AN ASSESSMENT OF STRESS CAUSED IN SHEEP BY WATCHING SLAUGHTER OF OTHER SHEEP

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Abstract *Animal Welfare 1996, 5:* 435-441

The question of whether witnessing slaughter of conspecifics is distressing was investigated in sheep. Previously catheterized sheep were allowed to see the stunning and sticking (exsanguination) of other sheep. Heart rate was monitored and serial blood samples were taken to assess stress responses. Although the measurable parameter levels were generally high due to human contact and handling, there were no specific increases in response to witnessing stunning and slaughter. This work failed to produce any evidence to suggest that sheep are distressed by witnessing the slaughter act.

Keywords: *animal welfare, sheep, slaughter, stress*

Introduction

The existing legislation in England and Wales (Ministry of Agriculture, Fisheries and Food 1995) prohibits slaughter (sticking) of red meat animals within sight of others. Although this prohibition is intended to protect the welfare of animals, trying to get stunned animals out of sight of others can often result in signs of recovery being shown prior to, during and following sticking in commercial situations. The problem relates solely to head-only electrical stunning, where the stun is reversible if prompt sticking is not carried out; as so-called head-to-back electrical stunning prevents recovery by inducing cardiac arrest. It has been highlighted by surveys of abattoir practice in sheep (Gregory & Wotton 1984) and more recently for pig electrical stunning and slaughter (Anil & McKinstry 1993). Average stunning-to-sticking intervals were found to be 21s (maximum 46s) and 31s (maximum 120s), in the sheep and pig surveys, respectively. Although there are no specified maximum permissible durations, slaughter animals are required to be stunned without showing signs of recovery until death supervenes. Therefore, stunned animals should be stuck as soon as possible, ideally within 15s as indicated by research (Anil 1991). The main reasons for unduly long stunning-to-sticking intervals were either slow hoist line speeds exacerbated by line design problems causing long journeys to the sticking points; or faults of the personnel operating the system, caused by inadequate care, supervision and education.

The question of whether witnessing killing of conspecifics is stressful has been addressed by other researchers; the most relevant study being by Bracke (1993). Behavioural responses in mice, hens and farmed deer were observed and analysed and Bracke concluded that there was no evidence of distress.

The aim of the following paper was to attempt to address the above question in regard to witnessing slaughter in sheep. A preliminary report of this work has been presented (Anil *et al* 1991).

Materials and methods

After obtaining a special Home Office licence and permission to carry out the procedures, a total of 44 sheep of mixed breeding, weighing between 30 and 60kg, were used. The animals were brought in from the farm to the laboratory the day before slaughter and each one was fitted with an indwelling jugular vein catheter. Polyvinyl catheters were introduced through a 16 gauge needle inserted into a jugular vein following local anaesthesia. The catheters were flushed and filled with heparinized saline (5iu ml^{-1} heparin). On the morning of slaughter they were removed from the pens in pairs. One member of the pair, the slaughter sheep, was kept on the floor for stunning and slaughter, whilst the other sheep (witnessing sheep) was placed in a hammock so that it could watch the other animal being slaughtered (slaughter sheep). The hammock consisted of a canvas top supported by a metal frame. The canvas top had four holes through which the animal's legs were placed so that each animal could lie suspended in the hammock sternally recumbent. The hammock provided comfortable restraint and enabled the sheep to freely move its head and legs.

Two electrocardiogram (ECG) needle electrodes were used for ECG recording. Each electrode was placed subcutaneously, one on the chest and one on the flank. The signal from the electrodes was fed to a Mingograph recorder (Mingograph, Elema-Schönander, Stockholm). The ECG was recorded from the start of the experiment up to the point of sticking in the slaughter sheep and until removal from the hammock in the witnessing sheep. Heart rate was assessed in beats per minute (bpm) from the R peak of the QRS complex. The heart rate was calculated over 80 second intervals so that data were available for the following times: just after the start of the experiment and immediately prior to the stunning of the slaughter sheep (sample 1); during and immediately after stunning of the slaughter sheep (sample 2); during and after sticking of the slaughter sheep (samples 3 and 4); and during stunning and slaughter of the witnessing sheep (samples 5 and 6).

All blood samples were taken simultaneously from both sheep via the jugular catheters, except for those taken from the sticking wound, into heparinized tubes and stored on ice. The sampling procedure is shown in Table 1. The sheep in the hammock, following the slaughter and removal of the slaughter sheep, was removed from the hammock and slaughtered in the same way.

The sheep were stunned by the head-only method using 150V 50Hz AC. Following stunning, during the phase of epilepsy, a blood sample was taken. The sheep were lifted on to a cradle, exsanguinated and removed to the abattoir for dressing and inspection.

Packed cell volume (PCV) was measured on whole blood using a microhaematocrit method. The plasma was then separated by centrifugation (4500rpm for 10 minutes). Aliquots of plasma were stored frozen for later analysis of blood parameters. Lactate and

glucose were determined using an Analox micro-stat GM7 analyser (Analox Instruments Ltd, London). Plasma cortisol was assayed as described by Thomas and Rodway (1983). Inter and intra-assay coefficients of variation were 13 per cent and 12 per cent respectively, and the detection limit was 0.6ng ml^{-1}. Plasma beta (ß) endorphin levels were measured using a radioimmunoassay as described by Fordham *et al* (1989) with an antiserum supplied by DGA Lincoln, Edinburgh, UK. Inter and intra-assay coefficients of variation were 7.3 per cent and 4.7 per cent, respectively. The detection limit was 25.0pg ml^{-1}.

For statistical analysis the sample corresponding to the pre-stun time of the slaughter sheep was taken as the control value and the other samples were compared with it using paired *t* tests.

Table 1 Blood sampling procedure.

Sample No	Time	Slaughter sheep	Witnessing sheep
1	0 min*	pre-stun	in hammock
2	3 min	immediately after stun during epilepsy	in hammock
3	5 min	from sticking wound	in hammock
4	7 min	-	in hammock
5	10 min	-	in hammock removal from hammock
6		-	during epilepsy
7		-	from sticking wound

* The reference point for the timing of blood sampling was taken as 0 minutes. This was approximately 2 minutes after the witnessing sheep had been placed in the hammock and the ECG electrodes had been positioned.

Results

Figure 1 shows the variations and pattern of heart rate. Although the measured values for the witnessing sheep appeared to decline gradually there were no significant changes. In particular, no change in heart rate was evident in response to watching stunning and slaughter.

PCV showed significant increases in both slaughter and witnessing sheep (Figure 2). PCV increased in the slaughter sheep in response to stunning ($P < 0.05$) and sticking ($P < 0.01$). Although the PCV in the witnessing sheep increased in samples 5 ($P < 0.01$), 6 and 7 ($P < 0.001$), there were no significant increases in samples 3 and 4 taken after watching the sticking act. The increase in PCV in sample 5 occurred in the witnessing sheep while the carcass of the slaughter sheep was being removed. There were further rises in the samples from both groups in response to their own electrical stunning and sticking.

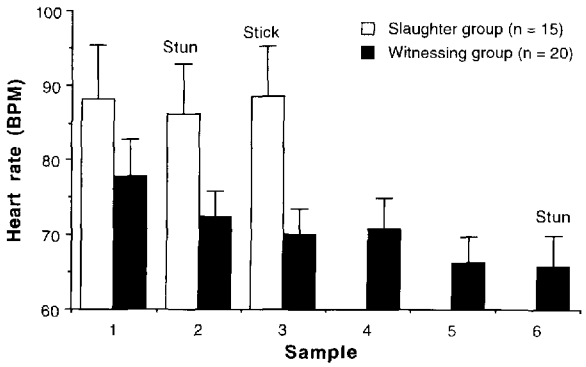

Figure 1 **Heart rate in sheep witnessing stunning and slaughter (mean ± SEM).**

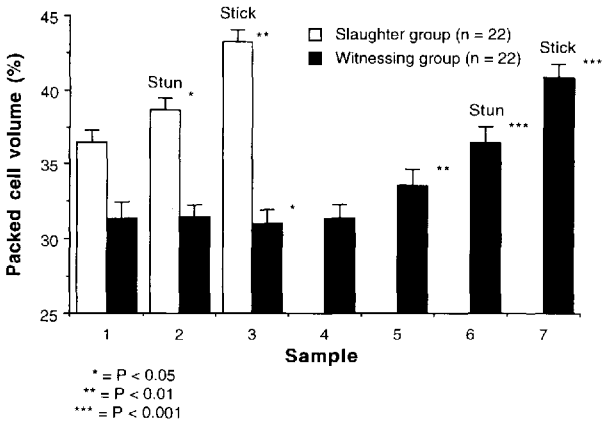

Figure 2 **Packed cell volume in sheep witnessing stunning and slaughter (mean ± SEM).**

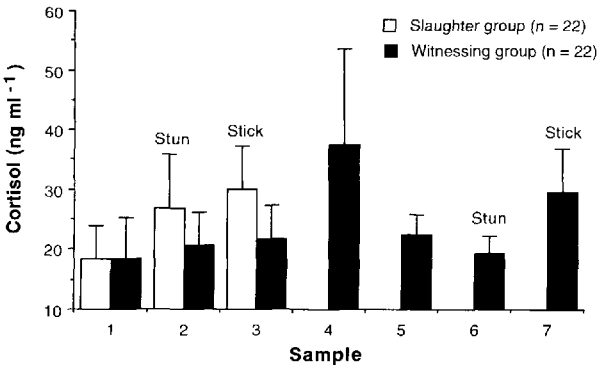

Figure 3 **Cortisol levels in sheep witnessing stunning and slaughter (mean ± SEM).**

Analysis of samples for cortisol and ß-endorphin, hormonal stress indicators, revealed no significant changes in both groups (Figures 3 and 4). There were wide variations in the values, particularly of ß-endorphin results. Glucose and lactate levels also did not vary significantly in response to witnessing stunning and slaughter (Table 2).

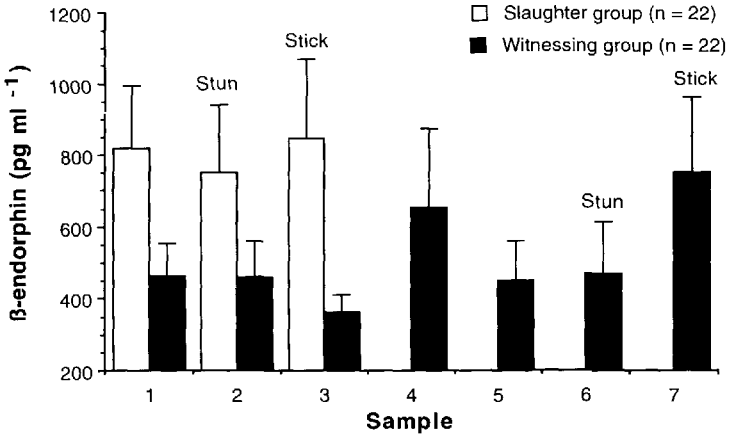

Figure 4 **β-endorphin levels in sheep witnessing stunning and slaughter (mean ± SEM).**

Table 2 **Lactate and glucose concentrations in sheep witnessing stunning and slaughter (mean ± SD) (n = 22).**

	Pre-stun	Stun	Stick
Lactate (nmol l^{-1})	3.73 ± 1.62	3.39 ± 1.54	3.33 ± 1.38
Glucose (nmol l^{-1})	5.70 ± 1.01	5.66 ± 0.93	5.86 ± 1.01

Discussion

This investigation concentrated on using blood profiles and heart rate to assess stress. Behavioural responses were not analysed. However, the subjective opinion of the authors is that the animals witnessing slaughter did not exhibit any signs indicative of a specific untoward response to the act. Bracke (1993) addressed a similar question, 'Can animals have a preference not to be killed?', by using behavioural observations rather than blood parameters. Behaviour of mice exposed to conspecifics being killed by cervical dislocation in a Y-maze did not reveal any distress. Bracke also observed and analysed behaviour of spent-hens and farmed deer (in the field) to culling of conspecifics and concluded that these species also did not find the experience aversive. The results from the present study are in agreement with these findings.

The stress parameters used in this study were not significantly elevated in response to sheep witnessing slaughter of conspecifics. Although there were some slight to moderate increases in some cases these were highly variable and statistically non-significant, except

in the case of PCV. PCV levels increased significantly in both slaughter and witnessing sheep in response to electrical stunning. This was probably due to electrical stimulation causing sympathetic neural activity and therefore leading to splenic contraction. However, during and following (2 minutes) witnessing slaughter there were no increases. In the subsequent 5 minute sample taken after sticking, PCV significantly increased. However, four animals actually showed decreased levels. The increases in PCV in the majority of the witnessing sheep may be due to this particular sampling time coinciding with removal of carcasses.

Sheep, like most other meat animals, are subjected to considerable handling prior to slaughter. Removal from the farm on to a transporter, the journey, unloading, lairaging and the final coercion and restraint prior to stunning and slaughter all cause stress. Therefore, at the point of slaughter the measurable indicators are, not surprisingly, already elevated (Fordham *et al* 1989). This has also been the case in our investigation. However, if the slaughter act per se caused distress then more significant increases would probably have been evident.

Heart rate of the witnessing sheep were within the normal range (60–90 bpm) and no tachycardia was evident. Acute stress at any time may have been expected to cause large surges and significantly higher heart rate measurements.

Cortisol and β-endorphin levels showed considerable variation. Cortisol in sample 4 (2 minutes after sticking) increased in 11 (50%) and decreased in 10 animals (45%), β-endorphin increased in 9 (41%) and decreased in 13 animals (59%) in the same samples. Similarly sample 5 cortisol levels (the subsequent 5 minute sample after sticking), were increased in 13 (59%), decreased in 9 (41%) and β-endorphins were elevated in 12 (55%) and declined in 10 animals (45%) in the same samples. Similar to the PCV responses, electrical stunning caused increases in both cortisol and β-endorphin due to direct stimulation of the nervous tissue.

The lack of evidence to the contrary suggests that witnessing slaughter does not distress sheep. Therefore, the prohibition of sticking (exsanguination) within sight of other animals may not be necessary. This requirement can cause undue delays in sticking (Gregory & Wotton 1984) and can lead to recovery of electrically stunned animals during the bleed out. Insensibility produced by electrical stunning lasts only a short time. The ideal stunning-to-sticking intervals should be less than 20 seconds in sheep (Gregory & Wotton 1985).

Animal welfare implications

In the light of the above findings it seems that slaughtering sheep in the same pen with conspecifics could be acceptable. Since witnessing the slaughter act does not cause undue distress, the stunned animals could be exsanguinated more promptly. This could reduce the stunning-to-sticking interval significantly, which could have major welfare advantages as the chance of recovery of sensibility would be reduced. An additional benefit would be that the speed and ease of the operation would be improved, which could enable the operatives to take more care.

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