

## Motion sickness in pigs during transport: effects on meat quality

R. H. Bradshaw<sup>1</sup>, J. M. Randall<sup>2</sup>, M. L. Forsling<sup>3</sup>, S. N. Brown<sup>4</sup> and D. M. Broom<sup>1</sup>

<sup>1</sup>Department of Clinical Veterinary Medicine, Madingley Road, Cambridge CB3 0ES, United Kingdom, <sup>2</sup>Silsoe Research Institute, Wrest Park, Silsoe, Bedford MK45 4HS, United Kingdom, <sup>3</sup>U.M.D.S., Division of Obstetrics & Gynaecology, St Thomas's Hospital, London SE1 7EM, United Kingdom, <sup>4</sup>Department of Clinical Veterinary Science, University of Bristol, Langford, Bristol BS18 7DY, United Kingdom

### Summary

This experiment examined whether concentrations of plasma LVP at exsanguination could be used as an indicator of which pigs were the most travel sick during transport and whether those pigs which exhibited behavioural symptoms of travel sickness had particularly poor meat quality. Fifty 90 kg slaughter pigs were transported on a lorry for 5h. RHB travelled in the main body of the vehicle scanning the individually marked pigs every 8 min for incidences of standing, lying and symptoms of travel sickness (sniffing, foaming at the mouth, chomping, retching and vomiting). Upon arrival at the slaughter house, pigs were unloaded, slaughtered immediately (with no time in lairage) and a blood sample was taken at exsanguination for analysis of plasma LVP. 24h after slaughter measures of meat quality were made (pHu, FOP and PQM) to allow assessment for PSE (pale, soft, exudative) or DFD (dark, firm, dry) meat. 13 pigs vomited or retched during the journeys. Correlations revealed no significant relationship between concentration of LVP and meat quality measures. The number of carcasses showing PSE or DFD in one or more muscle was 24 (of which 3 showed both). Travel sick pigs did not have poor meat quality.

**Key words:** motion sickness, welfare, transport, pigs, lysine vasopressin, meat quality

### Introduction

Forsling *et al.* (1984) have shown that exposure to vibration and noise leads to raised concentrations of plasma lysine vasopressin (LVP) in pigs. In addition, it is known that nausea is associated with enhanced vasopressin secretion in man (Rowe, *et al.* 1979). It has also been shown that vasopressin release is stimulated in monkeys (Verbalis, *et al.* 1987) and pigs (Parrott, *et al.* 1991) following iv injection of cholecystokinin, a gut/brain peptide that induces emesis (Verbalis, *et al.* 1987; Parrott, *et al.* 1991). Recently it has been shown that pigs, even when not fed before transport, can exhibit symptoms of travel sickness and that these symptoms appear to be associated with elevated concentrations of plasma LVP (Bradshaw *et al.* 1996a).

We wished to establish whether concentrations of plasma LVP at exsanguination may reveal which pigs had been travel sick during the journey to slaughter and whether those pigs which display behavioural symptoms of travel sickness exhibited subsequent poor meat quality.

### Materials and methods

Fifty 90 kg slaughter pigs were transported on a lorry (25 each day for two days, food withdrawn the previous evening at 1700) for five hours (0.49 m<sup>2</sup> per pig). On each of the two days pigs were loaded at 08.00 and transported in two groups of 13 (rear pen) and 12 (front pen) at a stocking density of 0.49m<sup>2</sup> per pig. This stocking density is lower than normal commercial practice due to constraints imposed by vehicle design.

RHB travelled in the main body of the vehicle throughout the journey (between the front and rear pen) scanning the individually marked pigs every 8 mins for incidences of standing, lying and symptoms of travel sickness (sniffing, foaming at the mouth, chomping, retching and vomiting). The physical vibration characteristics of the journey were measured using accelerometer equipment.

On each day, upon arrival at the slaughter house, pigs were unloaded, slaughtered immediately (with no time in lairage) and a blood sample taken at exsanguination, collected in 10 ml heparinised sample tubes ('Monovette', Sarstedt Ltd, Beaumont Leys, Leics.), for analysis of plasma LVP. Blood was centrifuged and the resultant plasma frozen in dry ice and subsequently stored at -30 °C pending analysis for LVP (conducted as described in Thornton *et al.* 1987).

24h after slaughter pHu, FOP and PQM were measured in one or more of three muscles (LD, SM, AD) to allow meat quality assessment for PSE (pale, soft, exudative) or DFD (dark, firm, dry) calculated according to Barton-Gade *et al.* (1996).

Behavioural records of travel sickness were related to concentration of LVP at exsanguination and subsequent meat quality.

### Results

13 pigs vomited or retched during the journeys (26%) distributed approximately equally over the two days. If foaming and chomping is also included as a symptom of travel sickness the total number was 26 pigs (52%).

The journey was not a particularly rough one based on acceleration shock events compared with previous studies; 16 acceleration events compared with 52 during an 8h journey in Bradshaw *et al.* (1996b).

Correlations revealed no significant relationships between concentration of plasma LVP and meat quality measures.

The number of individual carcasses showing PSE or DFD in one or more muscle was 24 (of which 3 showed both). Travel sick pigs (individuals who vomited or retched) did not have poor meat quality (DFD or PSE; chi-squared test;  $p > 0.05$  - see Table 1 for DFD).

Table 1. Pigs which vomited/retched or did not vomit/retch vs. those showing subsequent DFD or no DFD meat quality.

Behaviour:	vomit/retch	no vomit/retch	Total
DFD	2	10	12
no DFD	11	27	38
Total	13	37	n = 50

If foaming and chomping is also included as an unambiguous symptom of travel sickness (along with vomiting and retching) there was still no significant relationship between travel sickness and incidence of DFD or PSE (chi-squared test;  $p > 0.05$  - see Table 2 for DFD).

Table 2. Pigs which [vomited/retched + foamed/chomped] or did not display these symptoms vs. those showing DFD or no DFD meat quality.

Behaviour:	[vom/retch+foam/chomp]	[no vom/retch+foam/chomp]	Total
DFD	5	6	11
no DFD	27	12	39
Total	32	18	n = 50

### Conclusions

Concentrations of plasma LVP at exsanguination cannot be used to establish which pigs were the most travel sick during transport. Travel sick pigs did not have particularly poor meat quality.

### Acknowledgements

We thank ADAS Terrington, Terrington St. Clement, Kings Lynn, Norfolk PE34 4PW UK for supplying the pigs used in this experiment. Funding was provided by the EC (AIR project 262).

## References

- Barton Gade, P., Warriss, P. D., Brown, S. N. and Lambooi, E. 1996. Methods of assessing meat quality. In: New information on welfare and meat quality of pigs as related to handling, transport and lairage conditions. Proceedings of the EU seminar, 29 - 30 June 1995, Mariensee (Ed. A. Schütte). Landbauforschung Volkenrode, suppl. 166: 23 - 34.
- Bradshaw, R. H., Parrott, R. F., Forsling, M. L., Goode, J. A., Lloyd, D. M., Rodway, R. & Broom, D. M. (1996a) Stress and travel sickness in pigs: effects of road journeys on concentrations of plasma cortisol, beta-endorphin and lysine vasopressin. *Anim. Sci.* 63: 507 - 516.
- Bradshaw, R. H., Parrott, R. F., Goode, J. A., Lloyd, D. M., Rodway, R. & Broom, D. M. (1996b) Behavioural and hormonal responses of pigs during transport: effect of mixing and duration of journey. *Anim. Sci.* 62: 547 - 554.
- Forsling, M. L., Sharman, D. F. and Stephens, D. B. 1984. Vasopressin in the blood plasma of pigs and calves exposed to noise and vibration comparable with that experienced during transport. *J. Physiol.* 357: 96.
- Parrott, R. F., Ebenezer, I. S., Forsling, M. L. and Baldwin, B. A. 1991. The effect of intravenous cholecystokinin on vasopressin and cortisol release in the conscious pig. *Br. J. Pharmacol.* 102 (Suppl.): 47P.
- Rowe, J. W., Shelton, R. L., Helderman, J. H., Vestal, R. F., Robertson, J. L. 1987. Influence of the emetic reflex on vasopressin release in man. *Kidney International* 16: 729 - 735.
- Thornton, S. N., Forsling, M. L., Baldwin, B. A. and Delaney, C. E. 1987. Separate mechanisms for central osmotically-induced drinking and vasopressin release in mini-pigs. *Physiol. and Behav.* 39: 541 - 545.
- Verbalis, J. G., Richardson, D. W. and Stricker, E. M. (1987) Vasopressin release in response to nausea-producing agents and cholecystokinin in monkeys. *Am. J. Physiol.* 252: R749 - 753.