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Applied Animal Behaviour Science 40 (1994) 45–54

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APPLIED ANIMAL  
BEHAVIOUR  
SCIENCE

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## Resting behaviour of sheep in a slaughterhouse lairage

F.B. Kim<sup>a</sup>, R.E. Jackson<sup>a</sup>, G.D.H. Gordon<sup>b</sup>, M.S. Cockram<sup>\*.b</sup>

<sup>a</sup>*Institute of Ecology and Resource Management, University of Edinburgh, School of Agriculture Building, West Mains Road, Edinburgh EH9 3JG, UK*

<sup>b</sup>*Department of Veterinary Clinical Studies, Royal (Dick) School of Veterinary Studies, University of Edinburgh, Veterinary Field Station, Easter Bush, Roslin EH25 9RG, UK*

(Accepted 24 November 1993)

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### Abstract

Groups of sheep were observed in a slaughterhouse lairage in order to investigate the factors affecting their ability to rest. Thirty-four groups were observed using a video-camera and recorder from arrival to dusk (evening) and from dawn to removal (morning). Nineteen groups were transported by road to the slaughterhouse direct from farms and 15 groups were from markets. Continuous direct observations of focal sheep from 34 groups were made during their first 2 h in the lairage. Sixteen of these groups were transported by road to the slaughterhouse direct from farms and 18 groups were from markets. Sheep kept on wooden slats did lie down and rest during overnight lairage. During the evening period almost half of the time was spent with greater than one-third lying down. Movement by the group as a whole represented a small proportion of the time during the evening and morning periods. During the first 2 h in the lairage, sheep from markets lay down at a faster rate than those direct from farms (between 1.75 and 2.00 h after arrival in the lairage the proportion of scans at which focal sheep from markets and those from farms were observed lying down was 0.41 and 0.15, respectively). Most of the sheep lay down for most of the time during the morning period (mean proportion of time when more than two-thirds of the group were lying down was 0.59). Within the group and pen sizes studied, a space allowance of greater than 1 m<sup>2</sup> per sheep was required before most of the sheep within a group lay down. However, the provision of greater than 1 m<sup>2</sup> per sheep did not always result in greater than two-thirds of the sheep within a group lying down. During the first 2 h in the lairage, the mean proportion of scans at which focal sheep from markets were observed eating (0.06) was greater than those direct from farms (0.01), the mean number of drinking events in market sheep (2.95 h<sup>-1</sup>) was greater than those in sheep direct from farms (0.45 h<sup>-1</sup>). The presence of humans in the passageway was associated with head alert reactions, movement and decreased lying behaviour in the sheep.

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\*Corresponding author.

*Key words:* Sheep; Resting behaviour; Housing; Slaughtering

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## 1. Introduction

Warriss et al. (1990) surveyed the transport and lairage times of lambs at two slaughterhouses in the south of England and found that the mean distances travelled to slaughter were 206 and 265 km, and the mean lairage times were 17.9 and 8.8 h. The mean total times spent in transit and lairage were 22.3 and 13.3 h. Transport of sheep can involve several potential stressors, e.g. handling, loading and unloading, motion, restriction of food and water, and disturbed rest (Connell, 1984). When sheep arrive at a slaughterhouse they are put in a lairage pen for ante-mortem inspection and as a holding facility before slaughter. It has been traditional practice to provide a period of rest before slaughter. However, there is little evidence to suggest whether the welfare of sheep is either improved or put at risk by lairage before slaughter. Immediate slaughter might be preferable to being kept in a lairage for insufficient time and/or in an environment which does not enable them to settle down (Farm Animal Welfare Council, 1984). Observations of groups of cattle have suggested that they require at least 2 h before lying behaviour starts, and between 3 and 10 h before most of the cattle within a group lie down. In about half of the groups, the majority of the time was spent with no animals in the group lying down. The resting behaviour of the cattle was affected by their source, group size, and the degree of human and animal activity in the lairage (Cockram, 1990, 1991). Observations of pigs that were kept within a stable social group in a lairage pen showed that most groups lay down within 1 h (Moss, 1978). This study investigated whether sheep rest in a slaughterhouse lairage and examined some of the factors affecting the ability of sheep to rest in a lairage.

## 2. Animals, materials and methods

### 2.1. Management of the sheep

The sheep lairage consisted of 20 pens arranged in two rows and was directly adjacent to a cattle lairage. The floor of each pen was made of wooden slats 50 mm wide with 20 mm gaps and there was a water trough (2.60 m × 0.53 m) in one corner and a hay rack along one wall. Hay was usually provided on arrival and at 18.00 h. Entrance to each pen was by a tubular metal gate facing a central passageway. The other three sides of each pen were solid. The pens were illuminated by daylight and by fluorescent lighting during the working day.

Most groups were composed of weaned lambs, but some groups were composed of ewes. The sheep were from several breeds, e.g. Scottish Blackface, Suffolk and Cheviot, and several types of crossbreeds.

## 2.2. Video observations

Thirty-four groups of sheep that were to be kept overnight in the lairage before slaughter were selected at random and placed in one of two observation pens. The median group size was 37 (range 2–93). Each group consisted of sheep from one source. Nineteen groups had been transported by road to the slaughterhouse direct from farms and 15 groups were from markets. The median arrival time was 16.32 h and the median time that the sheep were removed from the lairage pen was 6.26 h.

The dimensions of one observation pen were 7.7 m × 5.9 m and those of the other pen were 6 m × 2 m. A video-camera was located above the pens and the behaviour of the sheep was recorded on a time-lapse video-recorder. When the fluorescent lighting was switched off at the end of the working day and there was insufficient natural daylight, no observations were possible. The time between arrival and dusk was described as the evening period (median duration 6 h), and the time between dawn and the time that the sheep were removed from the lairage pen for slaughter was described as the morning period (median duration 2 h). These periods were analysed separately. The video-recordings were analysed at 10 min intervals and the proportions of sheep standing still, moving and lying down at each interval were recorded. The number of times that humans and sheep were present in the central passageway outside of the observation pen were recorded.

## 2.3. Direct observations

Thirty-four groups of sheep that arrived in the lairage between 13:00 and 15:00 h were selected at random for continuous direct observations over their first 2 h in the lairage. The median group size was 45 (range 15–200). Sixteen groups had been transported by road to the slaughterhouse direct from farms and 18 groups were from markets. The groups were placed in pens with a floor surface area of between 21 and 68 m<sup>2</sup>. Within these groups a focal animal with an identifiable marking was chosen at random. The sheep were observed from either an elevated position adjacent to the pen or from behind a pen wall.

An ethogram/time budget of the focal animal was undertaken by recording the occurrence of certain behavioural states at 30 s intervals and the number of various behavioural events which occurred within each 30 s interval was recorded. The durations of the following behavioural states were recorded: standing-still; moving (changing position); lying (head raised/head lowered); eating; ruminating; investigating (sniffing or licking either the environment or another sheep); idling (non-alert state). The numbers of the following behavioural events were recorded: drinking; grooming (scratching, rubbing or licking); aggressive interactions (head butt/push, shoving with shoulder or pawing another sheep); head alert reactions (raised head and erect ears in response to external stimuli); vocalizations; defaecations; urinations.

Disturbances caused either by the presence of humans and sheep in the central

passageway or noise from activity out of sight of the sheep were recorded. In 19 groups the effects of these disturbances on the behaviour of the focal sheep were classified as follows: head alert reaction; getting-up from a lying position; movement within the same area of the pen; movement to the back of the pen; bunching with the rest of the group.

#### *2.4. Statistical analyses*

The behaviour of the sheep recorded by the video observations was described by the proportion of time in the evening and morning periods when less than one-third, between one-third and two-thirds, and greater than two-thirds of the sheep in the group were standing, moving and lying. The effect of space allowance, and the effect of space allowance and group size on these behaviours were examined by linear regression analyses (Ryan et al., 1985). Where the effect of including group size did not increase the proportion of variance explained by the relationship, results are presented for space allowance only. The effect of origin (groups direct from farms compared with those from markets) on the behaviour of the sheep during the evening and morning periods was examined by using Mann–Whitney tests (Ryan et al., 1985). The effect of origin and time in the lairage on the behaviour of focal sheep during the first 2 h in the lairage was examined by linear regression analysis, and a comparison of intercepts and slopes using the method described by Weisberg (1985). The groups of sheep were categorised into: high  $> 1.52 \text{ m}^2$  per sheep ( $n=8$ ), medium  $0.90\text{--}1.52 \text{ m}^2$  per sheep ( $n=10$ ) and low  $< 0.90 \text{ m}^2$  per sheep ( $n=16$ ) space allowances and Kruskal Wallis tests were used to examine the effect of space allowance on the behaviour of focal sheep during the first 2 h in the lairage (Ryan et al., 1985). Spearman's rank correlation coefficients were calculated between the number of disturbances during the evening and morning periods, and behaviour during that period (Ryan et al., 1985). There were insufficient balanced groups to examine the effect of breed on the behaviour of the sheep in the lairage.

### **3. Results**

The mean proportions of time during the evening period when greater than two-thirds of the group and between one-third and two-thirds of the group were lying was 0.17 and 0.30, respectively. The mean proportions of time during the evening period when greater than two-thirds of the group and between one-third and two-thirds of the group were moving was 0.01 and 0.03, respectively. The mean proportions of time during the morning period when greater than two-thirds of the group and between one-third and two-thirds of the group were lying was 0.59 and 0.16, respectively. The mean proportions of time during the morning period when greater than two-thirds of the group and between one-third and two-thirds of the group were moving was 0.00 and 0.02, respectively.

During the evening period, there was a significant effect of space allowance on

the time spent with greater than two-thirds of the group lying down (proportion of time =  $0.046 + [0.086 \times \text{space allowance m}^2 \text{ per sheep}]$ ;  $R^2 = 0.20$ ,  $P < 0.01$ ; Fig. 1). During the evening and the morning periods, there was a significant effect of space allowance and group size on movement of the sheep ( $P < 0.01$ ). There was greater movement within groups of sheep kept at high space allowances (small group size) than in those kept at lower space allowances (large group size). During the first 2 h in the lairage, there were no significant differences between the behaviour of sheep kept in pens at high, medium and low space allowances ( $P > 0.05$ ). At low space allowances sheep were sometimes observed to walk over other sheep and sometimes the movement of a sheep was restricted by either another sheep lying beside them or by getting their leg caught on another sheep when walking over it. However, the number of times that these behaviours were observed was too low to examine statistically. There was a tendency for sheep kept at high space allowances to exhibit a greater number of aggressive and grooming events than those at lower space allowances, but this was not statistically significant.

There was no significant effect of origin (farm/market) on the time spent standing, moving or lying by groups of sheep during the evening and morning periods. Over the first 2 h in the lairage, the time spent lying increased ( $P < 0.05$ ) and this increase was faster in sheep from markets than in those from farms ( $P < 0.05$ ). Figure 2 shows the proportion of scans spent lying with the head raised.

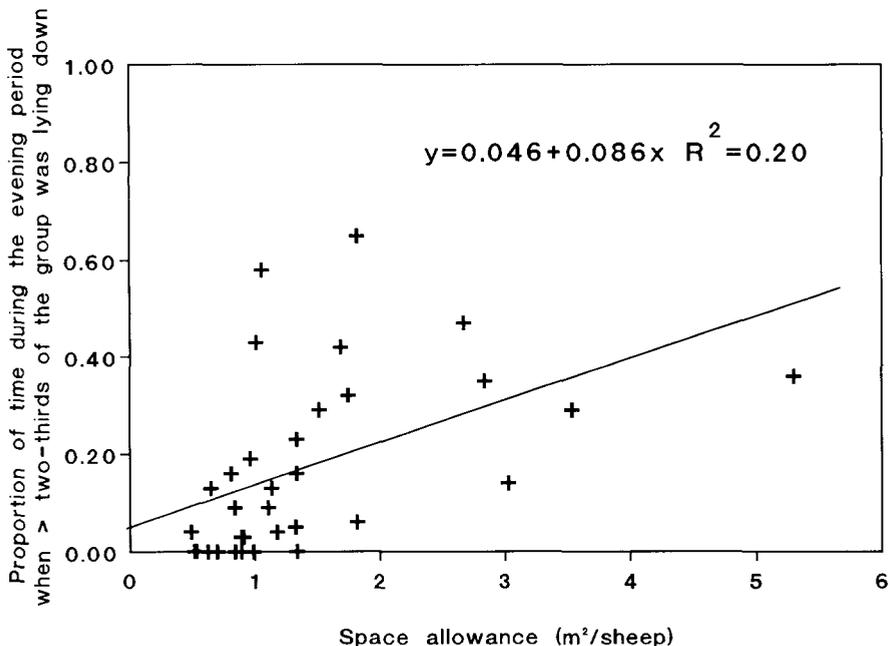


Fig. 1. Effect of space allowance on the mean proportion of time during the evening period when greater than two-thirds of group were lying down.

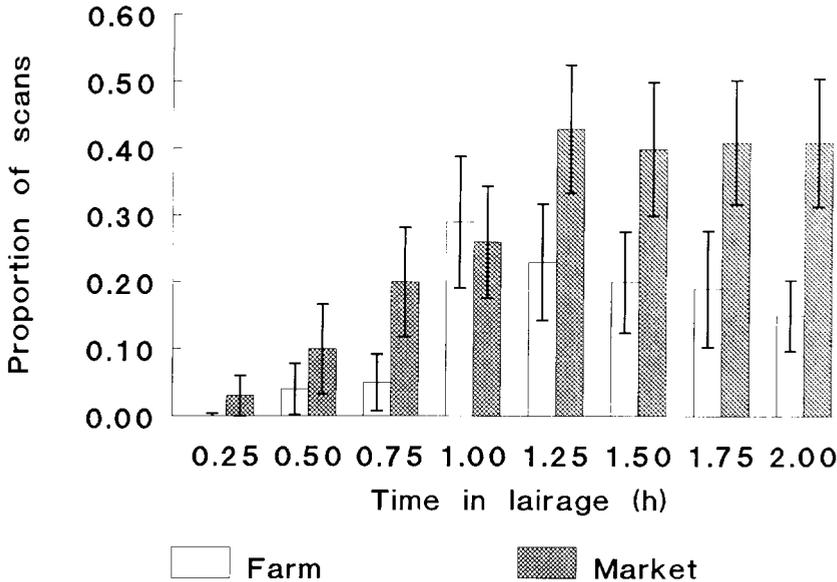


Fig. 2. Proportion of scans at which focal sheep direct from farms and those from markets were observed lying down with their head raised during the first 2 h in the lairage.

The proportion of scans per 15 min observation period at which the sheep were lying with their head lowered increased over the first 2 h in the lairage from 0.0 to 0.11 and from 0.0 to 0.01 in farm and market sheep, respectively. The proportion of scans per 15 min observation period at which the sheep were moving decreased over the first 2 h in the lairage from 0.1 to 0.05 ( $P < 0.001$ ). During the first 2 h in the lairage, the mean proportion of scans at which focal sheep from markets were observed eating (0.06) was greater than those direct from farms (0.01); the mean number of drinking events in market sheep ( $2.95 \text{ h}^{-1}$ ) was greater than those in sheep direct from farms ( $0.45 \text{ h}^{-1}$ ). The proportion of scans at which market sheep were observed investigating the environment decreased over the first 2 h in the lairage from 0.16 to 0.05 ( $P < 0.05$ ). Sheep from farms were observed to spend proportionately 0.04 of scans investigating the environment. The number of head alert reactions decreased during the first 2 h in the lairage ( $P < 0.001$ ) and were greater in number in farm sheep than in market sheep ( $P < 0.05$ ; Fig. 3). The number of urinations decreased over the first 2 h in the lairage ( $P < 0.05$ ) ( $0.10 \text{ h}^{-1}$  during the first hour and  $0.03 \text{ h}^{-1}$  during the second hour). There was no effect of either time in the lairage or origin on the proportion of time spent by focal sheep ruminating (0.13 of scans during the first 2 h in the lairage), investigating other sheep (0.02) and idling (0.08). There was no effect of either time in the lairage or origin on the frequency of grooming events ( $0.4 \text{ h}^{-1}$ ), aggressive interactions ( $1.1 \text{ h}^{-1}$ ), vocalization ( $4.6 \text{ h}^{-1}$ ), and defaecation ( $0.1 \text{ h}^{-1}$ ) by focal sheep during the first 2 h in the lairage.

There appeared to be a correlation between the number of disturbances caused

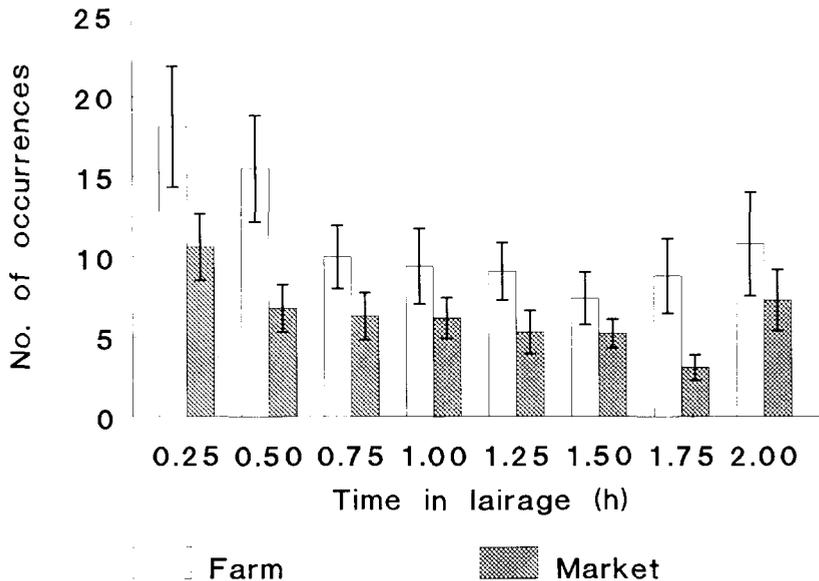


Fig. 3. Number of occurrences of head alert reactions in focal sheep direct from farms and those from markets during the first 2 h in the lairage.

by human presence in the lairage passageway in the evening and the proportion of time when greater than two-thirds of the group was moving, but this was not statistically significant ( $r_s=0.309$ ,  $P>0.05$ ). However, there were significant correlations between the number of disturbances caused by human presence in the lairage passageway in the morning and the proportion of time when between one-third and two-thirds of the group was moving ( $r_s=0.508$ ,  $P<0.01$ ), and when less than one-third of the group was lying ( $r_s=0.502$ ,  $P<0.01$ ). During the first 2 h in the lairage, the mean responses of 19 groups of sheep to humans in the passageway was a head alert reaction (0.47 of human disturbances), movement to form a bunch at the rear of the pen (0.21 of human disturbances) and movement within the same area (0.18 of human disturbances). Sheep in the passageway caused relatively little disturbance to the sheep in the lairage pen compared with that caused by human presence (there was no response to 0.32 of sheep disturbances). Head alert reactions were the main response of sheep in the lairage pen to sheep in the passageway (0.33 of sheep disturbances) and to noise in the lairage (0.82 of sheep disturbances). The type of reaction to human presence appeared to depend on the noise made by the human. At low space allowances, e.g. less than  $0.5 \text{ m}^2$  per sheep the sheep appeared to respond less to the presence of a human in the passageway than those at higher space allowances. The sheep appeared to respond more to and took longer to habituate to both mechanical noise, e.g. hosing, banging metal and human vocalization, than to animal noises, e.g. cattle and pig vocalization, and cattle fighting or mounting.

#### 4. Discussion

The results showed that after overnight lairage on wooden slats most sheep were lying down. During the evening period almost half of the time was spent with greater than one-third of the group lying down. Although it may be possible for sheep to rest without lying down, lying has been associated with brain patterns indicative of rest (Laurentie et al., 1989). Ruckebusch (1972) reported that ewes kept in a metabolic cage lay down for proportionately 0.30 of each 24 h and they slept for 0.16 of each 24 h. Most lying and sleeping occurred during a 12 h night period (proportionately 0.40 and 0.27, respectively). In the present study, movement by the group as a whole represented a small proportion of the time during the evening and morning periods. Lying behaviour increased and movement decreased during the first 2 h in the lairage. However, most of the time spent lying was with the head raised rather than with the head resting on the floor.

In this study any effect of space allowance could have been confounded by the effect of group size. The regression equation of lying behaviour against space allowance did not predict the lying behaviour of some groups which showed the greatest lying behaviour (Fig. 1). However, the results showed that, within the group and pen sizes studied, there was an association between lying behaviour and space allowance in the lairage pen, and a space allowance of greater than 1 m<sup>2</sup> per sheep was required before most of the sheep within a group lay down. The Meat and Livestock Commission (1974) recommended a space allowance of 0.56 m<sup>2</sup> per sheep in lairage pens. This appears to be less than the ideal space requirement for most sheep to rest. The requirement of every animal in the lairage to have sufficient space to stand up, lie down and turn around is recognised in the welfare codes and legislation concerning the management of slaughterhouse lairages (The Scottish Office Agriculture and Fisheries Department, 1992). Current practice and recommendations may allow sufficient physical space for the sheep to lie down, but these results indicate that the provision of more space would be beneficial to the sheep. Further work is required to examine the effect of space allowance on the lying behaviour of sheep in lairage pens and the utilization of the space available in the pen. The quality of space as well as the quantity affects the use of space. For example, while resting, animals prefer to position themselves around the perimeter of a holding pen rather than in the centre of the pen (Stricklin et al., 1979).

The observation that the presence of humans affected the behaviour of the sheep more than the presence of sheep in the passageway was consistent with previous work that has suggested that sheep resting behaviour is decreased when there is human activity (Ruckebusch, 1975; Done-Currie et al., 1984; Tobler et al., 1991). Disturbance from noise was also detrimental to resting behaviour.

The higher proportion of time spent by market sheep eating and drinking, and the faster increase in lying behaviour during the first 2 h in the lairage in these groups than in sheep direct from farms suggests that market sheep may have been without *ad libitum* feed, drink and rest for longer periods before they arrived at the slaughterhouse than sheep direct from farms. The provision of feed, water

and rest on arrival in the lairage is particularly important for the welfare of sheep arriving from markets.

## 5. Conclusion

Sheep are capable of resting during overnight lairage on wooden slats. The results indicate that a space allowance of greater than 1 m<sup>2</sup> per sheep increases the time spent lying down in the lairage. The design and management of the lairage are important in reducing the number of disturbances to the sheep that are caused by the presence of humans near the sheep. The provision of feed, water and rest are important welfare requirements for sheep kept in a slaughterhouse lairage.

## 6. Acknowledgements

G.D.H.G. and F.B.K. each received a Dorothy Sidley Memorial Award from The Humane Slaughter Association to undertake this work. The video equipment was provided by a grant from the Humane Slaughter Association. We are grateful to the Gorgie slaughterhouse, Edinburgh for their assistance and cooperation.

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