Small Ruminant Research 92 (2010) 52–56

Contents lists available at ScienceDirect

Small Ruminant Research

journal homepage: www.elsevier.com/locate/smallrumres

# Diagnostic significance of behaviour changes of sheep: A selected review☆

D.A. Gougoulis*, I. Kyriazakis, G.C. Fthenakis

*Veterinary Faculty, University of Thessaly, 43100 Karditsa, Greece*

ARTICLE INFO

*Article history:*
Available online 4 May 2010

*Keywords:*
Sheep
Diagnosis
Behaviour
Welfare
Lameness
Neurological signs
Appetite
Parasitic infection

ABSTRACT

Sheep welfare is the combination of subjective and objective (qualitative and quantitative) aspects of the conditions of life of animals, including health and disease, behaviour, husbandry and management; thus, it is a complex and abstract construct. The scientific approach to the problems of assessing suffering in sheep has to be evidence-based. Different approaches contribute to an assessment of animal suffering, such as measurements of physical damage to the animal, measurement of the animals' preferences and considerations of the conditions to which the animal is adapted in its normal social structure. Selected literature on the behavioural alterations of sheep, which indicate internal or external distressing procedures, is reviewed in this paper. There is a need for further research to identify indicators of distress in sheep, but in the meantime it would be reasonable to make the judgement that, in some circumstances, sheep observed vocalising, panting, showing markedly increased locomotory activity and/or changes in feeding or social patterns could be experiencing distress.



## 1. Introduction

Of all the affective states that animals experience, disease is of special interest. The indication and the complications of a disease are considered to be among the most considerable issues of animal welfare. Likewise, painful and distressed procedures performed on animals are among the most emotive of public concerns regarding animal welfare.

Poor physical health, caused by disease, injury or deformity, is relatively straightforward to recognise and can often be quantified, for example, by scoring how well an animal is walking or the size of lesions on its body (Dawkins, 2006). Disease reduces welfare status to the individual animal, the group of animal or the whole flock. Sheep are capable of not only feeling pain, but also of learning and displaying emotion and memory (Roger, 2008). Other, less obvious measures of decreased health, such as depressed immune function (Irwin, 1999) or reduced food intake (Dallman, 2001), have been reported in cases of reduced welfare. These can often give an indication that all are not well with the animal/group/flock, before clinical symptoms become obvious. In more advanced studies, to investigate the mental health state of an animal, one can use both physiology and behaviour.

Physiological measures of welfare that have been used so far, are the autonomic responses of the animals, such as increased heart rate, or increased levels of various hormones, e.g., corticosteroids (Korte, 2001). Behaviour has the advantage that it can be studied non-invasively and can give a direct insight into the view of the situation from the perspective of an animal. The answer to the, apparently simple, question: 'Does the animal have what it wants?' is the key to whether the animal is being treated in ways it dislikes (e.g., pain that it wants to avoid) and to whether the animal is deprived (i.e., it wants something it does not have) (Dawkins, 2004).

☆ This paper is part of the special issue entitled: Sheep diagnostic medicine, Guest-edited by G.C. Fthenakis, P.G. Gouletsou, V.S. Mavrogianni and I.A. Fragkou.

* Corresponding author.
*E-mail address:* dgoug@vet.uth.gr (D.A. Gougoulis).

0921-4488/$ – see front matter © 2010 Elsevier B.V. All rights reserved.
doi:10.1016/j.smallrumres.2010.04.018

We now have several different ways of 'asking' animals what they want and whether they find the situations they are in pleasurable or distressing. However, probing the emotional and behavioural life of sheep is one of the most difficult challenges that science is facing. This requires to comprehend the literature in sheep behaviour and distress (Rutherford, 2002) and to work through the key concepts for assessing behaviours during pathological conditions (Weary et al., 2006).

## 2. Diagnostic approach of behavioural alterations

The term 'distress' usually describes situations, in which sheep are likely to be suffering and show abnormal behaviours, i.e., they indicate that suffering (Ewbank, 1985). In reality, any agent that threatens an animal's welfare can lead to distress. Infections and acute environmental changes are potential threats for health and can induce distress in sheep.

As sheep are relatively stoical creatures, they do not always display obvious signs of distress and pain; alternatively, human observers do not have the ability or the skills to identify these indicators. In the wild, as animals can be preyed upon by predators, in evolutionary terms, it is possible that lack of signs of pain can be advantageous to sheep, as they would not become predator targets. Therefore, methods to assess welfare and pain in farm animals, objectively, are required (Fitzpatrick et al., 2006).

Research on assessment of distress in sheep has used one of the three approaches: (a) measures of general body functioning (e.g., feed or water intake/preference or weight gain), (b) measures of physiological responses (e.g., plasma cortisol concentrations) and (c) measures of behavioural changes (e.g., vocalisation, mobility or socialization). All three approaches have merit and can be useful within different contexts (Weary et al., 2006). The main behavioural responses to a range of stressors that have been identified in other species include increased immobility and increased locomotion, decreased sleeping/resting and increased alertness, decreased eating and drinking and increased vocalisation and elimination (Cockram, 2004).

## 3. Alterations of feeding, grazing and sucking patterns

Alterations of feeding and grazing behaviour are usually indications of inappropriate feeding or of gastrointestinal abnormalities. Feed available to grazing animals particularly during the dry season, can often be of low quality; frequently, it is also available at low densities per unit area. Grazing sheep try to adapt to these adverse conditions, by increasing the time during which they graze each day and also by dispersing more widely. However, the time for which animals can graze, may be limited by solar radiation or fly irritation during the day and by confinement of animals in pens during the night (Manteca and Smith, 1994).

Behaviour may be altered as animals respond to the invasion of their personal field. Reducing space allowance can lead to increase in aggressive interactions and is considered to be highly important for optimum welfare and production. Little is known about the direct effects of space allowance on the grazing behaviour of herbivores, since animal density cannot easily be altered without affecting the vegetation and is almost always confounded with differences in herbage availability (Sibbalda et al., 2000). In flocks raised under intensive husbandry conditions, Meisfjord Jørgensen et al. (2009) have reported that queuing at the feeding trough is a good indicator of increase population density.

A stereotypic change in feeding behaviour can be observed during the early stages of pregnancy toxaemia, when pregnant ewes switch from concentrate feeding to hay feeding, then to straw feeding, which, at terminal stages of the disease, is followed by complete self-starvation (Kronfeld, 1972). Progressive change of behaviour is a useful diagnostic sign of the disease, which on the other hand deteriorates the already energy-lacking situation of the pregnant ewes.

Sheep have a range of behaviours, by which they can reduce the probability of ingesting infective stages of gastrointestinal parasites during grazing. They avoid grazing swards contaminated with faeces and thus parasites; freshly contaminated swards are avoided most strongly, whilst this avoidance declines with time of contamination (Hutchings et al., 1998). If they were forced to graze swards contaminated with faeces, they would reduce the grazing depths, thus the probability of ingesting infective parasitic stages, which concentrate in the lower portions of the sward (Familton and McAnulty, 1997).

Young lambs change their sucking behaviour and reduce the time sucking a mammary gland with subclinical mastitis compared to the healthy gland (Gougoulis et al., 2008). This behavioural modification is a clear indication and can be used to raise a suspicion of presence of subclinical mastitis in a flock, which may be then confirmed by using other diagnostic techniques.

Villalba et al. (2006) showed that sheep learned to associate three illness-inducing substances in feeds, with three compounds known to cause recovery from those illnesses; sheep also showed greater preference for the medicinal compound that specifically attenuated the effect of each illness-inducing substance. Sheep learn to ingest medicines, such as polyethylene glycol, which can attenuate the aversive effects of tannins, when they eat feeds high in tannins; they can also adapt the dose of polyethylene glycol intake, in accord with the amount of tannin in their diet (Provenza et al., 2000). Sheep can discriminate the medicinal benefits of polyethylene glycol from non-medicinal substances, by selectively ingesting polyethylene glycol after eating a meal high in tannins (Villalba and Provenza, 2000). Sheep also choose to forage in areas with polyethylene glycol when offered feeds with a high tannin content. In contrast, time spent at locations with polyethylene glycol decreased, if tannins were not included in their diets (Villalba and Provenza, 2002).

Current evidence for the use of plant secondary metabolites by sheep for self-medication purposes remains equivocal. Plant secondary metabolites have both positive (anti-parasitic) and negative (toxic) effects on sheep. There is strong evidence suggesting that sheep have developed the skills needed to forage by taking advantage of