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

Animal Welfare 2007, 16: 107-110
ISSN 0962-7286

Normal behaviour as a basis for animal welfare assessment

B Wechsler

Swiss Federal Veterinary Office, Centre for Proper Housing of Ruminants and Pigs, Agroscope Reckenholz-Tänikon Research Station ART, 8356 Ettenhausen, Switzerland; email: beat.wechsler@art.admin.ch

Abstract

It is generally agreed that farm animal welfare is at a high level when the animals can behave naturally. Most of today's housing systems, however, differ considerably from the natural environment in which the behavioural organisation of the ancestors of our farm animal species evolved. Consequently, normal behaviour may be impaired in several ways. Frequency, duration or sequence of behavioural elements may be affected. Some normal behaviour patterns may not occur at all. The animals may also possibly behave in unnatural ways – in patterns that would never occur in nature. Furthermore, it is usual for farm animals to exhibit behaviour which is normal in form, but which is elicited by artificial structures within their housing system.

In view of these possible changes in normal behaviour, it is necessary to assess, for each farm animal species and each housing system, whether animal welfare is at risk in any way if the behaviour observed differs from the behaviour that would occur in a natural environment. In some cases the question can be answered by taking a theoretical evolutionary approach. In most cases, however, detailed knowledge about the behavioural organisation of the animals is necessary. Such knowledge is built up from animal motivation studies and investigations into the effect of environmental structures on animal behaviour.

A specific problem of on-farm animal welfare assessment is that there is often not enough time to collect sufficient data to make a judgement about the occurrence of normal behaviour. Resource-based assessment methods are appropriate as an alternative, provided that the resource standards used are based on evidence stemming from research into animal behaviour and motivation.

Keywords: *animal welfare, behavioural organisation, motivation, normal behaviour, on-farm research, welfare assessment*

Introduction

The behavioural organisation of the ancestors of our farm animal species was shaped and adapted to their natural environment over millions of years. As a result of this process, each species is characterised by a behavioural repertoire (ethogram) that allows the animals to cope with the problems they face in a natural environment. Several studies with farm animals kept in semi-natural enclosures have shown that domestication has hardly changed this behavioural repertoire (eg Duncan *et al* 1978; Jensen 1986; Stolba & Wood-Gush 1989). Consequently, it is generally agreed that farm animal welfare is at a high level when the animals can show natural/normal behaviour, and animal welfare is often defined in terms of natural living or normal functioning of behavioural systems (see Fraser *et al* 1997 for a review). Assuming that the function of the emotions of an animal is to reflect its ability or failure to cope with a given environment, positive and negative emotional states are also a product of natural selection. Successful coping includes not only physiological health, but also the animal's ability to perform normal behaviour to change its environment according to its motivational needs. It is thus reasonable to use the occurrence of normal behaviour as an indicator of animal welfare in farm animal housing systems.

Normal behaviour is altered by housing conditions

Most of today's farm animal housing systems differ considerably from a natural environment. The animals are usually kept indoors, in housing systems that have been designed to maximise productivity and minimise production costs. As a consequence, normal behaviour may be impaired in several ways in the housing systems.

Compared to the results of studies on the behaviour of farm animals kept in semi-natural enclosures, the behaviour observed in housing systems typically differs in frequency and duration. Pigs, poultry and beef cattle housed indoors, for example, are generally offered concentrated feed, resulting in a marked decrease in the time needed for feed intake and an increase in the time spent inactive. In comparative studies of housing systems, differences in the frequency and duration of specific behaviours can be attributed to specific characteristics of the housing. To give an example, finishing bulls kept in pens with fully slatted, concrete floors reduce the number of lying bouts per day and increase the duration of these bouts compared to bulls in housing systems with straw bedding (Mayer *et al* 2005), to avoid lying down frequently on a hard surface.

https://doi.org/10.1017/S0962728600031110 Published online by Cambridge University Press

Housing conditions may also have an effect on the sequential patterns in behaviour, although this has not been investigated much. With laying hens kept in battery cages, the sequence of dustbathing elements typical for hens having access to litter is markedly changed, as the birds direct bill-raking behaviour towards the feed instead of the floor (Müller-Fickenwirth & Fölsch 1988). Comparing the behaviour of fattening pigs kept in a semi-natural enclosure and in housing systems of varying environmental complexity, Stolba and Wood-Gush (1981) also reported differences in the sequence of behavioural elements.

Due to the condition of housing, some normal behaviour patterns may not occur at all. For example, animal production systems typically house animals in groups restricted to specific age categories, thus preventing social interactions that would occur if the animals were kept in naturally composed groups. Piglets housed in weaner groups are all about the same age, and laying hens kept in larger groups typically all hatched on the same day. Moreover, laying-hen chicks and calves in dairy production are reared separately from their mothers, thus preventing maternal behaviour. Most social behaviour is also missing if sows or calves are kept individually in crates or if dairy cows are housed in tie stalls. Finally, sows in farrowing crates are prevented from leaving the nest site before defaecation, and hens in battery cages cannot perform perching and nest-site selection behaviour.

Developments in production systems may also lead to housing conditions in which the animals behave in unnatural ways, in patterns that would never occur in nature. For example, sows may be fed via a nipple feeder (Weber *et al* 2002), and cows let down their milk in the absence of a calf, nowadays when visiting automatic milking systems. With laying hens, alternatives to cage housing systems are run with large groups, resulting in social behaviour not seen in the wild (D'Eath & Keeling 2003).

Finally, it is usual for farm animals to show behaviour that is normal in form, but elicited by artificial structures within their housing system. Calves drink milk from buckets or artificial teats, pigs are offered chains to perform investigative behaviour, and the nest boxes used in aviary systems are quite different from the nest sites chosen by feral hens.

How are alterations in normal behaviour linked to animal welfare?

In view of these possible changes in normal behaviour, it is necessary to assess, for each farm animal species and housing system, whether animal welfare is at risk in any way if the behaviour observed differs from that which would occur in a natural environment. In some cases the question can be answered by taking a theoretical evolutionary approach. Separating the calf from the cow immediately after birth, for example, may not result in impaired welfare for the cow, as stillbirths occur in nature and the behavioural organisation of cows is probably adapted to this situation. In fact, the response of a cow to being separated from the calf is markedly less pronounced if separation occurs soon after birth (Lidfors 1996; Flower & Weary 2001). Similarly, the inability of fattening pigs to wallow in pens with fully slatted floors at high temperatures is not likely to affect their welfare if their body temperature is lowered by means of sprinkling with water (Götz & Rist 1984). With both examples, however, it is not possible to state without any doubt that welfare is not at risk, and it is necessary to do further investigations if there are indications that welfare problems do exist.

In most cases, however, detailed knowledge about the behavioural organisation of the animals is necessary to judge whether alterations in normal behaviour affect their welfare. Such knowledge is built up from animal motivation studies and investigations into the effect of environmental structures on animal behaviour. For example, Arey (1992) showed by means of operant condition technique that sows are highly motivated to work for access to straw on the day before farrowing, when straw is used to build a nest. When provided with straw, the performance of nest-building behaviour itself seems to be important for the sows, as they continue to exhibit this behaviour even if offered preformed nests (Arey *et al* 1991). Similarly, the nest-building behaviour of laying hens is not inhibited by the existence of preformed nests (Hughes *et al* 1989), and they work harder for access to a nest box as oviposition approaches (Cooper & Appleby 2003). Motivation studies with laying hens have also revealed that they work for access to a perch (Olsson & Keeling 2002), or to litter in order to dustbathe (Widowski & Duncan 2000). Their motivation to exhibit dustbathing behaviour increases along with deprivation time (Vestergaard 1982; Vestergaard *et al* 1999), and sham-dustbathing on a wire-floor does not satisfy dustbathing motivation (Olsson *et al* 2002). Finally, calves fed milk from a bucket readily suck on an artificial dry rubber teat during the first 10 min following a milk meal, indicating that the ingestion of milk itself does not reduce sucking motivation (de Passillé 2001).

The results of these studies into the behavioural organisation of farm animals suggest that the alterations in behaviour observed in housing systems lacking specific stimuli to elicit normal behaviour are often related to motivational problems, and hence relevant to animal welfare. This is also true for behaviour labelled as abnormal, as shown by studies into the motivation and development of such behaviour. For example, tail-biting in fattening pigs (Day *et al* 2002) as well as stereotyped bar-biting in sows (Fraser 1975) is strongly related to the absence of straw that would elicit normal foraging behaviour. Similarly, feather pecking in laying hens is inversely related to foraging behaviour (Blokhuis 1986; Huber-Eicher & Wechsler 1998), and nibbling of penmates and objects in fattening bulls is much reduced if they are provided with hay to enhance normal feed-intake behaviour (Graf 1992).

Use of normal behaviour as an indicator in on-farm animal welfare assessments

It takes quite some time to form an accurate judgement about the occurrence of normal behaviour on a given farm, and visits made for on-farm animal welfare assessment

https://doi.org/10.1017/S0962728600031110 Published online by Cambridge University Press

studies usually last no more than a few hours. As a consequence, several measures of animal health and cleanliness are typically included in the animal-based protocols (ie protocols considering measures directed towards the animal) used in such studies, whilst recordings of behaviour are restricted to a few easily observable parameters. In studies of dairy cattle, for instance, only a small number of behavioural measures such as lameness, position of animals when lying in cubicles, and lying-down and standing-up movements are usually recorded (eg Whay *et al* 2003; Regula *et al* 2004; Veissier *et al* 2004). Animal-based protocols may be of limited value, therefore, in judging the occurrence of normal behaviour. Moreover, based on evidence from the literature, the results concerning the behavioural measures selected in these protocols are often quite predictable. For example, Regula *et al* (2004) assessing the welfare of dairy cows kept in cubicle systems or in tie stalls reported that lying space was more restricted for tied cows. Similarly, Cagienard *et al* (2005) found more tail-biting in fattening pigs kept in pens with fully slatted concrete floors than in pens with a straw bedded lying area.

As a consequence of these difficulties with animal-based assessment methods, resource-based protocols (ie protocols focusing on the design and state of the housing system) have been developed as an alternative to animal-based ones (eg Bartussek 1999; Hörning 2000). Such resource-based assessment methods are appropriate, provided that the resource standards used are based on evidence stemming from research into animal behaviour and motivation. For example, provision of straw is a good predictor for the occurrence of abnormal tail-biting in fattening pigs (Day *et al* 2002). Similarly, the effect of cubicle dimensions on lying behaviour in cattle can be inferred from experimental studies (Tucker *et al* 2004; Gygax *et al* 2005). As exemplified by Ofner *et al* (2003), the quality of resource-based protocols can be validated and improved by comparing the animal welfare assessments made on the basis of such protocols with the results of detailed animal behaviour observations made on the same farms.

Conclusions and animal welfare implications

Given that domestication has scarcely changed the behavioural organisation of our farm animal species as shaped by evolution, the occurrence of normal behaviour in housing systems is an important indicator of animal welfare. The behaviour observed in farm animal housing systems may vary in a number of ways from that exhibited in a natural environment, however, and it is not reasonable to assume that such alterations are generally associated with poor animal welfare. Consequently, basic studies into animal motivation and the effects of environmental structures on behaviour are needed to judge departures from normal behaviour occurring in a given housing system.

In principle, animal-based methods are preferable for assessing the welfare of farm animals based on their behaviour. Since such methods are time consuming, however, resource-based methods are often applied in on-farm assessment studies. To adequately assess the occurrence of normal behaviour, the resource standards used in resource-based protocols must be justified by the results of basic studies into animal behaviour and motivation.

References

Arey DS 1992 Straw and food as reinforcers for prepartal sows. *Applied Animal Behaviour Science 33:* 217-226

Arey DS, Petchey AM and Fowler VR 1991 The preparturient behaviour of sows in enriched pens and the effect of preformed nests. *Applied Animal Behaviour Science 31:* 61-68

Bartussek H 1999 A review of the animal needs index (ANI) for the assessment of animals' well-being in the housing systems for Austrian proprietary products and legislation. *Livestock Production Science 61:* 179-192

Blokhuis HJ 1986 Feather-pecking in poultry: Its relation with ground-pecking. *Applied Animal Behaviour Science 16:* 63-67

Cagienard A, Regula G and Danuser J 2005 The impact of different housing systems on health and welfare of grower and finisher pigs in Switzerland. *Preventive Veterinary Medicine 68:* 49-61

Cooper JJ and Appleby MC 2003 The value of environmental resources to domestic hens: a comparison of the work-rate for food and for nests as a function of time. *Animal Welfare 12:* 39-52

Day JEL, Burfoot A, Docking CM, Whittaker X, Spoolder HAM and Edwards SA 2002 The effects of prior experience of straw and the level of straw provision on the behaviour of growing pigs. *Applied Animal Behaviour Science 76:* 189-202

de Passillé AM 2001 Sucking motivation and related problems in calves. *Applied Animal Behaviour Science 72:* 175-187

D'Eath RB and Keeling LJ 2003 Social discrimination and aggression by laying hens in large groups: from peck orders to social tolerance. *Applied Animal Behaviour Science 84:* 197-212

Duncan IJH, Savory CJ and Wood-Gush DGM 1978 Observations on the reproductive behaviour of domestic fowl in the wild. *Applied Animal Ethology 4:* 29-42

Flower FC and Weary DM 2001 Effects of early separation on the dairy cow and calf: 2. Separation at 1 day and 2 weeks after birth. *Applied Animal Behaviour Science 70:* 275-284

Fraser D 1975 The effect of straw on the behaviour of sows in tether stalls. *Animal Production 21:* 59-68

Fraser D, Weary DM, Pajor EA and Milligan BN 1997 A scientific conception of animal welfare that reflects ethical concerns. *Animal Welfare 6:* 187-205

Götz M and Rist M 1984 Possibilities to avoid heat-stress in pigs. In: Unshelm J, van Putten G and Zeeb K (eds) *Proceedings of the International Congress on Applied Ethology in Farm Animals* pp 209-213. KTBL: Darmstadt, Germany

Graf B 1992 Orale Ersatzaktivitäten bei Mastbullen – Auftreten, Ontogenese und Ursachen. *KTBL-Schrift 351* pp 37-48. KTBL: Darmstadt, Germany. [Title translation: Oral substitute activities in fattening bulls – occurrence, ontogeny and causation]

Gygax L, Schulze Westerath H, Kuhlicke J, Wechsler B and Mayer C 2005 Assessing cubicle dimensions for finishing bulls based on animal behaviour and cleanliness. *Animal Science 81:* 423-430

Hörning B 2000 Scoring systems to assess housing conditions of farm animals – examples from dairy cows and laying hens. In: Blokhuis HJ, Ekkel ED and Wechsler B (eds) *Improving health and welfare in animal production. EAAP publication No. 102* pp 89-97. Wageningen Pers: Wageningen, The Netherlands

Huber-Eicher B and Wechsler B 1998 The effect of quality and availability of foraging materials on feather pecking in laying hen chicks. *Animal Behaviour 55:* 861-873

https://doi.org/10.1017/S0962728600031110 Published online by Cambridge University Press

Hughes BO, Duncan IJH and Brown MF 1989 The performance of nest building by domestic hens: is it more important than the construction of a nest? *Animal Behaviour 37:* 210-214

Jensen P 1986 Observations on the maternal behaviour of free-ranging domestic pigs. *Applied Animal Behaviour Science 16:* 131-142

Lidfors LM 1996 Behavioural effects of separating the dairy calf immediately or 4 days post-partum. *Applied Animal Behaviour Science 49:* 269-283

Mayer C, Schulze Westerath H, Thio T, Ossent P, Gygax L, Friedli K and Wechsler B 2005 Spaltenböden mit Gummiauflage für Mastbullen: Auswirkungen auf das Liegeverhalten und Veränderungen am Integument und an den Klauen. *KTBL-Schrift 437* pp 33-41. KTBL: Darmstadt, Germany. [Title translation: Concrete slats with rubber top-layer for fattening bulls: effects on the lying behaviour and lesions on the integument and claws]

Müller-Fickenwirth A and Fölsch DW 1988 Dustbathing of hens - Sequence analysis indicates normal behaviour and welfare. In: Unshelm J, van Putten G, Zeeb K and Ekesbo I (eds) *Proceedings of the International Congress on Applied Ethology in Farm Animals* pp 143-144. KTBL: Darmstadt, Germany

Ofner E, Amon T, Lins M and Ofner B 2003 Correlations between the results of animal welfare assessments by the TGI 35 L Austrian Animal Need Index and health and behavioural parameters of cattle. *Animal Welfare 12:* 571-578

Olsson IAS and Keeling LJ 2002 The push-door for measuring motivation in hens: laying hens are motivated to perch at night. *Animal Welfare 11:* 11-19

Olsson IAS, Keeling LJ and Duncan IJH 2002 Why do hens sham dustbathe when they have litter? *Applied Animal Behaviour Science 76:* 53-64

Regula G, Danuser J, Spycher B and Wechsler B 2004 Health and welfare of dairy cows in different husbandry systems in Switzerland. *Preventive Veterinary Medicine 66:* 247-264

Stolba A and Wood-Gush DGM 1981 Verhaltensgliederung und Reaktion auf Neureize als ethologische Kriterien zur Beurteilung von Haltungsbedingungen bei Hausschweinen. *KTBL-Schrift 264* pp 110-128. KTBL: Darmstadt, Germany. [Title translation: Sequential patterns in behaviour and responses to a novel object as indicators of animal welfare in pig housing systems]

Stolba A and Wood-Gush DGM 1989 The behaviour of pigs in a semi-natural environment. *Animal Production 48:* 419-425

Tucker CB, Weary DM and Fraser D 2004 Free-stall dimensions: effects on preference and stall usage. *Journal of Dairy Science 87:* 1208-1216

Veissier I, Capdeville J and Delval E 2004 Cubicle housing for cattle: comfort of dairy cows depends on cubicle adjustment. *Journal of Animal Science 82:* 3321-3337

Vestergaard K 1982 Dust-bathing in the domestic fowl - diurnal rhythm and dust deprivation. *Applied Animal Ethology 8:* 487-495

Vestergaard KS, Damm BI, Abbott UK and Bildsoe M 1999 Regulation of dustbathing in feathered and featherless domestic chicks: the Lorenzian model revisited. *Animal Behaviour 58:* 1017-1025

Weber R, Ibscher A and Stauffacher M 2002 Aggressionsverhalten und tageszeitliche Verteilung der Futteraufnahme von Zuchtsauen am Breinuckel. *KTBL-Schrift 407* pp 28-35. KTBL: Darmstadt, Germany. [Title translation: Aggressive behaviour and daily distribution of feed intake of dry sows at the "Breinuckel" feeding system]

Whay HR, Main DCJ, Green LE and Webster AJF 2003 Assessment of the welfare of dairy cattle using animal-based measurements: direct observations and investigation of farm records. *The Veterinary Record 153:* 197-202

Widowski TM and Duncan IJH 2000 Working for a dustbath: are hens increasing pleasure rather than reducing suffering? *Applied Animal Behaviour Science 68:* 39-53

https://doi.org/10.1017/S0962728600031110 Published online by Cambridge University Press