking parlor.

Evaluation of the extend the welfare assessment system fulfils its purpose, being a description of the welfare of the animals in the herd and allowing the farmer to assess the development over time and to respond appropriately, is carried out using three different approaches:

Individual annual welfare reports are developed as described by Bonde et al. (2000). Problem areas should be pointed out with enough detailed information to function as a decision support tool in animal welfare considerations on farm, enabling the farmers to act accordingly. The reports consist of three parts: overview, documentation and evaluation. The overview is relevant to set the priorities for animal welfare intervention on farm. The documentation serves to link the animal welfare conclusion to the exact registration on farm and validate the welfare assessment. The reports are presented to the farmers and possibilities for improvement are discussed. Subsequently, systematic interviews of the 10 involved farmers are carried out. The farmers are asked about their view on animal welfare and their experience form their involvement in the project. They are also interviewed about their expectations of this type of decision support in the future.

Furthermore, the data from the 10 hers are analyzed for correlation between welfare indicators. Coherence between indicators form different sources (health, behavior, systems description and management) is applied in the validation of the welfare indicators as well as the welfare protocol as a whole.

An expert panel on animal welfare is established to analyze the draft of the welfare assessment report. The panel participants will be asked on their opinion on animal welfare using the 10 herds as cases. The experts will be given different levels of information from the welfare reports for studying the relative impact of the different indicators, and finally the experts will be interviewed on their opinion of the welfare assessment system.

In this way we expect to advance towards an applicable welfare assessment method, based on valid robust key indicators measurable on commercial farms within a realistic framework.