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# Effects of Lavender Straw on Stress and Travel Sickness in Pigs

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*Objective:* **To observe pigs during road journeys in order to establish whether lavender straw was likely to decrease stress and incidence of travel sickness.**
*Subjects:* **Forty 70-kg Large White pigs were transported by road for 2 hours, 20 animals each day, over a 2-day period.**
*Design:* **On day 1, ample wheat straw was provided as bedding such that the floor of the vehicle was entirely covered (straw condition). On day 2, lavender straw was provided as bedding (lavender condition). During the journey, direct behavioral observations of the individually marked pigs were made by scanning every 10 minutes for incidence of standing and lying along with the less severe symptoms of travel sickness (foaming at the mouth and repetitive chomping). Incidences of retching and vomiting were noted as they occurred. A general activity index was also scored every 10 minutes (5 = high activity, 1 = low activity). Saliva samples were taken from each animal at different stages of the journey for analysis of cortisol.**
*Results:* **Pigs stood more when in the straw condition, but were more active when standing in the lavender condition. Symptoms of travel sickness appeared to be less acute in the lavender condition, with more animals exhibiting the less severe symptom, foaming and chomping (a total of 3 in straw compared with 6 in lavender), but fewer animals showing the more severe symptoms of retching and vomiting (in straw, 3 retched, 6 vomited; in lavender 0 retched, 3 vomited). A total of 6 animals retched or vomited in the straw condition but only 3 in the lavender. There was a significant difference in mean concentrations of cortisol between conditions but this was due to a difference in mean baseline concentrations between groups.**
*Conclusion:* **Addition of lavender straw appeared to decrease incidence and severity of travel sickness but not overall levels of stress (as measured by concentrations of salivary cortisol).**

Recent interest in the welfare of pigs during road transport has focused on the effects of the physical (Lambooy and Engel, 1991; Randall, 1993) or social (Guise and Penny, 1989; Bradshaw et al., 1996a, 1996b) environment, concentrations of stress hormones in the blood (eg, Dalin et al., 1993; Geers et al., 1994; Bradshaw et al., 1996b, 1996c) and behaviors observed during the journey (Bradshaw et al., 1996a, 1996b, 1996c). In addition, it has recently been established that under certain conditions pigs can become travel sick (Bradshaw et al., 1996a, 1996b, 1996c; 1997). Direct observation of the pigs during the journey appears to be essential to allow accurate identification of all travel-sick individuals (Bradshaw and Hall, 1996), but the degree to which travel sickness occurs under normal commercial practice remains the subject of debate (Bradshaw and Hall, 1996; Riches et al., 1996). Bradshaw et al. (1997) reported that during a 5-hour journey conducted on a commercial livestock lorry,

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loading, 10:30 am after loading during the first part of the journey, 11:15 am in the middle of the journey, and noon on completion of the journey (before unloading). Salivary cortisol was measured using an enzyme-linked immunosorbent assay (ELISA) (Cooper et al., 1989).

*Data analysis*

The average number of pigs standing or lying and an average activity index was calculated for each group based on all the 10-minute scan intervals during the 2-hour journey. In the case of standing and lying, this average number was then expressed as a percentage of the total number of animals in the group.

In the case of concentrations of cortisol, three comparisons were made using a two-tailed *t*-test. First, concentrations of cortisol were compared in straw and lavender conditions at each stage of the journey. Second, concentrations of cortisol were compared between conditions when initial baseline concentrations (before loading) were subtracted from subsequent values (ie, after loading, in the middle, and at the end of the journey). Third, a comparison was made of cortisol concentrations during the first part of the journey after loading (10:30 am), in the middle (11:15 am) and at the end of the journey (noon) relative to preloading levels (9:15 am).

## RESULTS

Pigs in transit spent most of their time standing in both conditions (Table 1). Whether pigs lay down has been found to depend on the degree of roughness of the journey (Bradshaw et al., 1996b). Pigs generally lay down more during the lavender journey, which is surprising considering that the activity index in the lavender was nearly a third greater than in the straw. This implies that when the pigs stood in the lavender condition they were more active (and were observed to spend considerable time engaging in substrate directed exploratory behaviors). Symptoms of travel sickness appeared to be less acute in the lavender condition, with more animals exhibiting the less severe symptom, foaming and chomping (a total of 3 in straw compared with 6 in lavender), but fewer animals showing the more severe symptoms of retching and vomiting (in straw 3 retched, 6 vomited; in lavender 0 retched, 3 vomited). A total of 6 animals retched or vomited in the straw condition, but only 3 in the lavender.

Mean concentrations of salivary cortisol (nmol/L) for all the pigs at each stage of the journey for day 1 (straw condition) and day 2 (lavender condition) are shown in Table 2.

Concentrations of cortisol were significantly higher in the lavender condition (compared with straw) before loading ($p < 0.05$), after loading ($p < 0.05$), and in the middle of the journey ($p < 0.05$), but by the end of the journey there was no significant difference ($p < 0.1$). There was also no significant differences between concentrations of cortisol between conditions when the initial baseline concentrations (before loading) were subtracted from subsequent values ($p > 0.05$ for after loading, in the middle of the journey, and at the end).

TABLE 1. MEAN PERCENTAGE OF PIGS (BASED ON AN AVERAGE OF 10-MINUTE SCANS) STANDING, LYING AND ACTIVITY INDEX (ACT), AND NUMBER OF PIGS EXHIBITING SYMPTOMS OF TRAVEL SICKNESS (FOAMING + CHOMPING, RETCHING AND VOMITING) FOR PIGS DURING DAY 1 STRAW JOURNEY (STRAW) AND DAY 2 LAVENDER (LAV) JOURNEY FOR THE SMALL GROUP (S; $n = 5$) AND THE LARGE GROUP (L; $n = 15$) AND TOTAL (COMBINED SMALL AND LARGE GROUPS)

| | *Behavior* | | *Condition* | | | |
|---|---|---|---|---|---|---|
| | *Standing* | *Lying* | *Foam + chomp* | *Retch* | *Vomit* | *ACT* |
| STRAW-S | 66.0 | 34.0 | 0 | 0 | 3 | – |
| STRAW-L | 93.3 | 6.7 | 3 | 3 | 3 | – |
| TOTAL STRAW | | | 3 | 3 | 6 | 2.0 |
| LAV-S | 44.0 | 56.0 | 2 | 0 | 1 | – |
| LAV-L | 74.0 | 26.0 | 4 | 0 | 2 | – |
| TOTAL LAV | | | 6 | 0 | 3 | 2.8 |

TABLE 2. MEAN CONCENTRATION OF SALIVARY CORTISOL (NMOL/L ± S.E.) FOR ALL PIGS AT EACH STAGE OF THE JOURNEY (9:15 AM BEFORE LOADING, 10:30 AM AFTER LOADING AND START OF JOURNEY, 11:15 AM IN THE MIDDLE OF THE JOURNEY, NOON ON COMPLETION OF THE JOURNEY) DURING DAY 1 STRAW JOURNEY (STRAW) AND DAY 2 LAVENDER (LAV) ($n$ = 20)

| | *Time of sample* | | | |
|---|---|---|---|---|
| | *9:15 am* | *10:30 am* | *11:15 am* | *noon* |
| STRAW | 4.9 ± 0.57 | 4.97 ± 0.68 | 8.86 ± 0.73 | 8.66 ± 0.59 |
| LAVENDER | 6.82 ± 0.66 | 7.38 ± 0.94 | 11.41 ± 0.83 | 9.92 ± 0.72 |

In the straw condition, concentrations of cortisol were not significantly higher relative to preloading levels after loading ($p > 0.05$) but concentrations were significantly elevated relative to preloading levels in the middle of the journey ($p < 0.001$), and at the end ($p < 0.001$). In the lavender condition this pattern was repeated with concentrations not significantly different after loading ($p > 0.05$), but elevated in the middle ($p < 0.001$) and at the end of the journey ($p < 0.01$) relative to preloading levels.

## DISCUSSION

In this study any difference in incidence of travel sickness between journeys may be attributed to one or any combination of three factors: type of journey; group of pigs; and type of straw substrate used during the journey (wheat or lavender).

Considerable care was taken on each day of the experiment to travel the same route and to employ the same lorry and driver (who was also requested to drive at the same speed). In addition, each group of pigs had been reared under exactly the same conditions at one farm with exposure to the same stock people. Thus, while acknowledging the possibility that there may have been some effect of group or day, it does seem likely that the decrease in the incidence of the most severe symptoms of travel sickness (ie, retching and vomiting) on day 2 may be attributed to the presence of the lavender straw.

In previous studies, which have involved the direct observation of pigs during transport in order to estimate travel sickness, Bradshaw et al. (1996b) found 33% of unmixed pigs (8/24) retched or vomited during a 1.5-hour journey, while Bradshaw et al. (1997) found this figure was 26% (13/50) during a 5-hour journey. It is noteworthy that in the present study a similar percentage of pigs also became travel-sick in the straw condition (30% of pigs, ie, 6 of 20) while the percentage of travel-sick pigs in the lavender condition was considerably lower (15%, ie, 3 out of 20). This adds some further support to the suggestion that the addition of the lavender straw resulted in a decrease in the incidence of travel sickness. This could either have occurred via the effect of the aromatic compounds on the pig (whose olfactory sense is well developed) or by providing an environmental enrichment during the journey, thereby distracting the animals and delaying the onset of travel sickness (which was found to be case for fighting [Bradshaw et al., 1996b]). Whether travel-sick symptoms are alleviated completely or their onset delayed is unclear but this is unimportant because many journeys to slaughter are of a short duration.

The difference between concentrations of cortisol in the straw and lavender conditions may be attributed to a difference in mean baseline concentrations between groups (and not the effects of the condition) because cortisol was already significantly higher in the lavender condition before loading. Indeed, throughout the experiment the pattern of increase of cortisol within each journey (ie, condition) was remarkably consistent with concentrations lower during the first half of the journey and elevated in the second half. This is initially surprising because concentrations in the lavender may have been expected to have been elevated as a consequence of increased activity (the activity index in the lavender condition was approximately a third higher), but the pigs in lavender also spent more time lying down (conversely, the straw-condition pigs stood more but were less active). Thus it appears that

while the time budget was different for the two conditions, the overall level of activity was similar. It is interesting to note that cortisol did not significantly increase in either condition in response to loading that was conducted from a raised loading ramp (which supports data reported by Bradshaw et al. [1996b] who loaded unmixed pigs and also found no elevation in salivary cortisol).

In conclusion, the addition of lavender straw appeared to decrease incidence and severity travel sickness but did not appear to affect overall levels of stress (as measured by concentrations of salivary cortisol). While further research is required to conclusively show that lavender is useful in decreasing incidence of travel sickness, these results form the basis against which future studies may be compared.

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