

HANDLING OF SLAUGHTER PIGS IN LAIRAGE:
BEHAVIOURAL AND PHYSIOLOGICAL EFFECTS

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Abstract

A survey of the treatment of pigs in Dutch slaughterhouses showed that brooms and/or electric goads are still commonly used to drive pigs; in one slaughterhouse handling techniques resulted in severe skin damage. A peak in agonistic interactions was generally observed after half an hour following introduction into lairage. From the point of view of welfare, it may be better to slaughter the animals immediately upon arrival since aggression and time spent in lairage were associated with skin damage. Duration of aggressive behaviour received was positively correlated with skin damage in the front region of the animal. Skin damage was also positively correlated with time spent in lairage.

The effect of mixing and driving after transport was further examined by means of an experiment. Immediately following transport, 10 groups of 6 or 7 pigs were subjected to one of the following treatments: two groups were driven through a passageway (thus simulating 'driving' in lairage); four groups were mixed (i.e. two groups were mixed and another two groups were mixed separately), and four groups received both driving and mixing treatments (combined treatment). After transportation cortisol levels rose significantly. Driving following unloading did not have an overall additional effect on cortisol levels. An hour after the start of mixing, cortisol levels decreased. During mixing, fighting was significantly positively correlated with aggressive behaviour initially shown in the home pen. After a combined treatment of driving and mixing, cortisol levels significantly increased. It is concluded that a combination of driving and mixing (the usual treatment in lairage conditions) is very stressful to pigs and fatigues them reducing their predictability of reaction.

Introduction

The treatment of slaughter pigs during lairage at the abattoir may cause psychological and physical stress, and may also lead to a deterioration in meat quality. Design of lairage, handling by stockmen and social behaviour may significantly affect welfare. Several studies have led to recommendations for improvements of design and handling to promote both ease and speed of driving and welfare (Grandin, 1990; Lambooy, 1992; Warris et al, 1992). In addition to design and handling, individual reactions of pigs may play a role with regard to

their welfare. Several recent studies have shown that different behavioural and physiological strategies are consistent within individual pigs (Hessing et al., 1994; Mendl et al, 1992), although some authors doubt these studies support the existence of discrete 'categories' of individuals (Jensen, 1994). The objectives of our first study were to investigate pigs held in lairage at various slaughterhouses in order to examine: 1) handling; 2) the level of agonistic interactions in the holding pen and individual differences in aggressive behaviour; and 3) skin damage after slaughter and its relation to social behaviour.

In a second study an experiment was conducted in order to examine whether individual differences in behaviour and physiology in home pen conditions (and during a mild challenge test) were related to subsequent reactions during periods of transport, driving and mixing.

Materials and Methods

Study 1: Five Dutch slaughterhouses were visited. Visits to three of the Dutch slaughterhouses (A, B, and C) were repeated twice. Four groups of pigs were monitored during lairage and skin damage was scored post-mortem after scalding and evisceration. Behaviour of two groups was recorded on video tape after introduction in the holding pens. Thirty individuals in each video-recorded group were marked on the back with a standard marker spray to allow easy identification. In addition, the other two groups were sampled during each slaughterhouse visit for five 10-minute bouts. Frequency and duration of agonistic interactions were calculated. After scalding and evisceration, skin damage in front, middle and hind region was assessed subjectively employing a 4 point scale which takes product utilisation into account (Barton-Gade, 1993).

Data were analysed using a split-plot analysis of variance model. Analyses were performed on group means. Slaughterhouse effects were introduced as fixed effects in the model and visits within slaughterhouses as random effects. Analyses were performed with facilities for restricted maximum likelihood (REML; Pattersen and Thompson, 1971) in GENSTAT 5 (1990). With regard to the groups recorded on video, the Spearman Rank Correlation Coefficient (r_s) was used to examine the relationship between aggression received and skin damage. For each of the Dutch slaughterhouses A, B and C a pooled Spearman correlation coefficient was obtained by averaging over separate coefficients calculated within groups. To test whether a pooled correlation differed from 0, a normal approximation was used, with

an approximate variance of $\Sigma(n-1)^{-1}m^{-2}$, where n denotes group size and m is the number of groups.

Study 2: Five groups of six pigs and five groups of seven 60 kg slaughter pigs were studied. All animals were 16 weeks old at the start of the study. A total of four hours of data on agonistic interactions were focally sampled in the home pen. At the age of 20 weeks all groups of pigs were transported for 0.5 hours on a lorry. Immediately following this period groups were subjected to one of the following treatments: two groups were driven through a passageway (thus simulating 'driving' in lairage); four groups were mixed (i.e. two groups were mixed and another two groups were mixed separately), and four groups received both driving and mixing treatments (combined treatment). Data recorded during driving consisted of the order individual pigs proceeded along the passageway and the number of times individuals were pushed by the driver. Agonistic interactions were recorded during mixing. Saliva samples for analysis of cortisol were taken and skin damage scored for each pig before transport, after transport and following each treatment.

The Wilcoxon matched-pairs test was used to analyse changes in levels of cortisol. Overall rank correlations were obtained by averaging over separate Spearman correlations calculated within groups. A split-plot analysis of variance model was used to study differences in cortisol levels and behavioural parameters in relation to treatment and skin damage.

Results

Experiment 1: In all slaughterhouses but one, electric goads and brooms were used to move pigs. In the slaughterhouse where driving was done quietly, speed of driving did not seem to be different. A peak in aggression was observed after half an hour. After an hour, the incidence of fighting decreased again. Total duration of received aggression correlated significantly with skin damage in the front region in slaughterhouses A ($r=0.28$; $P<0.01$) and B ($r=0.35$; $P<0.001$). Lairage time correlated significantly with skin damage in all parts of the body (front: $r_s=0.39$, $P<0.01$; middle: $r_s=0.41$, $P<0.01$; hind: $r_s=0.38$, $P<0.01$). Skin damage scores for the middle and hind region in one slaughterhouse were significantly higher ($P<0.05$). In this slaughterhouse rubber sticks were used to drive the animals and during scoring of skin damage values, the marks these sticks left in the middle and hind region were clearly visible.

Experiment 2

Transport. Mean levels of cortisol increased significantly ($n=10$, $P<0.01$) during transport although there were large individual differences in levels of cortisol and five pigs even showed a decline.

Driving. Driving had no significant effect on cortisol levels. Neither order nor frequency of being pushed by the driver correlated with change in levels of cortisol ($r_s=0.25$; $r_s=0.10$, ns).

Mixing. Fighting was significantly positively correlated with frequency of aggressive behaviour in the home pen ($r_s=0.46$, $P<0.05$) and rise in cortisol ($r_s=0.42$, $P<0.05$). Pigs with high skin damage scores after mixing were those which had fought for longer during mixing ($P<0.001$) and they showed a smaller decrease in cortisol ($P<0.05$) than pigs with low skin damage scores. Pigs showed a significant decline in cortisol during mixing relative to control ($P<0.05$).

Combined treatment (driving and mixing). None of the above findings were significant but cortisol levels rose significantly in response to mixing ($P<0.01$). Frequency, duration and distribution of agonistic encounters during mixing did not differ between the mixing and the combined treatment.

Discussion

Electric goads are still commonly used to move pigs, even though it is well known that this increases a pig's heart rate and increases blood splashing in the meat. It was also observed (but not measured) that using electric goads did not appear to improve speed of driving. In some instances, using sticks to drive pigs resulted in severe skin damage in the middle and hind region.

It is still common practice to mix different rearing groups of one producer during transport and lairage despite the fact that pigs tend to fight during transport as well as in lairage (Bradshaw et al, 1995). The observed peak in aggression after half an hour contradicts earlier studies which showed that the majority of aggressive encounters after mixing occur in the first 30 minutes (Moss, 1978). However, Moss mixed two groups of five pigs and in the current study, groups consisted of at least 36 pigs and thus more than two rearing groups were mixed. A larger group size with more unfamiliar pigs may well prolong occurrence of fighting. A period of rest in lairage is generally recommended to allow pigs to recover from

transport and associated handling. It is believed that this will lead to the production of better meat (Tarrant, 1989) as well as being desirable from a welfare point of view (Warris et al., 1992).

The second experiment showed that in the mixing treatment the correlation between frequency of aggressive behaviour in the home pen and duration of fighting during mixing suggests a consistent response when pigs are presented with similar situations. In the case of the combined treatment (driving followed by mixing) this relationship is absent and the increase in cortisol was higher after the combined treatment compared with either of the other two treatments suggesting that pigs were more stressed under this condition.

It is concluded that, from the point of view of welfare, it may be better to slaughter the animals immediately upon arrival at the slaughterhouse because: 1) aggression and lairage time are associated with skin damage; 2) a combination of driving and mixing, which mimicks lairage conditions, is very stressful to pigs and fatigues them (which leads to a reduction in their predictability of reaction).

References

- Barton-Gade, P., 1993. Methods of assessing meat quality. Danish Meat Research Institute Roskilde, Report nr. 02.674/1.
- Bradshaw, R.H., Parrot, R.F., Goode, J.A., Lloyd, D.M., Rodway, R.G. and Broom, D.M., 1995. Behaviour and physiology of pigs during transport: response to mixing and duration of journey. This issue.
- GENSTAT 5 Committee, 1990. GENSTAT 5 Release 2 Reference Manual Supplement, R.W. Payne (Chairman), P.W. Lane (Secretary). NAG.
- Grandin, T., 1990. Design of loading facilities and holding pens. *Appl. Anim. Behav. Sci.*, 28: 187-201.
- Hessing, M.J.C., Hagelsø, A.M., Schouten, W.G.P, Wiepkema, P.R. and van Beek, J.A.M., 1994. Individual behavioural and physiological strategies in pigs. *Physiol. Behav.* 55: 39-46.
- Jensen, P., 1994. Individual variation in behaviour - noise or functional strategies? Proceedings of the 28th International Congress of the ISAE, Foulum, Denmark, 3-6 August 1994, pp 93-101.
- Lambooy, E., 1992. Behandeling van slachtvarkens in relatie tot kwaliteit. In: L.A. den Hartog, D.L. Schumer and M.I. Visser-Reyneveld (Editors), *Kwaliteitszorg in de Varkenshouderij. Van voer tot vlees*. Pudoc, Wageningen, pp. 95-104.
- Mendl, M., Zanella, A. and Broom, D., 1992. Physiological and reproductive correlates of behavioural strategies in female domestic pigs. *Anim. Behav.*, 44: 1107-1121.
- Moss, B.W., 1978. Some observations of the activity and aggressive behaviour of pigs when penned prior to slaughter. *Appl. Anim. Ethol.*, 4: 323-339.
- Patterson, H.D. and Thompson, R., 1971. Recovery of inter-block information when block sizes are unequal. *Biometrika*, 58: 545-554.
- Tarrant, P.V., 1989. The effects of handling, transport, slaughter and chilling on meat quality and yield in pigs - a review. *Ir. J. Food Sci. Technol.*, 13: 79-107.
- Warris, P.D., Brown, S.N., Edwards, J.E., Anil, M.H. and Fordham, D.P., 1992. Time in lairage needed by pigs to recover from the stress of transport. *Vet. Rec.*, 131: 194-196.

SESSION 3: LAIRAGE (Chairman: J. Hartung)

(Discussion Leader: P. Barton-Gade (DK))

- A. Fisher, Ire: I have a question to Carlos Santos? What was the effect of high humidities at 20°C and higher?
- C. Santos: Yes at these temperatures there are differences with different humidities, because pigs don't lose sufficient heat through breathing then and we have a negative effect on meat quality.
- J.M. Randall, GB: I also remember from a housing experiment, that at above 30°C humidity was important.
- D. Broom, GB: I have a question to Steve Brown. He found higher cortisol-levels at the arrival in lairage, which then went down, but were still elevated after three hours. I would not conclude from this that pigs must rest as long as possible. As we saw from the results of Nicoline Geverink fighting can be of major importance for welfare, and therefore we should kill the pigs as soon as possible, even when welfare is not equal to meat-quality at this point.
- S. Brown, GB: From the point of view of meat quality we found that it is better to let them rest 2-3 hours.
- P. Barton-Gade, DK: I disagree with Don Broom. Pigs are very difficult to drive when they are slaughtered immediately after transport. They have to rest first.
- P. Vingerling, NL: But we must let them rest and just mustn't let them fight and reduce fighting by putting together the pig transport-groups in delivery-pens before transport.
- P. Warriss, GB: We must think of the whole time in lairage. If pigs are more easy to drive after resting, that will reduce stress overall because less coercion will be needed.
- D. Broom, GB: Effects of lairage depends on the lairage-conditions, when the lairage is bad immediate slaughter may be better than a long resting time.
- A. Briese, G: We have lairages in Germany, where the pigs are driven around from one pen to another, so that the real resting time is much shorter than the time in lairage.
- P. Barton-Gade, DK: That just means that pigs must not be driven around during lairage.
- T. Jones, GB: A higher percentage of deaths on arrival is observed at higher temperatures, thus the time of the day should be taken into account.
- N. Geverink, NL: In my impression when the pigs were unloaded, they were looking around and could easily go not only to the lairage-pen, but also to the stunning-box.
- P. Warriss, GB: I do not agree, because driving to the stunning-box is not like driving to the lairage-pen.
- P. Barton-Gade, DK: And as I said before, they are more difficult to drive without resting.
- D. Broom, GB: Lairage duration should also be related to transport duration, e.g. Brazil (long distances, lairage is 8 h).

- A. Hanssen, NL: Could we advise longer lairage-times after longer transport-times for example?
- P. Warriss, GB: We transported our pigs for different distances, and we saw no interaction between the effect of distance and lairage-times. But we did not carry out experiments using very long transport-times (of 8-24 hours).
- K. v. Holleben, G: I want to come back to showering. Achim Schütte gave advice to shower once and said, that the activity of the pigs rose after showering. When pigs are very tired after transport, the activity they get after showering may be a positive activity. They then start exploring and lie down after the second or third showering. So more showering-intervals may be good.
- A. Briese, G: A question to Nicoline Geverink, do you think that long narrow lairage pens reduce fighting and second, could we reduce fighting by taking the fighters out of the pens?
- N. Geverink, NL: Most of the lairages have long narrow pens now, I think, they are good. By taking out the fighters..., perhaps others would take their role.
- P. Barton-Gade, DK: It's just good to keep them in smaller groups up to 15. In my opinion there must really be other ways of reducing fighting than by reducing lairage time.
- F. Serneels, B.: And we always have to take the background of the pigs into account.