

Broom, D.M. 2006. Traceability of food and animals in relation to animal welfare. *Annales da II Conferência Internacional sobre Rastreabilidade de Produtos Agropecuários* (Annals of the 2nd International Conference on Agricultural Product Traceability) 195 – 201. Brasília: Ministério da Agricultura.

Pre-publication copy

Traceability of food and animals in relation to animal welfare

D.M. Broom
Centre for Animal Welfare and Anthrozoology
Department of Veterinary Medicine
University of Cambridge
Maddingley Road
Cambridge CB3 0ES
UK
dmb16@cam.ac.uk

Animal welfare concepts

In Europe, domestic animals are considered to be sentient because of evidence of their complex behaviour and physiology and high degree of cognitive ability (Broom 2003, 2006c). There is much concern amongst the people about animal welfare. Members of the European Parliament receive more letters about animal welfare than about any other subject (Broom 2002).

Welfare is a term which refers to animals including man. It requires strict definition if it is to be used effectively and consistently. A clearly defined concept of welfare is needed for use in precise scientific measurements, in legal documents and in public statements or discussion. If animal welfare is to be compared in different situations or evaluated in a specific situation, it must be assessed in an objective way. The assessment of welfare should be quite separate from any ethical judgement but, once an assessment is completed, it should provide information that can be used to take decisions about the ethics of a situation.

How well can our domestic animals adapt to the conditions that we impose upon them? (Broom 2006a). At the individual level, adaptation is the use of regulatory systems, with their behavioural and physiological components, to help an individual to cope with its environmental conditions (Broom 2006a). Animals can adapt better if

their needs are met.

Welfare refers to a characteristic of the individual animal rather than something given to the animal by man. The welfare of an individual is its state as regards its attempts to cope with its environment (Broom, 1986). This definition refers to a characteristic of the individual at the time. The question is how well the individual is at a particular time (for further discussion, see Broom 1998, 2001b, 2006b; Broom & Johnson 1993/2000, Broom and Kirkden 2004, Broom and Molento 2004). The concept refers to the state of the individual on a scale from very good to very poor. This is a measurable state and any measurement should be independent of ethical considerations. When considering how to assess the welfare of an individual, it is necessary to start with knowledge of the biology of the animal. The state may be good or poor, however, in either case, in addition to direct measures of the state, attempts should be made to measure those feelings which are a part of the state of the individual.

The feelings of an animal are an extremely important part of its welfare (Broom 1991, 1998). Suffering is a negative unpleasant feeling which should be recognised and prevented wherever possible. Feelings are aspects of an individual's biology which must have evolved to help in survival (Broom 1998), just as aspects of anatomy, physiology and behaviour have evolved. They are used in order to maximise its fitness, often by helping it to cope with its environment. In the fastest acting urgent coping responses, such as avoidance of predator attack or risk of immediate injury, fear and pain play an important role. In longer time-scale coping procedures, where various risks to the fitness of the individual are involved, feelings rather than just intellectual calculations are amongst the causal factors affecting what decisions are taken. In attempts to deal with very long-term problems which may harm the individual, aspects of suffering contribute significantly to how the individual tries to cope. In the organisation of behaviour so as to achieve important objectives, pleasurable feelings and the expectation that these will occur have a substantial influence. The general hypothesis advanced is that whenever a situation exists where decisions are taken which have a big effect on the survival or potential reproductive output of the individual, it is likely that feelings will be involved. This argument applies to all animals with complex nervous systems, such as vertebrates and cephalopods, and not just to humans. Feelings are not just a minor influence on coping systems, they are a very important part of them.

The word stress should be used for that part of poor welfare that involves failure to cope. Stress can be defined as an environmental effect on an individual which overtaxes its control systems and reduces its fitness or seems likely to do so (Broom and Johnson, 1993/2000, see also Fraser & Broom 1990/1997, Broom 2001).

Welfare assessment.

The general methods for assessing welfare are summarised in Table 1 and a list of measures of poor welfare is presented in Table 2. Most indicators will help to pinpoint the state of the animal wherever it is on the scale from very good to very poor. Some measures are most relevant to short-term problems, such as those associated with human handling or a brief period of adverse physical conditions, whereas others are more appropriate to long-term problems. (For a detailed discussion of measures of welfare, see Broom 1988 and Broom and Johnson 1993/2000).

Table 1 - Summary of Welfare Assessment

<u>General Methods</u>	<u>Assessment</u>
Direct indicators of poor welfare	How poor
Tests of (a) avoidance and (b) positive preference	(a) Extent to which animals have to live with avoided situations or stimuli (b) Extent to which that which is strongly preferred is available
Measures of ability to carry out normal behaviour and other biological functions.	How much important normal behaviour or physiological or anatomical development cannot occur
Other direct indicators of good welfare	How good

(modified after Broom 1999)

Table 2 - Measures of welfare

- Physiological indicators of pleasure
- Behavioural indicators of pleasure
- Extent to which strongly preferred behaviours can be shown
- Variety of normal behaviours shown or suppressed

Extent to which normal physiological processes and anatomical development are possible.

Extent of behavioural aversion shown

Physiological attempts to cope

Immunosuppression

Disease prevalence

Behavioural attempts to cope

Behaviour pathology

Brain changes, e.g. those indicating self narcotization

Body damage prevalence

Reduced ability to grow or breed

Reduced life expectancy

(after Broom 2000)

Some signs of poor welfare arise from physiological measurements. For instance increased heart-rate, adrenal activity, adrenal activity following ACTH challenge, or reduced immunological response following a challenge, can all indicate that welfare is poorer than in individuals which do not show such changes. Behavioural measures are also of particular value in welfare assessment (Broom 2005b). The fact that an animal avoids an object or event strongly gives information about its feelings and hence about its welfare. The stronger the avoidance the worse the welfare whilst the object is present or the event is occurring. An individual which is completely unable to adopt a preferred lying posture despite repeated attempts will be assessed as having poorer welfare than one which can adopt the preferred posture. Other abnormal behaviour such as stereotypies, self mutilation, tail-biting in pigs, feather-pecking in hens or excessively aggressive behaviour indicates that the perpetrator's welfare is poor. Disease, injury, movement difficulties and growth abnormality all indicate poor welfare. Health may be defined as an animal's state as regards its attempts to cope with pathology (Broom 2000). In this statement, animals include humans. Pathology is the detrimental derangement of molecules, cells and functions that occurs in living organisms in response to injurious agents or deprivations (Broom and Kirkden 2004, Broom 2006b). Pathology is also the study of such conditions. Health is an important part of welfare.

Indicators of poor welfare in animals which may be traceable include: signs of infectious disease, injury to the body surface, broken bones, meat quality changes

such as PSE (pale soft exudative) or DFD (dark firm dry) meat, some abnormalities of behaviour resulting from inadequate housing, signs of malnutrition and signs of metabolic disease.

Traceability and welfare improvement

There are several ways in which traceability may be of value in trying to improve animal welfare.

1. If foods fed to animals can be traced, it is less likely that toxins or other poor quality materials will be fed to them.
2. If foods fed to animals can be traced, it is less likely that pathogens emanating from food will be in their diet.
3. If animals can be traced, the sources of animal disease outbreaks are more likely to be found.
4. If animals can be traced, the places where injuries, or other causes of poor welfare, occurred are more likely to be found.

How can food or animals be traced? This is the central question addressed by other papers in this Congress. The answer is that there must be a combination of good record keeping systems and a good method of marking the food item or individual animal. However, the system and marking method must be such that accident, incompetence, and deliberate deception do not lead to failure of traceability. Animals can be marked with tattoos, ear-notching, ear-tags that may be electronic, freeze brands, implanted electronic tags, a bolus in the gut, unique descriptions of individuals, DNA fingerprinting, etc. In every case it is necessary to consider whether the mark could be removed or modified.

1. If foods fed to animals can be traced, it is less likely that toxins or other poor quality materials will be fed to them.

It might be that a toxin is present in the food fed to animals. For example, plant toxins such as aflatoxins could be in a consignment of animal feed and could cause morbidity, and hence poor welfare, or death in farm, companion or laboratory animals. If the components of the feed were traceable, the source could be found and repetitions of the event prevented. Action might be taken by government, companies

involved in the supply chain or consumers. The possibility of loss of reputation for the food processing company or punitive action could reduce the likelihood of such poor welfare in consumer animals in future.

2. If foods fed to animals can be traced, it is less likely that pathogens emanating from food will be in animal feed.

A disease outbreak could be a consequence of pathogens in the feed fed to animals. This involves some contagious diseases. For example, milk or other dairy by-products, even if pasteurised, can carry foot-and-mouth disease (Alexandersen et al 2003) or MAP (*Mycobacterium avium pseudotuberculosis*) (Forshell 2001) and can infect cattle and some other animals. Foot-and-mouth disease causes painful lesions and serious malaise so the welfare of clinically infected animals is very poor. If the components of the feed were traceable, the source could be found and repetitions of the event prevented. Again, action might be taken by government, companies involved in the supply chain or consumers. The possibility of loss of reputation or punitive action could reduce the likelihood of such poor welfare in consumer animals in future.

Other diseases may be transmitted to animals via feed but are not transmitted further by contact between animals. For example, BSE (bovine spongiform encephalopathy = mad cow disease) is now known to be transmitted in animal feed. If a case is detected, it is necessary to trace all of the feed fed to that animal because there is a long delay between consumption of the feed and signs of disease. BSE is very distressing for clinically infected cattle and the consequences of its occurrence can lead to other poor welfare, for example because of cattle movement restrictions.

3. If animals can be traced, the sources of animal disease outbreaks are more likely to be found.

If there are records of each individual animal during animal transport and of the movements of animals through markets, provided that there is an effective marking system for the animals, diseased animals can be traced and the sources of infection found (Broom and Kirkden 2004, Broom 2005a). The animal marking system is likely to be an implanted chip in future. When an animal with classical swine fever or

foot-and-mouth disease is found during a check of transported animals, or animals arriving at a slaughter-house, or in meat, tracing of the animals is important for economics and animal welfare.

4. If animals can be traced, the places where injuries, or other causes of poor welfare, occurred are more likely to be found.

When an animal is found at a slaughter-house with bruises, skin lesions, PSE meat or DFD meat, the welfare of the animal at various stages in its past can be deduced. With regard to the lesion that are recognisably recent, the following questions can be asked. Which persons moved these calves in the slaughter-house? On which vehicle did they travel and who was driving it? Which persons moved the animals on to the vehicle? If the carcass can be traced to the people who caused the skin lesions, bruises and any meat quality defects, there can be a financial penalty for the persons who caused the poor welfare and reduced value of the carcass. For further information on the welfare of transported animals see EU scientific committee reports, now EFSA reports, at:

http://europa.eu.int/comm/food/fs/sc/scah/out71_en.pdf

http://www.efsa.eu.int/science/ahaw/ahaw_opinions/424/opinion_ahaw_01_atrans_ej44_annex_en1.pdf

http://www.efsa.eu.int/science/ahaw/ahaw_opinions/424/opinion_ahaw_01_atrans_ej44_en1.pdf

A chicken with severe hock-burn might be found in a slaughter-house or in a shop or supermarket. The injury is known to be caused in the rearing conditions rather than during transport, pre-slaughter handling or post-mortem treatment (Goksoy et al 1999, Weeks et al. 2000, Bradshaw et al. 2002. A study of 384 chicken carcasses in U.K. supermarkets (Broom and Reefmann 2005) showed that 82% of whole chicken carcasses had some degree of hock-burn. If carcasses can be traced, since hock-burn is caused by a combination of poor litter quality and weak legs on the rearing farm, the farmer at fault can be found. Welfare on that farm can then be improved. This principle would be used according to the proposal of the Commission of the European Communities “for a Council Directive laying down minimum rules for the protection of chickens kept for meat production”. Traceability of chickens would be legally required so that injuries found in the slaughterhouse can be traced and the offenders required to change.

If a cow arrives at a slaughter-house lame, for example with a sole-ulcer or with an injury or other disease condition, If it can be traced the cause might be remedied and the welfare of future cows from the farm where it was kept improved.

Conclusions

1. Animal welfare is the subject of rapidly increasing concern in most countries in the world and this concern is resulting in changes in the ways in which farmers and other animal users keep and treat animals. The welfare of an individual is its state as regards its attempts to cope with its environment. Health is an important part of welfare, as are feelings and other adaptive responses. There are various indicators of good and poor welfare which can be used to find out about present and previous welfare. Many different systems for coping with the environment should be considered when assessing welfare.

2. Traceability of animal feed can help to reduce the risk of poor welfare because of the effects of toxins or pathogens. The sources of important diseases such as foot and mouth disease and bovine spongiform encephalopathy can be traced and, since these diseases cause very poor welfare in infected animals, the traceability can improve animal welfare as well as reducing costs to farmers.

3. Traceability of animals can help to reduce disease, injuries caused by bad handling or transport of animals and poor housing conditions. If the farms where bad conditions caused carcass lesions, and the animal handlers or drivers who caused such lesions can be traced, the bad conditions and practices can be improved with consequent benefits for animal welfare.

References

Alexandersen, S., Zhang, Z. and Donaldson, A. I. (2002). Aspects of the persistence of foot-and-mouth disease virus in animals- the carrier problem. *Microbes Infect* 4, 1099-1110.

- Bradshaw, R.H., Kirkden, R.D. and Broom, D.M. 2002. A review of the aetiology and pathology of leg weakness in broilers in relation to their welfare. *Avian Poultry Biology Review*, 13, 45-103.
- Broom, D.M. 1986 . Indicators of poor welfare. *British Veterinary Journal* 142, 524-526.
- Broom, D.M. 1988. The scientific assessment of animal welfare. *Applied Animal Behaviour Science*, 20, 5-19.
- Broom, D.M. 1991. Assessing welfare and suffering. *Behavioural Processes* 25, 117-123.
- Broom, D.M. 1998. Welfare, stress and the evolution of feelings. *Adv. Study Behav.*, 27, 371-403.
- Broom, D.M. 1999. The welfare of dairy cattle. *Proceedings of the 25th International Dairy Congress, Aarhus 1998, Vol III, Aargaard, K. (ed.) Future of Milk Farming*, pp. 32-39. Danish National Committee of International Dairy Federation, Aarhus.
- Broom, D.M. 2000. Welfare assessment and problem areas during handling and transport. In *Livestock handling and transport*, 2nd edn., ed. T. Grandin, 43-61. Wallingford: C.A.B.I.
- Broom, D.M. 2001. The use of the concept of Animal Welfare in European conventions, regulations and directives. In: *Food Chain 2001*, pp. 148-151. SLU Services, Uppsala.
- Broom, D.M. 2001. Coping, stress and welfare. In *Coping with Challenge: Welfare in Animals including Humans*. Ed. D.M. Broom, 1-9. Berlin: Dahlem University Press.
- Broom, D.M. 2002. Does present legislation help animal welfare? *Landbauforschung Völkenrode*, 227, 63-69.
- Broom, D.M. 2003. *The Evolution of Morality and Religion* (pp.259). Cambridge: Cambridge University Press.
- Broom, D.M. 2005. The effects of land transport on animal welfare. *Revue scientifique technique Office internationale des Epizoöties*, 24, 683 – 691.
- Broom, D.M. 2005. O comportamento animal e o bem-estar. *Albèitar*, 1, 32 – 38.
- Broom, D.M., 2006. Adaptation. *Berliner und Münchener Tierärztliche Wochenschrift*, 119, 1 – 6.
- Broom, D.M. 2006. Behaviour and welfare in relation to pathology. *Applied Animal Behaviour Science*. 97, 71-83.
- Broom, D.M. 2006. The evolution of morality. *Applied Animal Behaviour Science*.
- Broom, D.M. & Johnson, K.G. 1993/2000. *Stress and Animal Welfare*. Dordrecht: Kluwer, 211pp.

- Broom, D.M. and Kirkden, R.D. 2004. Welfare, stress, behavior , and pathophysiology. In *Veterinary Pathophysiology* , ed. R.H. Dunlop and C-H Malbert, 337-369. Ames, Iowa: Blackwell.
- Broom, D.M. e Molento, C.F.M. 2004. Bem-estar animal: conceito e questões relacionadas –revisão. *Archives Veterinária Scientia*, 9, 1-11.
- Broom, D.M. and Reefmann, N. 2005. Chicken welfare as indicated by lesions on carcasses in supermarkets. *British Poultry Science*, 46, 407 – 414.
- Forshell, K. P., 2001. Description of paratuberculosis. On-farm control and diagnosis of paratuberculosis. *Bulletin of the International Dairy Federation*, 364, 9-13.
- Fraser, A.F. & Broom, D.M. 1990/1997. *Farm Animal Behaviour and Welfare*. CABI, Wallingford, 437pp.
- Goksoy E.O., McKinsty, L.J., Wilkins, L.J., Parkman, I., Phillips, A., Richardson, R.I. and ANnil, M. H. 1999. Broiler stunning and meat quality. *Poultry Science*, 78, 1796-1800.
- Weeks C.A., Danbury, T.D., Davies, H.C., Hunt, P and Kestin, S.C. 2000. The behaviour of broiler chickens and its modification by lameness. *Applied Animal Behaviour Science*, 67, 111-125.

O rastreabilidade da comida e dos animais em relação do bem-estar animal.

Donald M.Broom, Centre for Animal Welfare and Anthrozoology, Department of Veterinary Medicine, University of Cambridge, Madingley Road, Cambridge CB3 0ES, U.K. (dmb16@cam.ac.uk)

O bem-estar de um indivíduo é seu estado em relação às suas tentativas de se adaptar ao seu ambiente. Esta definição refere-se a uma característica do indivíduo e ao estado de um indivíduo em uma escala variando de muito adequado a muito ruim. Bem-estar se refere a tudo os mecanismos de enfrentar: fisiológico, comportamento, sentimento e as respostas á patologia. A saúde é o estado de um animal resultante das suas tentativas para enfrentar diversas patologias. O estado é das sistemas do corpo e do cérebro as qual combatem as patogénias, os danos tissular, e as desordems fisiológicas. O bem-estar é um termo mais amplo que o saúde mas o saúde faz parte importante do bem-estar. É possível que o rastreabilidade da comida dos animais agropecuários melhorará o bem-estar animal se há o bem-estar ruim nos animais a causa : 1. da comida tóxica ou da qualidade pobre, 2. das patogénias emanando da comida; e o rastreabilidade dos animais agropecuários melhorará o bem-estar animal se há o bem-estar ruim nos animais a causa: 3. das patologias contagioso nos animais, ou 4. das lesões etcetera com as origems do alojamento ou o tratamento durante o movimento e o transporte dos animais. Os exemplos são rastreabilidade: 1. dos aflatoxins na comida animal, 2. do vírus FMD no produtos lácteos, ou do prion BSE na comida da origem animal, 3. do CSF nos suínos descobrido no matadouro, e 4. os hematomas dos bezerros ou o dermatitis dos frangos ou os ossos quebrados nas

galinas. A lei da protecção dos frangos na Europa incluem a necessidade do rastreabilidade dos animais para avaliar a mortalidade e o nível dos danos nos animais. O rastreabilidade da comida e dos animais é muito importante para o bem-estar animal.

Keywords: rastreabilidade da comida, rastreabilidade dos animais, bem-estar animal, patologias animais, lesões aos animais.