

Science-based management of livestock welfare in intensive systems: looking to the future

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Summary

As welfare is a multidimensional concept, its assessment should be a multidisciplinary process, providing a comprehensive assessment of animal welfare in any given system. The different measurable aspects of welfare may be turned into welfare indicators and assessed in a scientific manner. Assessment of welfare may combine different approaches that include the assessment of the production system and measurement of animal-based welfare indicators. With both approaches, however, risk managers face difficulties related to the availability of resources for implementing regulations and training staff. Most animal-based welfare indicators have the advantage that they can be measured whatever the production system; they relate to the animal's experience of its own state. It is essential to confirm the reliability of the measures and their robustness to ensure valid welfare assessment, especially for a science-based management approach. Many welfare indicators, even those measured at the individual level, are expressed at group level, as a proportion of the animals. This allows benchmarking and following of trends over time. The decision on what is or is not acceptable from a welfare point of view is an ethical or managerial one. The advantage of a graded welfare indicator is that it allows different thresholds to be set by different people, countries or organisations, depending on the purpose of the assessment. The development of a set of harmonised international welfare indicators for global trade is also discussed.

Keywords

Inspection – Multidimensional concept – Multidisciplinary approach – Production system – Welfare assessment – Welfare indicator.

Introduction

Good animal welfare is increasingly seen as a requirement by consumers in many countries. In the last 10 to 20 years, several countries and regions have implemented regulations to improve the welfare of food-producing animals (1, 2). In these regulations, animal welfare is assessed by looking at:

- the means of production, e.g. the production system
- the outcomes of the production system in terms of animal welfare, e.g. using animal-based welfare indicators.

In the first case, risk managers are often faced with difficulties in applying the regulations to diverse systems. In a world trade context, or in regions with contrasting climates, it is

often difficult to apply a single regulation to very different systems. In the second case, where welfare indicators are used, the assessment related to a specific animal production unit should be based on the calculation of welfare scores from the information collected from that unit; however, in most cases, individual measures would still be used. As welfare is a multidimensional concept, its assessment should be a multidisciplinary process, based on a variety of different parameters that can provide a more comprehensive view of an animal's welfare in any given system. A European Union (EU) research project was developed to define and calculate these criteria, as applied to different species (3). The knowledge collected from this project and other such research projects in developed countries can provide a platform for science-based management of livestock welfare

in intensive systems, but it may also be particularly valuable in developing countries where animal production may be less standardised and often more extensive.

Difficulties in inspecting and evaluating systems

The choice of a good science-based welfare management system

Given that there are difficulties in inspecting and evaluating production systems, some countries have implemented a process in which buildings or new forms of equipment for animals are approved before they are constructed (4). In countries with small-scale production this may not be feasible, but as livestock production becomes more intensive and the size of the farms increases, this pre-testing can become a powerful tool to prevent some of the known animal welfare problems linked to poorly designed facilities or equipment. This may also be applied to slaughterhouses, which are the final link in the intensive livestock production chain. Indeed, there are several ways in which science-based knowledge can help to enhance animal welfare in slaughterhouses. For example, research into the welfare implications of the management of poultry during stunning and shackling has led to the development of new systems of automatic unloading and controlled atmosphere stunning that result in less distress and pain for the birds (5, 6). Also, choosing the right building design and implementing appropriate handling and management systems can lead to calmer pigs, cattle and sheep, thus decreasing stress, fear, injuries and accidents (7, 8). This has been illustrated by Grandin's (9) science-based recommendations for animal handling, management and building design in slaughterhouses for cattle and sheep, which involve very precise scoring systems for evaluation (10).

Difficulties of welfare inspection

As the number of animals and systems to inspect increases, so also will the number of people required to inspect them. This puts increased emphasis on inter-observer reliability, especially if there are new scoring systems to be learned and applied (11, 12). At the same time, it may allow some inspectors to specialise in particular species. When the approach is based on achieving specific levels of welfare outcomes, the focus is on animal welfare status rather than on risks to welfare. For example, when the EU Directive 2007/43/CE (13) requires that the official veterinarian shall evaluate the results of the post-mortem inspection to identify other possible indications of poor welfare conditions (Annex III, item 2), this implies a scoring of animal welfare that will probably be based on lameness, as

assessed by the incidence of foot pad dermatitis and hock burn in slaughterhouses. This will increase the need for inspectors or automated equipment, because all flocks will have to be evaluated. Attention also needs to be paid to training to ensure reproducibility and repeatability within and between slaughterhouses and countries. The welfare indicators in such regulations must have a scientifically supported correlation with animal welfare state and their scoring should be practicable in the field. In Europe, each Member State may need to interpret the regulations in order to implement the most relevant control system. For example, Annex 1 of Directive 2008/119/CE (14), which lays down minimum standards for the protection of veal calves, states: '...To this end, their feed must contain sufficient iron to ensure an average blood haemoglobin level of at least 4.5 mmol/litre...'. The question arises: do we consider a minimum average level for the batch or for each individual? Scientific analysis is needed to determine the best way of sampling the batch and subsequently the best way of conducting the inspection.

Economic constraints are another issue and often mean that there is a limit on the duration of an inspection visit. This may result in remote farms being inspected less often and time-consuming indicators not being recorded. For example, observations of social behaviour or the ability of animals to move around easily within the system are rarely included in practical welfare assessment systems, even if they are generally regarded as important. The trend towards larger farms usually implies several buildings, and animals may be grouped according to age, sex or stage of production. It will be necessary to inspect the interior of all the buildings even if they initially appear to be the same. This is because animals differ in their reactions even under apparently similar housing conditions, e.g. more aggression in groups of males, greater sensitivity to extremes of temperature in young animals, and so on. Many inspection and evaluation systems confront operators with the dilemma of finding an appropriate balance between the comprehensiveness and accuracy of the welfare assessment and the cost. It is therefore very important to be clear about the purpose of the visit and the implications for the animal and the farmer if the assessment is not detailed enough, not regular enough or the assessor insufficiently trained. Similar difficulties may be seen in developing countries, depending on the resources available.

Difficulties in evaluating the impact of different production systems on animal welfare

During recent decades, the pressure to improve animal welfare has come not only from regulators but also from consumers and retailers. Some large food suppliers have established their own animal welfare criteria for farms and slaughterhouses, with their own control systems, and some countries have banned specific production

systems because of their implications for welfare. However, welfare requirements should be based on scientific welfare evaluation and not only on public perception of good welfare. Generally speaking, the modification of a production system must be tested and validated before it is applied in the field. For example, the modification of a housing system should be assessed before it is implemented to ensure that it does not have undesirable side effects for:

- animal health and survival: free-range systems for birds can be associated with more parasitic and infectious diseases (15, 16, 17) or predation (18)
- animal welfare: putting animals in larger groups (sows, laying hens) can lead to aggression, injuries and cannibalism (19)
- food safety: outdoor rearing can lead to decreased food quality, e.g. *Campylobacter* in broiler chickens, *Salmonella* in layers, *Trichinella* in pigs (20, 21, 22)
- farmers' working conditions: in winter, feeding pigs outdoors is more time-consuming than feeding them indoors.

For these reasons, housing and management changes in intensive systems should be evaluated using a multidisciplinary approach in order to assess all the consequences for animal welfare and health, as well as for food production.

The concept of welfare indicators

For many years, animal welfare scientists and veterinarians in practice have used behavioural and physiological indicators to measure welfare (23). When used for assessment schemes or animal welfare legislation, these welfare indicators have traditionally been focused on the environment, either the physical environment (resource-based measures) or the treatment of the animals (management-based measures). However, more recently, the EU Welfare Quality® project succeeded in promoting the systematic use of animal-based measures to assess welfare in commercial practice (24). It was proposed that measurable aspects of welfare could be considered within 12 different criteria. These criteria were the same for cattle, pigs and poultry and reflected how the animals were being fed and housed as well as their health and behaviour. The actual welfare indicators used to assess each of these criteria necessarily varied according to the species.

The Animal Health and Welfare Panel of the European Food Safety Authority (EFSA) has the responsibility of addressing

animal welfare risk. It has outlined how this can be done and how the links between the different risk factors (resource- and management-based measures) are linked to welfare consequences (animal-based measures) (25, 26, 27). Both the Welfare Quality® project and the scientific opinions of EFSA have emphasised the importance of confirming the reliability of the measures and their robustness, to ensure a valid welfare assessment. Many of the animal-based welfare indicators, even if measured at the individual level, are expressed at the group level as a proportion of animals. This allows benchmarking and the following of trends over time. The decision on what is acceptable or not from a welfare point of view is an ethical or managerial decision. The advantage of having a graded welfare indicator is that it allows different thresholds to be set by different people, countries or organisations, depending on the purpose of the assessment.

The animal-based indicators are usually used for two main purposes:

- implementation of regulations
- internal/external audit and control.

Recent animal welfare regulations include some animal-based measurements for which a threshold of acceptability has been fixed, as noted above for EU Directive 2008/119/EC laying down minimum standards for the protection of calves, which specifies that average blood haemoglobin levels should be at least 4.5 mmol/litre. If the choice is made to work on average data from a herd, it is best to determine a minimum number of individuals that should have blood levels above the threshold and then a maximum number of veal calves that may have sub-threshold concentrations. The thresholds and minima must be determined using available published information, field data (e.g. on intra-group variability) and the objectives of the Directive.

Another example is Directive 2007/43/EC, which appears to necessitate a scoring of broiler welfare at slaughterhouses in terms of welfare outcomes. For that purpose, the Directive asks Member States (Article 6.2) 'to submit to the Commission the results of the data collection based on monitoring of a representative sample of flocks slaughtered during a minimum period of one year'. Collecting data from different Member States is important because it will provide comparable data about animal-based welfare indicators at different slaughterhouses. These data will be used to assess the welfare of broiler chickens, as linked to these indicators, and will allow comparison between different countries or regions. The data collected can be used to determine a threshold of acceptability; for example, in terms of lesion prevalence. In the case of this Directive, these thresholds may be very important because they may influence the stocking density that will be allowed on farms. However, the establishment of a threshold is very delicate because:

- the situation in a country is highly dependent on the climate, genotype used, production systems, etc.
- exceeding a threshold could lead to a reduction of stocking density and potential economic losses.

In principle, however, this is the same as deciding on any threshold or specification in a regulation (e.g. feeding space per animal, transport distances, etc.) and will be negotiated in a similar way.

Internal and external audit and control can be used for evaluation in order to monitor progress on a specific farm, or as a means of certification. Tools such as the Welfare Quality® protocols categorise welfare criteria into four welfare principles (good feeding, good housing, good health, and appropriate behaviour), and propose thresholds for ranking a farm in terms of animal welfare according to four categories (not classified, acceptable, enhanced, and excellent) (28). Independently of the regulations in force, this or another system could be used to characterise the welfare of animals on a farm and to obtain a label or other sign of quality or acceptability to customers. Large food companies are using these systems, and farmers (29) or slaughterhouses (30) have to comply with their requirements in order to sell their products.

The need for minimum requirements in criteria related to production systems

In developing countries, where animals are often still reared in traditional production systems, attention should be paid to the available scientific results before intensive systems are introduced. Two main aspects must be considered:

- animal welfare must be considered from the very beginning
- automatic data collection cannot replace good animal husbandry.

These two points are explained in more detail below.

Industrial animal production arose in the second half of the 20th Century in order to supply the large populations in developed countries with cheap animal protein. Towards the end of the century, these animal production systems were considered to be the optimum system in terms of productivity, animal health, food safety and working conditions for farmers. Nowadays, however, they are being re-evaluated because of the implications they have for animal welfare. In Europe, at least, several regulations now

state that any new or modified housing and management systems that are introduced should have features that improve farm animal welfare. Thus, when building new industrialised production systems, it is advisable to consider the scientific findings on animal housing in groups (31, 32), mutilation procedures (33) and enrichment (34, 35).

New tools are available, such as automatic data collection in the context of precision livestock farming (36, 37, 38), which could contribute to the early detection of on-farm welfare and health problems and to the improvement of working conditions for farmers. When these systems are implemented on very large farms, however, it is important that the attention of an experienced farmer should not be replaced by sensors. Automatic data collection should be a tool that is used to enhance animal welfare, not used to allow more industrialisation and less direct attention to the animal.

When countries with limited welfare regulations plan to extend them, the contributions of housing, management and evaluation at farm level to the welfare of intensively managed animals should be given serious consideration. This is partly because worldwide regulations may eventually be introduced and specific customers may require the implementation of minimum welfare standards. Particular attention should be given to whether or not current industrialised farming models may need to be adapted to accommodate possible differences in climate, genotypes, materials, sanitary conditions, housing and stocking densities, etc.

Discussion

The establishment of formal animal welfare assessment that involves inspection and management of livestock can result in a combination of different approaches, including evaluation of the features of production systems and measurement of welfare indicators. However, when both approaches are required by regulations, risk managers will be faced with difficulties related to staff training in the competent authorities and the availability of the resources needed to implement the regulations. These issues can be particularly acute in developing countries.

All systems and management practices need to be validated, with the aim of avoiding adverse effects. Ideally, farmers and consumers would not have to choose between *i*) systems that allow more freedom and a wider behavioural repertoire but are accompanied by injuries and cannibalism (e.g. loose housing systems), and *ii*) systems which are physically safer and more hygienic, but in which animals have less freedom to express natural behaviour (e.g. close-confinement systems). Anthropomorphism and aesthetic

appeal should not result in systems and management with negative impacts on animal health and welfare, nor should hygiene considerations and economic risks prevent the modification of livestock housing systems and management in ways that may improve animal welfare. Realistically, however, it appears that all livestock systems have both advantages and disadvantages for animal welfare, so that in each case management is aimed at safeguarding the particular advantages and minimising the particular disadvantages. The likely global trend towards increased intensive management of livestock offers a stimulus to increase science-based efforts to reconfigure facilities and management in ways that combine the best outcomes of, for example, loose housing systems and close-confinement systems.

Most animal-based welfare indicators have the advantage of being measurable whatever the production system. Thus, it seems logical that animal welfare criteria should be taken into consideration in international trade. If not, an unfair economic distortion may be created between countries imposing such standards and those with no specific requirements in regard to welfare. Some countries, including those of the EU, have argued that animal welfare should be brought within the ambit of the World Trade Organization (WTO) Agreement on the Application of Sanitary and Phytosanitary Measures (the SPS Agreement) (39). However, there is a lack of consensus about this

proposal, especially between the EU and other regions, and any WTO decision needs the unanimity of WTO Member Countries. The World Organisation for Animal Health (OIE) could play a significant role in international arbitration in the field of animal welfare, as it has already done in the animal health field. The International Organization for Standardization has created an *ad hoc* working group to develop standards on animal welfare which could be founded on OIE standards. In negotiations on bilateral agreements, the supporting documents already use the OIE standards on animal welfare.

In the future, a set of harmonised welfare outcome indicators should be internationally defined on the basis of the results from the research programmes developed in recent years. These indicators could be used by Competent Authorities in the framework of inspection, as well as by the private sector when promoting their standards to consumers. This approach would require risk managers to define herd-level acceptability thresholds for each welfare indicator. All these data may also be used to improve transparency in the trade of animals or animal products. These tools could be used as an objective and scientific basis for the implementation of the labelling of animal products with regard to welfare. ■

La gestion scientifique du bien-être animal dans les systèmes d'élevage intensif : perspectives d'avenir

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Résumé

Le bien-être étant un concept pluridimensionnel, son évaluation devrait être un processus pluridisciplinaire afin que l'évaluation du bien-être animal soit aussi complète que possible indépendamment du système d'élevage considéré. Les différents aspects mesurables du bien-être peuvent être exprimés sous forme d'indicateurs du bien-être et évalués scientifiquement. Pour ce faire, plusieurs approches différentes peuvent être associées, en particulier l'évaluation du système de production et le relevé d'indicateurs du bien-être sur l'animal. Néanmoins, quelle que soit l'approche adoptée, les gestionnaires du risque rencontrent des difficultés liées au manque de ressources dont ils disposent pour appliquer la réglementation et former leurs personnels. La plupart des indicateurs du bien-être axés sur l'animal présentent l'avantage d'être quantifiables quel que soit le système de production ; en effet, ils s'attachent au ressenti de l'animal face à ses conditions de vie. Il est essentiel de confirmer la fiabilité des relevés et leur robustesse, afin de s'assurer de la validité de l'évaluation du bien-être,

en particulier lorsqu'on souhaite mettre en place des méthodes de gestion scientifiquement fondées. Nombre d'indicateurs du bien-être, même ceux dont le relevé se fait au niveau de l'animal individuel, sont exprimés en termes collectifs, à savoir en pourcentage d'animaux. Cette méthode permet de définir des points de référence et de suivre l'évolution des tendances dans le temps. Le jugement sur ce qui est acceptable ou inacceptable du point de vue du bien-être animal est de nature éthique mais relève aussi d'une problématique de gestion. Les indicateurs gradués du bien-être sont intéressants car ils permettent de mettre en place des seuils différents suivant les personnes, les pays où les organisations, en fonction du but de chaque évaluation. Les auteurs examinent également la création d'un ensemble harmonisé d'indicateurs du bien-être animal au plan international pour les besoins des échanges commerciaux.

Mots-clés

Approche pluridisciplinaire – Évaluation du bien-être – Indicateur du bien-être – Inspection – Systèmes de production.



Gestión científicamente fundamentada del bienestar del ganado en sistemas intensivos: rumbo al futuro

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Resumen

Dado que el «bienestar» es un concepto poliédrico, su evaluación debería ser un proceso multidisciplinar, que arroja una valoración global del nivel de bienestar del animal en cualquier sistema. Los distintos aspectos cuantificables del bienestar pueden ser transformados en indicadores de bienestar y determinados científicamente. Para evaluar el bienestar se pueden combinar distintos métodos, que incluyan la valoración del sistema productivo y la cuantificación de indicadores de bienestar centrados en el propio animal. Con ambos planteamientos, sin embargo, los responsables de gestionar el riesgo tienen dificultades ligadas a la falta de recursos para aplicar la reglamentación y formar al personal. En su mayoría, los indicadores de bienestar centrados en el animal presentan la ventaja de que es posible cuantificarlos sea cual sea el sistema de producción, pues tienen que ver con la forma en que el animal experimenta su propio estado. Es esencial confirmar la fiabilidad y robustez de las medidas para garantizar que la evaluación del bienestar sea válida, especialmente a la hora de aplicar métodos de gestión científicamente fundamentados. Muchos indicadores de bienestar, incluso aquellos que se miden en cada individuo, se expresan a la escala del grupo, en forma de proporción de animales, lo que permite establecer niveles de referencia y seguir la evolución temporal de las tendencias. La decisión sobre lo que resulta o no aceptable desde el punto de vista del bienestar es una decisión ética o de gestión. Los indicadores de bienestar que admiten una gradación tienen la ventaja de que diferentes personas, países u organizaciones puedan fijar distintos umbrales dependiendo de la finalidad de la evaluación. Los autores también abordan la elaboración de un conjunto de indicadores de bienestar internacionalmente armonizados con fines de comercio mundial.

Palabras clave

Evaluación del bienestar – Indicador de bienestar – Inspección – Planteamiento multidisciplinar – Sistema de producción.



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