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How well do farm animals cope with their environment during transport?

D M Broom

Department of Clinical Veterinary Medicine
University of Cambridge
Madingley Road
CAMBRIDGE
CB3 OES
U K

Abstract

The welfare of animals during handling and transport can be assessed using a wide variety of measures which are described. These measures provide information about how much difficulty the animal has when trying to cope with the transport environment and about the extent to which an individual animal fails to cope. Management and housing prior to transport can have a considerable effect on welfare during transport. The effects of management and vehicle conditions on animals are described. The importance of proper training for staff involved in animal transport is emphasised and other conclusions are listed.

Introduction

The environment in which farm animals find themselves when they are removed from their housing conditions, moved to a lorry, train, ship or aeroplane, then loaded and transported, is often difficult for them. They may: mix with strange conspecifics; come into close contact with frightening people; receive painful stimulation; have to move up or down slopes; have to enter dark or otherwise disturbing places; be forced to crowd closer together than they would wish; be unable to lie down to rest or carry out normal behaviour such as grooming or ruminating; experience extremes of temperature, humidity and noise; experience accelerations or regular motion which is unpleasant; and be deprived of food and water because it is unavailable or because they are too sick or frightened to get it.

The welfare of an animal is its state as regards its attempts to cope with its environment (Broom 1986). This state includes the feelings of the animal and various aspects of it can be measured (Broom 1988, 1991, Broom and Johnson 1993). Welfare can vary from very good to very poor according to the difficulty which the individual has when trying to cope with its environment and the extent of positive responses to the environment or of failure to cope. Since there are many ways of coping and many indicators of how good or poor welfare is, it is important that a range of measurements be used when welfare is being assessed. Some of these methods of measurement are described in the next part of this paper but for a more detailed account see Broom and Johnson (1993). The final part of the paper is a review of some of the problems which arise during transport and a series of recommendations about what should be done to improve welfare during transport.

Welfare measures relevant to farm animal transport

1. Behavioural responses and tests

Behaviour changes which are part of an emergency response are particularly useful as indicators that the animal has encountered a problem. When a pig reaches a dark area in a raceway or when cattle are confronted with sharp shadows or an open sided race, they often stop moving and freeze (Grandin 1980,1982). If animals are disturbed by a noise or other stimulus they may show a sudden escape response, running and hitting walls or other animals. Both of these behavioural responses give information about the difficulty experienced by the animal as a result of environmental conditions.

Behavioural responses can also give some information about severe effects of physical conditions on animals. For example, panting may occur or it may be evident that the animal has difficulty when it walks or tries to stand or lie, However, there are many situations where the effects on the animal are extreme but no behavioural response is seen. Some species, e.g. sheep, may be in severe pain but show no behavioural response. These behavioural responses give information about the extent of an animal's problems with its environment but absence of such responses

does not mean that there is no problem. This point also applies to all other measures of poor welfare.

The extent to which normal behaviour is shown provides information about the state of an animal. In a recent study of sheep transport (Hall and Broom in prep), sheep travelled for 16 hours in a lorry, which stopped several times, before rumination was observed. These animals would have ruminated much earlier if they had not been transported so the delay before necessary normal behaviour is shown is an indicator of the magnitude of the effect on the animals.

Aggressive behaviour is often shown when animals encounter unfamiliar individuals. Butting in cattle or sheep, pecking at the head region in poultry, biting at the flanks and neck in pigs, and biting or kicking in horses are all clear signs of aggression. The behaviour indicates that the individual which shows the behaviour has some degree of problem and it often results in problems for the individual to whom the action is addressed.

Tests of behavioural aversion can provide useful information about treatments which result in poor welfare. When animals are hurt or frightened in a place they may remember this and refuse to go back to that place. The effort which they make to try to avoid returning to the place can measured and used in assessing the extent of aversion which the animal feels and hence the degree of unpleasantness of the event which has triggered the aversion. Rushen (1986 a, b) drove sheep down a race to a place where they were either gently handled, or subjected to shearing, or electro-immobilised. When taken back to the race, those handled gently went down the race more rapidly on the second occasion. After shearing, however, the animals were harder to drive down the race and after electro-immobilisation they were very reluctant to go down the race. Such experimental procedures could be used to assess the likely effects on welfare of many aspects of transport procedures.

2. Physiological measures

There are very many physiological measures which can indicate the extent to which an animal has difficulty in coping with adversity. Some of these measures will be mentioned here, the first being heart rate. When pigs were driven using an electric prodder, their heart rate increased by a factor of 1.5 and when they had to climb a steep ramp the heart rate was 1.7 times higher than when standing beforehand (van Putten and Elshof 1978). Steeper ramps caused greater increases up to a maximum level (van Putten 1982). Some of the change in heart rate is a consequence of increased activity but heart rate can increase during disturbing events in the absence of increased physical activity. In a study of the effects of various handling procedures on sheep, Baldock and Sibly 1990 obtained basal levels of heart rate for various levels of activity and then took account of these when calculating responses to: approach of a strange human, isolation, standing on a trailer, brief transport, etc (Table 1). In these regularly handled sheep visual isolation and social mixing were more disturbing then transport. It is clear from these and many other studies that records of heart rate, if interpreted carefully, can

provide much useful information about welfare during transport procedures.

Body temperature increases in animals which are severely disturbed more than in animals which are less disturbed. Such disturbance may be separation of an infant from its mother (Reite et al 1981), defeat in a fight (von Holst 1988) or transport (Trunkfield et al 1991). The measurement of rectal temperature after transport is relatively easy and the measurement of body temperature during journeys is becoming easier during experimental studies.

Adrenal cortex responses occur in non-stressful situations such as during courtship and food catching but such responses are readily distinguished by context from emergency responses in difficult situations. The response lasts for 2 - 30 minutes, or possibly somewhat longer, so measurement must be made soon after the treatment. Examples of studies in which such measurements were useful include the higher levels of cortisol or corticosterone seen after: transport of broiler chickens (Freeman et al 1984), carrying hens roughly upside down as compared with head upwards (Broom et al 1986), and transporting calves rather than leaving them without food for the same period (Kent and Ewbank 1986). The glucocorticoids can be measured in saliva or in plasma, and together with their metabolites, in urine.

Enzymes levels can vary in blood according to degree of injury, exercise or mental disturbance. Creative kinase levels reflect injury and exercise. Lactate dehydrogenase (LDH) in blood also increases after muscle damage but LDH isoenzyme 5 leaks from striated muscle into blood during rough handling even without any tissue damage. Mormède et al (1982) and Trunkfield (1990) reported higher levels of LDH5 in cattle after transport. Recently captured park deer had high levels of LDH5 for some hours after capture (Jones and Price 1990) even when they had been lying quietly with their heads covered for almost all of the time since capture.

3. Mortality, injury and carcass characteristics

If many animals are dead on arrival at a slaughterhouse, the welfare of these and others travelling with them must have been very poor at some point or for some periods during the journey. The worst journeys can be readily recognised by means of this measure. Most farm animals are very resilient so even a very low level of mortality indicates severe problems for the animals. Recent estimates of the numbers of broilers and laying hens dead on arrival at UK slaughterhouses are 0.4% and 0.5% respectively (Knowles and Broom 1990 b). The incidence of pig deaths during journeys was as high as 0.7% 25 years ago in the Netherlands but it is now one tenth of this.

Bone breakage is a severe injury which can occur during a journey. It is especially prevalent in laying hens. Gregory and Wilkins (1989) found that 29% of end of lay hens from battery cages had at least one broken bone by the time that they reached the stunner. The incidence was about 10% in hens from percheries or free range (Gregory et al 1990). Lack of

exercise in battery cages is a major cause of bone weakness (Knowles and Broom 1990 a). The detection of broken bones in poultry is often not easy but such a painful injury is clearly an important indication of poor welfare as well as being expensive for the meat industry. Where carcasses are examined after slaughter, bruising is readily assessed. Bruising and scratches result in economic losses and clearly show that welfare before slaughter was poor (Guise 1991).

Another important cost for the meat industry is the downgrading of dark firm dry (DFD) and pale soft exudative (PSE) meat. Each of these kinds of meat condition is also relevant to the welfare of the animals before slaughter. The circumstances in which DFD meat occurs in cattle involve fighting, threat or mounting (Kenny and Tarrant 1987b, Tarrant and Grandin 1993). Hence any occurrence of DFD meat indicate that there is a welfare problem. The frequency of occurrence of PSE meat is much greater in some genetic strains of pigs than in others but the condition only arises when the animals are subjected to some overtaxing of physiological control systems. Hence a given level of PSE does not mean the same in different breeds but it does mean that the individuals which show it are considerably affected by the conditions so it is an indicator of poor welfare.

Effects of previous housing and management on welfare during transport

Farm animals do not react in an uniform, automatic way to the situations which they encounter during handling and transport.

A horse which is taken frequently to a race track or a show jumping area and which is, as a consequence, familiar with the loading procedure and the vehicle in which it travels, is much less affected by the whole sequence of events during transport than a similar horse which has never before experienced such situations. Most farm animals, however, experience transport only once or twice during their lives so the effects on them are much greater than would be expected by the average person, who travels frequently.

One of the most extreme problems during transport for some farm animals is that they have to come into close proximity to humans. The typical broiler chicken is not handled, except perhaps when it is one or two days old, and never comes very close to humans. The hen which lives for a year in a battery cage is normally able to maintain a distance of one or two metres from humans. A pig which has grown to 100 kg weight may not have been touched by a human since it was a very young piglet and, like the chickens, may have been able to maintain a critical, important, minimal distance from humans. As a result of the lack of direct, friendly human contact which most farm animals receive, there can be a considerable shock when much closer contact occurs prior to transport or slaughter, even if the contact does not result in any pain for the animal. When Hemsworth et al (1986, 1987) spent a short time handling young pigs, these were much easier to handle when older and much less disturbed by handling procedures. Similarly, Le Neindre et al (1992) showed that beef cattle which were handled when very young calves, especially, when newly weaned, were much more amenable to

handling at a later age. It is clear that farmers who have to manage animals should take account of such research results and give animals appropriate experience of humans and of some of the situations which they will encounter during the pre-slaughter period.

The actual housing conditions in which farm animals live can have an effect on their responses to transport. As mentioned above, hens in battery cages which do not get enough exercise have weaker bones than those which can walk about and flap their wings (Knowles and Broom 1990 a, Norgaard-Nielsen 1990). Pigs can also be affected in this way; Marchant and Broom (in press) have found that sows which have lived all of their life in stalls have considerably weaker bones than sows from a group-housing system. The consequences for the hens are more severe than those for the sows as a very much higher proportion of hens have bones broken during handling and transport procedures before slaughter (Gregory and Wilkins 1989). A further example of the way in which the extent of the responses of animals to transport depends on previous housing conditions in the work of Trunkfield (1990), Trunkfield et al (1991) on calves. Calves reared in crates had higher cortisol levels (Fig 1), higher body temperature, and an increased proportion of LDH5 after handling and transport than calves reared in groups. Many of the calves in crates had obvious walking difficulties but they also had to contend with social contact in a new and disturbing situation. Trunkfield (1990) has also shown that those calves which were of high rank in the home pen were less disturbed, in that they had lower cortisol levels after transport, than calves of low rank. All of these results emphasise the importance of considering the necessity for handling and transport in the future life of an animal when its conditions of housing and management are being decided.

Effects of management when animals are transported

The evidence for adverse effects on beef cattle and pigs when animals which have come from different pens or fields are mixed together, is very clear. Kenny and Tarrant (1987 a, b, c) found that mixing bulls or steers from different social groups increased the incidence of fighting, superficial carcass damage and DFD meat. Similarly, Guise and Penny (1989 a, b) found that skin damage and meat quality were affected when pigs from different pens were mixed prior to transport or at lairage. There was an increase of 7.2% in skin blemishes of the kind which result in carcass down-grading so there must be a substantial effect on the welfare of the animals. In order to improve welfare and to minimise carcass damage, the mixing of cattle and sheep from different pens should be avoided.

The way in which the animals are treated during loading and unloading prior to slaughter is of great importance. The cost to the animals and to those who wish to market the meat is very large. Animals should not be frightened, or abused, or forced to climb steep ramps, or left in unfavourable conditions. The design of the loading and unloading facilities is also of great importance. No animal should be required to climb a ramp steeper than 15° and all ramps should be non-slippery. Farms which frequently transport animals and all slaughterhouses should

have fixed ramps to which vehicles can easily dock or appropriate floor lifting systems. Vehicles with a hydraulically operated tail gate or floor should be used whenever possible. The advantages of following these recommendations are very large in financial terms as well as being desirable for improving animal welfare.

Vehicle conditions and journey management

Extreme physical conditions for animals on road vehicles, or to a lesser extent on other means of transport result in poor welfare and, sometimes, in high mortality. The following pointsapply to all journeys or or to all but the shortest journeys. Stocking density should be such that animals can lie down. The floor should be non-slippery and comfortable for animals to lie on. Bedding should be provided if this adds to the comfort of the animals. Ventilation should be sufficient during movement and during periods when the vehicle is stationary. This is achieved by having adjustable side panels, vents in the front of the vehicle or trailer and sufficient room over the animals' heads. If the vehicle is stationary in hot conditions, auxiliary fans may be needed. Vehicles should have no projections which could injure animals. For cold conditions, adequate screens or insulation are necessary. In some cases, vehicles should have means for the provision of food and water on the vehicle although for some species it is necessary that the animals be unloaded. Animals must not be allowed to become dehydrated or glycogen depleted. Animals must be able to recuperate adequately if they have been disturbed by transport for some hours. These last points require that there be a maximum journey time.

Care of animals during transport and training of transport staff

The points mentioned above about journey time are also relevant to the care of animals during transport. A plan for transport which is adhered to is needed and drivers of vehicles should not be encouraged to act in any way which results in the welfare becoming poor. Managing animals during transport requires training. Drivers of transport vehicles need to be much more careful to avoid sudden braking or great lateral movement of the vehicle than drivers of vehicles carrying human passengers. A human who is sitting or standing but holding on to a bar or strap is much better able to avoid being thrown around than a four legged animal which is standing. Sheep, cattle or pigs which are standing are readily thrown against one another when road vehicles go around corners or aircraft take off. This fact is largely ignored by many of those who drive animal vehicles.

People who load animals on to vehicles and who inspect animals during journeys need training to do this. No person should be allowed to do this job unless properly trained. It should be illegal to employ people to drive animal transporters who have not received training, or who are not registered as in the process of training.

In order to maximise the chances that those who are in charge of animals during transport will act in such a way that the welfare of the animals will be good, those people should receive a financial incentive to treat the

animals well. this will not only improve animal welfare but will increase the value of the meat by reducing the frequency of carcass downgrading.

Conclusions

1. Consider handling and transport when designing housing conditions.
2. Give animals experience of human contact to make handling easier later.
3. Avoid social mixing.
4. Handle carefully, avoid painful or damaging methods of moving animals.
5. Provide good loading facilities.
6. Keep stocking density from being too high.
7. Improve vehicle design.
8. Train the people who will be responsible for the animals.
9. Give these people a financial incentive to improve animal welfare and carcass quality.
10. Limit the length of journeys.

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Table 1 Sheep heart rate responses (bpm) (from Baldock and Sibly. 1990) .

Treatment	Change in heart rate (taking account of activity)
Spatial isolation	0
Standing in stationary trailer	0
Visual isolation	+20
Introduction to new flock (0-30min)	+30
Introduction to new flock (30-120 min)	+14
Transport	+14
Approach of man	+45
Approach of man with dog	+79

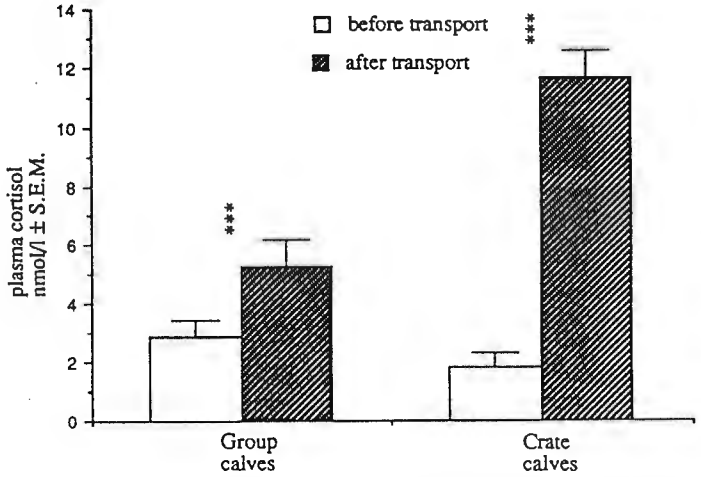

Fig. 1 Mean plasma cortisol levels both before and after handling & transport
Group-reared calves v crate-reared calves