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The Old School, Brewhouse Hill, Wheathampstead,
Hertfordshire AL4 8AN, UK

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Animal-based parameters are no panacea for on-farm monitoring of animal welfare

MBM Bracke

Animal Sciences Group, Wageningen University and Research Centre, PO Box 65, 8200 AB Lelystad, The Netherlands;
email: marc.bracke@wur.nl

Abstract

On-farm monitoring of animal welfare is an important, present-day objective in animal welfare science. Scientists tend to focus exclusively on animal-based parameters, possibly because using environment-based parameters could be begging the question why welfare has been affected and because animal-based parameters would be better indicators of welfare. However, selection of even the best animal-based parameters that have conventionally been used in experiments could have unacceptable consequences. Systems that are generally considered to be poor welfare systems may generate unacceptably high welfare scores. The monitoring systems could fail to match basic intuitions in society and the scientific community. In order to avoid this problem, available knowledge, eg about animal motivation derived from consumer demand studies and knowledge about the natural behaviour of the animals, should be used explicitly in welfare assessment. This requires making welfare inferences from knowledge about the relationships between environment-based and animal-based parameters using standard operating procedures. The on-farm measurement of animal-based parameters may be regarded as the measurement of critical control points, which must be compared and reconciled with predictions based on available scientific knowledge. For this purpose the formalisation of welfare assessment should be developed further.

Keywords: *animal welfare, assessment, design criteria, housing, monitoring, performance criteria*

Introduction

On-farm monitoring of animal welfare is a hot topic in animal welfare science (Blokhuis *et al* 2003; Webster & Main 2003; Keeling 2005). Existing monitoring schemes (eg Tiergerechtheitsindex/Animal Needs Index; Bartussek 1999) are criticised for relying on environment-based parameters (Whay *et al* 2003). Many scientists believe that a proper monitoring system should exclusively contain animal-based (behavioural and [patho]physiological) parameters (Keeling 2005). In this paper I will question this underlying value judgement.

Concepts

Feelings, biological functioning and natural behaviour have been proposed as necessary elements in the concept of animal welfare (Fraser *et al* 1997). In line with these requirements I defined the term 'animal welfare' as the quality of life as perceived by the animals themselves taking into account the various (welfare) needs associated with each main behavioural system (Bracke *et al* 1999b).

In accordance with a common conceptual framework for welfare assessment (Anonymous 2001) I will use the term 'environment-based parameter' to refer to causes and risk factors affecting the animal's welfare. The pen and its climate, but also conspecifics and stockpersons, are all elements of an animal's environment. Environment-based parameters have also been called 'design criteria', which also include some causal animal-based factors such as breed and ontogenetic factors (Anonymous 2001). The term '(welfare) performance criteria' refers to animal-based parameters indicating the animal's ability to cope with threats. Animal-based parameters include behaviours (eg aggression, fear), (re)productive criteria (eg body condition scores), physiological measures (eg cortisol) and pathological measures (eg skin lesions and lameness).

Animal-based monitoring

Proponents of animal-based monitoring suggest that design criteria are unreliable, and that performance measures should be taken (Keeling 2005). This is in line with the tradition of animal welfare science, where, as a general rule, behavioural and (patho)physiological responses of farm animals have been measured under experimental conditions. In this tradition using environment-based design criteria to assess welfare would be begging the question of why welfare is affected – the underlying idea being that one cannot know what the (welfare) effects of design criteria are unless (welfare) performance-based measures have been recorded.

Problems for animal-based monitoring

One widely-recognised problem for animal-based monitoring is feasibility (Spoolder *et al* 2003): most experimentally recorded animal-based parameters are difficult, if not impossible, to measure under commercial conditions.

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Substitution of animal-based parameters with environment-based parameters could be allowed when these parameters were highly correlated. To date, however, these correlations remain to be identified.

More importantly, however, the exclusive use of animal-based parameters may generate a serious interpretation problem, because in order to properly interpret the welfare impact of animal-based performance measures information about environment-based design criteria is often required. For example, a proper interpretation of plasma cortisol levels requires taking into account factors like time of day and activity level, and an interpretation of the level of tail biting in a herd of pigs requires taking into account factors like tail status (docked tails) and social conditions (eg individual housing). A good body condition may not guarantee the absence of hunger. In pregnant sows, for example, we know that a 'good' body condition score may nevertheless be associated with a high motivation to feed (Lawrence *et al* 1988). Such knowledge must be incorporated into the reasoning process when assessing on-farm animal welfare. This implies that proper welfare assessment cannot rely on animal-based performance measures alone.

We can take this argument one step further. Suppose a rather extensive list of the most valid, reliable and feasible animal-based parameters has been drawn up to monitor welfare under commercial conditions. This may include extensive recordings of abnormal behaviours, skin lesions, body condition scoring, etc. Next, it is crucial to show that the list of parameters is complete and capable of detecting all serious welfare problems, including problems like lack of social contact, lack of space and lack of foraging substrate (Bracke *et al* 1999a; Anonymous 2001). In these particular cases sophisticated animal-based measures could, perhaps, meet these criteria, but the more practical measures are likely to fail, while the environment-based information is already obvious given the considerable body of scientific evidence available establishing that welfare problems (in terms of animal-based parameters) are associated with these factors under experimental conditions. Monitoring systems that exclusively focus on animal-based parameters such as abnormal behaviours, fear and aggression (and their proxies) must avoid overlooking parameters that are highly environment-related such as whether animals can walk, turn around, stretch their limbs and perform natural behaviours. These factors relate to most basic intuitions about animal welfare prevalent in society and in the scientific community, and these must be acknowledged in the reasoning process for making a proper welfare assessment.

An information-based approach

A crucial point is to recognise the role of scientific knowledge. Whereas in traditional experimental work scientific information from other studies only plays a role in the formulation of the problem/hypothesis and in the interpretation of the results, in assessing animal welfare available scientific knowledge provides an explicit source of input which is to be integrated with the (environment-based as well as animal-based) information obtained from the farm. When assessing welfare at system level, published scientific findings play a most explicit role in generating a science-based welfare assessment (Bracke *et al* 2002a).

Over the last four decades many experiments have been conducted, often establishing relationships between environment-based risk factors and animal-based welfare performance criteria. When the objective is to conduct the best possible welfare assessment based on all available information, this information cannot be ignored for logical as well as for biological reasons. This is because the conceptual framework underlying welfare assessment perceives welfare as the product of the interaction of the animal with its (past and present) environment (Anonymous 2001).

A science-based welfare assessment, furthermore, requires that the available scientific information is used to assess all aspects of welfare, ie covering all welfare needs (Bracke *et al* 1999c, 2002a,b). To assess the welfare status of pregnant sows we modelled the available scientific information and constructed a list of welfare criteria/parameters including attributes such as 'space per pen', 'feeding level', 'social contact' and 'rooting substrate' (Bracke *et al* 2002a). This list has been perceived to be mainly including environment-based parameters (eg Keeling 2005). Despite the appearance, however, these attributes are not exclusively environment-based. Each of these criteria has been based explicitly on an analysis of the concept of welfare (welfare needs) and scientific information collected on a database. This implies that each attribute represents a combination of a (class of) emotion(s)/feeling(s) (ie need state), animal-based parameters and environment-based parameters. For example, feeding level refers not only to the amount of food, but also to the (presumed) motivation of the animals to feed and their feeding level. This implies that an attribute like 'space per pen', with 1-1.5 m^2 and > 6,250 m^2 as its worst and best levels respectively, does allow a pen (ie an enclosure) with relatively few m^2 to be scored with a higher level, eg when the pen would contain a functional treadmill, meeting (part of) the animal's need to exercise. Each attribute, therefore, refers to an aspect of welfare and its assessment benefits from taking into account both animal-based and environment-based parameters, depending on their availability.

Conclusions

In addition to measuring animal-based parameters on the farms, I suggest, therefore, to measure also the environment-based parameters and, more importantly, to use the available knowledge about the relationships between these parameters in making inferences from basic facts to the final conclusion about the level of welfare. These inferences may be very simple inferences such as 'when sows are housed individually in boxes of less than 70 cm wide, they cannot turn around'. More complex inferences are also possible, eg when a multifactorial, so-called semantic model is used to assess the risk of tail biting (see Bracke *et al* 2004a,b). The reasoning process requires that the state of satisfaction and frustration of each welfare need be assessed. In this approach animal-based parameters are

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registered on the farm to serve as critical control points verifying the predictions based on the environment-based parameters derived from information contained in standard operation procedures that define the farm and its management. A crucial step in the assessment is to reconcile the predicted and the measured values in an overall assessment of animal welfare. This requires an evaluation of the reliability and availability of all parameters, including the on-farm measured, animal-based parameters, the environment-based parameters and the predicted animal-based parameters. Heuristic rules need to be formulated to guide this process. The entire syllogism of welfare assessment must be formalised further in order to clarify its logic and underlying assumptions such as the dimensions of intensity, incidence and duration (cf Willeberg 1991; Anonymous 2001).

In conclusion, animal-based parameters are no panacea for on-farm monitoring of animal welfare and welfare assessment is best perceived as a bio-logical activity.

Animal welfare implications

Standardisation of science-based welfare assessment is likely to benefit animals in the long term. Using the most reliable sources of information to formally derive the best possible assessment of animal welfare will provide the necessary input for sound ethical and political decision making.

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