108. Broom, D.M. 1990. The assessment of pain and welfare in sheep. *Proc. Sheep vet. Soc.*, 13, 41-45.

THE ASSESSMENT OF PAIN AND WELFARE IN SHEEP

by

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Discussions about sheep welfare and how to improve it are of greater value if measurements of welfare can be obtained. *The welfare of an individual is defined as its state as regards its attempts to cope with its environment* (Broom 1988). When conditions are difficult, individuals use a variety of physiological and behavioural methods to try to cope with the difficulties. Sometimes they fail to cope and there are long-term adverse effects on that individual. In other circumstances they succeed in coping, in that they do not die or fail to grow and reproduce. In either case, however, the extent of their attempts to cope can be measured. Welfare varies on a continuum from very good to very poor and is a characteristic of the animal rather than anything which is imposed or given by man. The measurement of welfare is independent of any moral considerations but, once such information is available, moral judgement is needed about what is acceptable.

When is sheep welfare poor? The major welfare problem in the United Kingdom is lameness, especially that due to foot-rot. This and certain other diseases are long-term problems which will have acute components as well. The same is true of housing in cramped conditions. There has been little work on most long-term welfare problems of sheep, although the situations which lead to wool-pulling and various stereotyped behaviours have been documented (Fraser & Broom, 1990). Short-term welfare problems will be considered in this paper because there is some recent scientific evidence about them. How poor is the welfare when the following occur?

1. Operations and treatment such as vaccination, drenching, shearing, ear-notching, tail-docking, castration, mulesing, tooth-grinding and electro-immobilisation.

2. Handling and transport including moving animals, grouping, isolating, driving, use of a dog, loading, transporting in a vehicle.

3. Accidents and injuries.

4. Dog worrying or other predation.

One form of poor welfare is suffering pain. *Pain is a sensation which is itself extremely aversive.* The pain may be very brief and constitute a trivial welfare problem, or it may be intense, long-lasting or frequent, in which cases it is difficult to cope with so the welfare is poor. In every case it is desirable to determine how poor the welfare is. For discussions of pain assessment see Morton & Griffiths (1985) and Sandford et al (1986).

The response to pain may be behavioural or may involve adrenal action or may be the production of analgesic peptides in the brain. In many situations each of these can occur but there is variation amongst species and amongst individuals in the nature of the response. The sheep has the same sort of pain receptors and pain pathways as have other mammals, including man. Yet while some mammals, e.g. castrated piglets show obvious behavioural responses to pain, including vigorous movements and loud vocalisations, sheep show much reduced behavioural responses. After a large area of skin is cut from the anal region during mulesing, sheep often show little behavioural response. It could be that those sheep which showed large behavioural responses after severe injury were less likely to survive predator attack so there has been selection against such responses. In species such as man, dog or pig where members of the social group might come to the aid of an individual crying out in pain, there would have been selection for such a response. In the assessment of pain we must look at all possible responses and not conclude that pain is not felt if one of these responses is not shown.

Studies by Shutt et al (1987) of all surgical procedures on lambs which are routine on Australian farms have provided evidence of the magnitude of the physiological response. The procedures of tail-docking (T), castration (C), and mulesing (M) were carried out surgically without anaesthetic on 3-5 week old Border-Leicester X Merino lambs. Blood samples were taken 15 minutes after the operation and 15 minutes after similar handling in controls.

As shown in Table 1, plasma cortisol concentrations increased by an amount which was related to the severity of the operation.

Treatment	Cortisol nmol/l	β-endorphin pg/ml
Control	87	83
Tail-dock (T)	136	266
Castrate (C) + T	171	797
Mulese (M) + T	187	707
M + C + T	232	680

Table 1 Postoperative concentrations of plasma cortisol and β-endorphin in lambs

(After Shutt et al, 1987)

Significant increases in cortisol occurred after all operations and significant increases in plasma β-endorphin occurred after all but tail-docking. Although β-endorphin has an analgesic effect in the brain it is likely that it is acting more as an information carrier, as ACTH does, in this situation. The increased level of β-endorphin persisted for c.60 minutes. It was of particular interest that lambs which had been mulesed still had doubled cortisol concentrations 24 hours after the operation. The results of this study show that measurement of activity in the hypothalamic-pituitary-adrenal axis provides useful indicators of poor welfare and probably of pain. Pearson and Mellor reported that adrenal changes occurred in anaesthetised sheep during an operation but they also noted a further peak when the sheep recovered from the anaesthetic.

Another measure of poor welfare in the short-term is heart rate. In a study of the effects of various sorts of farm handling on sheep, Baldock & Sibly (1985) used a sophisticated measure of heart rate which took account of activity. Heart rate increases as activity increases but there are also changes in heart rate which animals bring about because they recognise a problem or predict that there will be a problem. Baldock and Sibly found base-line heart rates in individual sheep for various activity levels and then calculated responses to the imposed situations taking account of these base-line rates. Table 2 shows that visual isolation and introduction to a new flock were more disturbing, in those frequently handled sheep, than being transported on a trailer. The approach of a man with a dog was much more disturbing.

Treatment	Net heart rate change
Standing in stationary trailer	0
Spatial isolation	0
Visual isolation	+ 20
Introduction to new flock 0-30 min	+ 30
Introduction to new flock 30-90 min	+ 14
Transport, trailer on road	+ 14
Approach of man with sheep dog	+ 84

Table 2 Heart rate responses, taking account of activity, of sheep during farm handling procedures

(data from Baldock & Sibly)

An attempt has been made by Fell and Shutt to compare farm operations and other handling procedures in severity for the sheep, based on plasma cortisol concentrations. Their conclusions were that mulesing had the greatest effect, followed in order of decreasing effect by castration, tail-docking, rough transport, tooth-grinding, driving with dogs, driving without dogs and mating. It should be emphasised, however, that a battery of measures, rather than a single measure, is needed in welfare assessment because there is variation in coping responses amongst individuals and amongst situations (Broom, 1988).

Other studies of farm operations have included measures of behaviour as well as physiological assays of blood plasma hormones. Shutt et al (1988) and Mellor & Murray (in press) have looked at the use of rubber rings for castration and tail-docking. Mellor and Murray found that lambs of 0-60 days old which had a rubber ring put on the tail showed kicking, stamping, tail-wagging and some bleating for about 30 minutes and had a plasma cortisol concentration of about 15 ng/ml after 30 minutes. Lambs with a rubber ring put on the scrotum showed a greater behavioural response for about twice as long which included standing up, lying down, lying on the side, kicking, rolling and occasional bleating. The plasma cortisol was 42ng/ml by 30 minutes and this response was not very different according to age during days 0-7 (Mellor & Murray, in press). Shutt et al (1988) reported the same very large behavioural response lasting up to 60 minutes, to putting the rubber ring on the scrotum. The behaviour response during and after surgical castration was much less extreme but posture when standing or walking was altered. The behaviour was not described in great detail. Plasma cortisol concentrations 15 minutes post-operative were significantly increased after rubber ring application and after surgical castration but the latter increase was greater. It is of interest that plasma β-endorphin did not increase significantly either 15 minutes or 24 hours after rubber ring application but there was a substantial increase after surgical castration. The authors interpret this result as meaning that there is an opiate analgesic effect after surgery but not after rubber ring application but it is not clear how plasma β-endorphin would have any analgesic effect or necessarily reflect what is happening to the μ receptors in the brain. However, it is quite clear that welfare is poor, perhaps very poor indeed, after the application of a rubber ring for castration purposes. The behavioural evidence is very convincing in this respect, as it is in studies of the effects of electro-immobilisation on sheep. Rushen (1986) assessed the ease of driving sheep down a race after various sorts of previous experience at the end of this race. Whereas sheep which had no unpleasant experience at the end of the race were easier to drive down the race on subsequent occasions, those which experienced rough handling or injury were difficult to drive down the race again. Those subjected to electro-immobilisation were the most reluctant to go down the race again, suggesting that this experience is extremely aversive to sheep.

Questions about sheep welfare can be answered by proper scientific study of the effects of operations, procedures and situations on the animal. A combination of measures including those of behaviour, heart rate, plasma cortisol and other plasma hormones is desirable if welfare is to be assessed and farm practice modified accordingly.

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