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Behavior of Lambs in Rest Pens During Long-Distance Transport

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The aim of this study was to determine how one group of lambs utilized 2 consecutive rest periods in novel environments with access to food and water that occurred during 22 hr of motor transport. The 18.5 ± 0.6 kg lambs (n = 15) were transported for 8 hr and then unloaded for a 6-hr rest period. After 6 hr, the lambs were reloaded for another 8 hr of transport followed by a 24-hr rest period. Reloading for a second 8 hr of transport followed the initial rest period. The percentage of lambs engaged in drinking, eating, lying, playing, or “other” was determined at 15-min intervals. During the 6-hr rest period, peak lying behavior occurred during the 2nd and 6th hr of the period. During the first 6 hr of the 24-hr rest period, the percentage of lambs lying increased while the percentage of lambs eating decreased. In addition, the percentage of lambs lying during the first 6 hr of the 24-hr rest period was greater than during the 6-hr rest period. Lying down had a greater priority than eating during the second (24-hr) rest period.

Transport of species used in food production negatively affects each of the “five freedoms of [nonhuman] animal welfare” defined by the Farm Animal Welfare Council (FAWC; 2006). Previous work has investigated the effect on sheep of (a)

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24 hr of transport (Knowles et al., 1995); (b) the potential of periodic rest periods throughout the journey (Cockram et al., 1997); and (c) posttransport recovery periods (Cockram et al., 2000; Cockram et al., 1999) to maintain the welfare of nonhuman animals when production systems require transport. Cockram et al. (1997) observed that sheep spent a large portion of either 3- or 12-hr rest periods eating, which would indicate improved welfare from the reduction of hunger (FAWC, 2006). In addition, behavioral observations following 15 hr of transport suggested that access to water was important only if supplied concurrently with feed (Cockram et al., 1999). The novelty of posttransport environments was not found to have a detrimental effect on the ability of sheep to recover from the stress of a journey (Cockram et al., 2000). Collectively, these studies demonstrated the existing potential to devise transport protocols which could improve the welfare typically experienced by lambs while in transit. These positive benefits, however, were limited to a single rest period during transport; there has not been an examination of multiple rest periods.

The European Commission (2002) recently published recommendations for horses, pigs, calves, and lambs that required rest periods alternating in duration between 6 and 24 hr following every 8 or 12 hr of transport, depending on the species, until the final destination was reached. The goal was to further reduce the detrimental effects of transport on the welfare of animals from an expansion of the benefits found in single rest periods. There was no scientific evidence supporting these recommendations at the time of introduction and there is concern about the great increase in overall time spent in transit. Furthermore, the recommendation for 6- and 24-hr rest periods for horses, lambs, calves, and pigs (European Commission, 2002) is much more restrictive than current legislation in the United States that requires only horses en route to slaughter be unloaded for 6 hr following 28 hr of transport (Final Rule, 2001).

Krawczel, Friend, Caldwell, Archer, & Ameiss (2007) recently investigated differences in plasma constituents, antibody response, and body weight (BW) from lambs transported for 22 hr continuously, lambs transported for 22 hr following the proposed recommendations for rest periods of the European Commission (2002), and a nontransported control. Although indicators of food deprivation were eliminated and loss of BW minimized in the group transported according to the proposed recommendations of the European Commission, dehydration was not evident in either transported group; suppression of antibody production was evident in both transported groups. These results indicated the lambs experienced some stress from transport regardless of whether they were provided rest periods or transported straight through (Krawczel et al., 2007). The aim of the present study was to evaluate how the same group of lambs utilized two consecutive rest periods of 6 and 24 hr occurring after an initial 8 hr of transport and separated by a second 8 hr of transport.
METHOD

Animals, Housing, and Management

Fifteen 14-week-old Rambouillet-Suffolk lambs (7 males and 8 females) from the Physiology and Reproduction laboratory at Texas A&M University were used in this study. The lambs were weaned at 8 weeks and then housed as a group on Bermuda grass pasture for the next 6 weeks prior to transport. During the 6 weeks between weaning and the initiation of transport, the lambs were moved from the adjoining pasture into a covered “home pen” at 0900 and 1700 and group-fed 8 kg of 16%-protein-pelleted feedstuff (Producers Cooperative, Bryan, TX) and habituated to human contact and presence. Water was continuously available in a 1-m long water trough. At the start of transport, the lambs weighed 18.5 ± 0.6 kg. All procedures were approved by the Texas A&M University Agricultural Animal Care Committee. These lambs were the “rested treatment” in a concurrent study (Krawczel et al., 2007) that compared plasma constituents, weight loss, and immune function in lambs transported continuously for 22 hr, transported for 22 hr with rest periods (these lambs), and a control that remained in the home pasture.

The lambs (n = 15) were loaded on to a trailer at 0800 and transported over local roads for 8 hr. The lambs were then unloaded into a pen for a 6-hr rest period. After 6 hr, the lambs were reloaded onto the same trailer, transported for an additional 8 hr, and then unloaded into a pen for a 24-hr rest period. Transport occurred in a 7.2 × 1.8-m (Gooseneck, Bryan, TX) trailer with a deck height of 0.4 m. The trailer was positioned at the entryway into the pen, and lambs were loaded and unloaded without using a ramp.

The lambs were transported at the recommended density of 0.23 m² per lamb (European Commission, 2002). Rest periods were provided in a completely novel pen (9.4 × 4.0 m) with wood shavings after bedding. Novel pens allowed each rest period to mimic conditions that would be encountered during commercial transport. Prior to unloading, approximately 11 kg of 16%-protein-pelleted feedstuff (Producers Cooperative, Bryan, TX) was dispensed into a permanent feeder (6.5 m long × 0.5 m tall) with adequate space for all lambs to access feed at the same time. Grass hay was available in a feeder along the wall opposite the grain. Water was provided in four buckets placed across the northern end of the pen an average of 2 m from the closest portion of the feeders. The lambs had no prior experience with the feeding and watering equipment or the building in which the pens were located before the 6-hr rest period; however, the 16%-protein-pelleted feedstuff provided was the same that was used during the habituation period. The 6-hr rest period began at 1600, and the 24-hr rest period began at 0600 the following day.
Behavior Collection

The number of lambs engaged in drinking, eating, lying, playing, or “other” was recorded at 15-min intervals throughout the rest periods by two observers. A lamb was recorded as drinking or eating when the lamb’s body was oriented toward a water or food source and the subject was actively ingesting. Lambs were lying when their weight was not supported by all four legs and they were not in motion. Play was recorded when a lamb who was running leapt into the air with rigid legs (Hafez, Schein, & Ewbank, 1969), attempted to butt another lamb, or butted another lamb. Due to the age of the lambs, all butting was assumed to be play. Behavior that was not previously mentioned was recorded as “other.” Supplemental lighting was used at night to allow direct observation of behaviors.

Hourly means were used to determine if any trends were evident in the behavioral data; however, due to lack of replication and the confounding effect of the differing start times to the rest periods, these data were not statistically analyzed. As a result, this is a descriptive study.

RESULTS

The majority of the lambs were observed to be recumbent within the trailer prior to unloading into the rest pen at the conclusion of each transport period. Mean temperature was 28.4°C, and mean relative humidity was 59.9% during the study. The lambs readily unloaded and loaded into the trailer, and no apparent injuries were observed. For both rest periods, the lambs immediately went to feed—with no discernable latency—when released from the trailer. The average latency between unloading and drinking during the 6-hr rest period was 17.7 ± 4.5 min. The latency data for the second period were not recorded.

The percentage of lambs eating was greater during the 6-hr rest period compared with the first 6 hr of the 24-hr rest period (Table 1). The overall percentage of time spent lying was much less during the 6-hr rest period when compared with the first 6 hr of the 24-hr rest period (18.8 vs. 63.7% (Table 1). During the 6-hr rest period, lying behavior was highly variable, although there was a general increase during each subsequent hour between the 3rd and 6th hr of the period (Figure 1). There was a much more pronounced increase in the mean percentage of lambs lying and a decrease in the mean percentage of lambs eating during the first 6 hr of the 24-hr rest period (Figure 1). Upwards of 70% of the lambs were motivated to lie down during the first 11 hr of the 24-hr rest period, after which the lambs became active and began eating until 17 hr, when they again decreased eating and commenced lying (Figure 2). The final hour of behavioral observations was omitted during the 24-hr rest period due
TABLE 1
Behavior of the Lambs During Rest Periods

<table>
<thead>
<tr>
<th>Rest Period</th>
<th>Drinking</th>
<th>Eating</th>
<th>Lying</th>
<th>Playing</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 hr</td>
<td>6.4 ± 4.3</td>
<td>41.4 ± 6.7</td>
<td>18.8 ± 6.5</td>
<td>1.2 ± 0.8</td>
<td>29.6 ± 6.7</td>
</tr>
<tr>
<td>First 6 hr of 24 hr</td>
<td>2.9 ± 1.2</td>
<td>15.2 ± 4.0</td>
<td>63.7 ± 7.4</td>
<td>1.3 ± 0.9</td>
<td>16.8 ± 4.0</td>
</tr>
<tr>
<td>24 hr</td>
<td>1.9 ± 0.4</td>
<td>19.5 ± 2.4</td>
<td>61.0 ± 3.6</td>
<td>1.3 ± 0.4</td>
<td>16.3 ± 4.6</td>
</tr>
</tbody>
</table>

Note. Mean percentage of lambs ± SE (n = 15) engaged in each behavior during the 6-hr rest period, the first 6 hr of 24-hr rest period, and the entire 24-hr rest period. Percentages were calculated from the number of lambs engaged in each behavior during scan samples at 15-min intervals.

FIGURE 1
Mean percentage at hourly intervals of lambs ± SE (n = 15) engaged in drinking (a), eating (b), lying (c), and playing (d) during the 6-hr rest period or the first 6 hr of the 24-hr rest period. Percentages were calculated from the number of lambs engaged in each behavior during four scan samples per hour recorded at 15-min intervals. The first scan sample was recorded 15 min after the lambs were unloaded into the rest pen.
FIGURE 2  Mean percentage at hourly intervals of lambs ± SE (n = 15) engaged in drinking, eating, lying, and playing during the 24-hr rest period. Percentages were calculated from the number of lambs engaged in each behavior during four scan samples per hour recorded at 15-min intervals. The first scan sample was recorded 15 min after the lambs were unloaded into the rest pen.

to collection of blood samples for the physiological study (Krawczel et al., 2007).

DISCUSSION

The rest periods beginning at different times of the day confound the results obtained from this study; however, if rest periods were implemented, this is typical of what would happen during actual commercial transport with a similar starting time. These results are preliminary and are the first to demonstrate how lambs may utilize consecutive rest periods occurring at different points during transport.

During this study, the lambs consistently went to food rather than water immediately after unloading for both rest periods. The preference for food over water in sheep has previously been found after 15 hr (Cockram et al., 1999) and 24 hr (Cockram et al., 1997) of transport, although this preference may be temporary. Knowles et al. (1995) reported a return to pretransport eating patterns 1 hr after unloading. Following the initial consumption of food immediately after unloading, feeding diminished during the final 2 hr of the 6-hr period and
throughout the first 6 hr of the 24-hr rest period. A concurrent increase in the number of lambs lying was observed as the number of lambs eating decreased, which may indicate a greater motivation to rest after feeding needs have been met and as the number of hours in transit increases.

A 50% reduction in the percentage of lambs observed drinking during the first 6 hr of the 24-hr rest period occurred relative to the 6-hr rest period. This may be caused by the 6-hr rest period beginning at 1630 when the temperature exceeded 35°C, compared with the 24-hr rest that began at 0600 when the temperature was approximately 25°C. Alternatively, the lambs may have been sufficiently fatigued by the 16 hr of cumulative transport and the 6-hr rest period (22 hr total of exposure to novel environments) to prioritize resting over drinking. The reduced number of lambs observed drinking during the second period might indicate that dehydration was not occurring and that the 6-hr rest period provided sufficient access to water following exposure to the highest temperatures of this study. Physiological evidence that these lambs were not dehydrated immediately prior to each rest period or at the end of transport was published in Krawczel et al. (2007).

The feeding that occurred during the 6-hr and 24-hr rest periods reduced physiological indicators of food deprivation and changes in BW but did not alleviate transport stress as indicated by concentrations of cortisol and suppression of IgG and unaffected response of IgM in response to vaccination (Krawczel et al. 2007). This suggests that only limited benefits were gained during the rest periods and that further work is needed to determine if these potential gains from one or two rest periods during a 22-hr-long trip are greater than the costs of achieving them. In addition, a methodology of providing rest while also ensuring biosecurity would need to be established before off-trailer rest periods are incorporated into transport protocols. The potential risk of increased incidents of disease resulting from the exposure to a greater number of unfamiliar animals during off-trailer rest periods could be problematic. For those reasons, the European Commission (2002) suggested on-trailer rests. However, it has not been demonstrated that sufficient access to food, water, and rest space are available to achieve the benefits of rest periods as observed in this study and by Krawczel et al. (2007) during on-trailer rest.

The novelty of the rest pen, feeders, or watering buckets did not appear to affect the behavioral response as all lambs went immediately to the grain when released into the rest pen. Previous work demonstrated that novel environments do not negatively affect recovery in sheep, as measured by plasma constituents and time spent feeding and drinking (Cockram et al., 2000). The lambs in this study were provided with the same grain that had been supplied throughout the acclimation period prior to the start of this study. This may have facilitated the immediate move to grain; the preference for familiar food in novel environments has been established (Burritt & Provenza, 1997).
CONCLUSION

Although feeding was the immediate priority at the start of each rest period for the lambs in this study, the portion of the rest period spent feeding diminished while time spent lying increased during consecutive rest periods occurring after 8 hr and 16 hr in transit. The results of this study indicated that the welfare of lambs was improved overall from the opportunities to feed, drink, and rest during transport. However, these results should be interpreted with caution due to the lack of replication of the treatment. In addition, only a small percentage of the lambs lay down to rest during the first period as compared to those who lay down to rest during the first 6 hr of the second period. This indicates that the first rest period was not very efficacious. The lambs also became active during the second rest period after 11 hr, indicating that a rest period as long as 24 hr may not be necessary. The optimal duration of transport between rest periods, the number of rest periods, the duration of rest periods, and the economic costs of greatly increasing the overall length of a trip (22 hr vs. 52 hr in this case) still need to be determined.

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REFERENCES


