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QUANTIFICATION OF PIG WELFARE BY BEHAVIOURAL PARAMETERS

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SUMMARY

Transport and associated handling always have some adverse effects on welfare. Indicators of welfare include behavioural responses which are dependent on genotype, coping strategy and experience of the animal. During fattening social status of the piglets can be determined by observation of behaviour in the home pen. Social status may also be determined by the outcome of "food competition" tests. An "open door" test can be used to test for individual degree of exploration and activity.

Pigs should be loaded and unloaded with minimum disturbance but this is seldom the case since driving is rarely done gently. Measured parameters during driving include the order of individuals in the group and the frequency of pushing by the driver. During mixing and in lairage the frequency and duration of aggressive behaviour may be recorded. During transport behavioural observations relate to the duration of standing, sitting or lying for individual pigs. Pigs tend to lie down in transit.

Despite considerable recent developments and recommendations welfare, design and handling in lairage is still a cause of distress to slaughter pigs. To examine the response of pigs, attention should be given to design and handling techniques. Duration in lairage and frquency of showering may also be recorded as well the treatment of pigs that are unable to walk.

INTRODUCTION

The most common means of transport for (slaughter) pigs is the lorry even though it is generally found that lorry transport is worse for pigs than rail, sea or air transport. Pigs are likely to suffer motion sickness during road transport, which may result in vomiting after eating 4 hours before transport (Bradshaw et al, 1995a; 1995b). For this reason pigs require careful preparation before transport and comprehensive plans for the journey should be made. The transport conditions are usually worse for slaughter pigs than for breeding animals.

The welfare of an individual is its state as regard its attempts to cope with its environment (Broom, 1991; Broom & Johson, 1993). Transport and associated handling always have some adverse affects on the welfare of pigs (v. Putten & Lambooij, 1982). Adverse effects are related to psychological, physical, environmental, metabolic and treatment factors (Figure 1). Indicators of poor welfare include behavioural responses indicative of coping ability. Where control systems are overtaxed the term stress is used (Broom & Johson, 1993); a well known disease related to transport is the Porcine Stress Syndrome (Tarrant, 1989).

Nowadays transport distances of pigs by road between farms or to the slaughterhouse are increasing because of the economic consequences of greater opportunities for long distance trade. Within the European Union (EU), free movement of animals from one member state to another has resulted in more long distance transports to slaughter. Regulations on the protection of animals during transport are laid down in the Council Directive of 19 November 1991. Article 3b states: Member States shall ensure that no animal shall be transported unless it is fit for the intended journey and unless suitable provisions have been made for its care during the journey and on arrival at the place of destination. Animals that are ill or injured shall not be considered fit for transport. Pending implementations of these provisions, Member States may, subject to the general provisions of the Treaty, apply relevant national additional rules. The conditions during transport and duration of transport and the welfare of transported animals are more and more the subject of discussion.

COPING STYLE

Pigs are kept under specific housing conditions for several months which vary according to the particular production system. After this period they have to be transported either to another farm or to a slaughterhouse. Individual pigs respond in different ways to stressors. The response is dependent on the genotype, coping style, treatment and experience of the animal. On the basis of their response, pigs can be divided into groups in which different behavioural and physiological characteristics may be noted. Pigs may be divided into active and passive individuals based on behaviour tests. The normal cortisol value in blood is higher in passive animals compared with active ones. However, after an ACTH challenge, the value is equal in

both groups. When piglets are placed on their back ("back" test) the active animals show a higher increase in heart beats than passive animals (Hessing, 1994). However, it should be noticed that behavioural characteristics vary in a population (Jensen et al, 1995). Based on agonistic interactions pregnant sows may be divided in 3 groups of animals with high success to win, low success and no success. The normal cortisol value is highest in animals with low success, while these animals respond highest on the ACTH challenge test (Mendl et al, 1992).

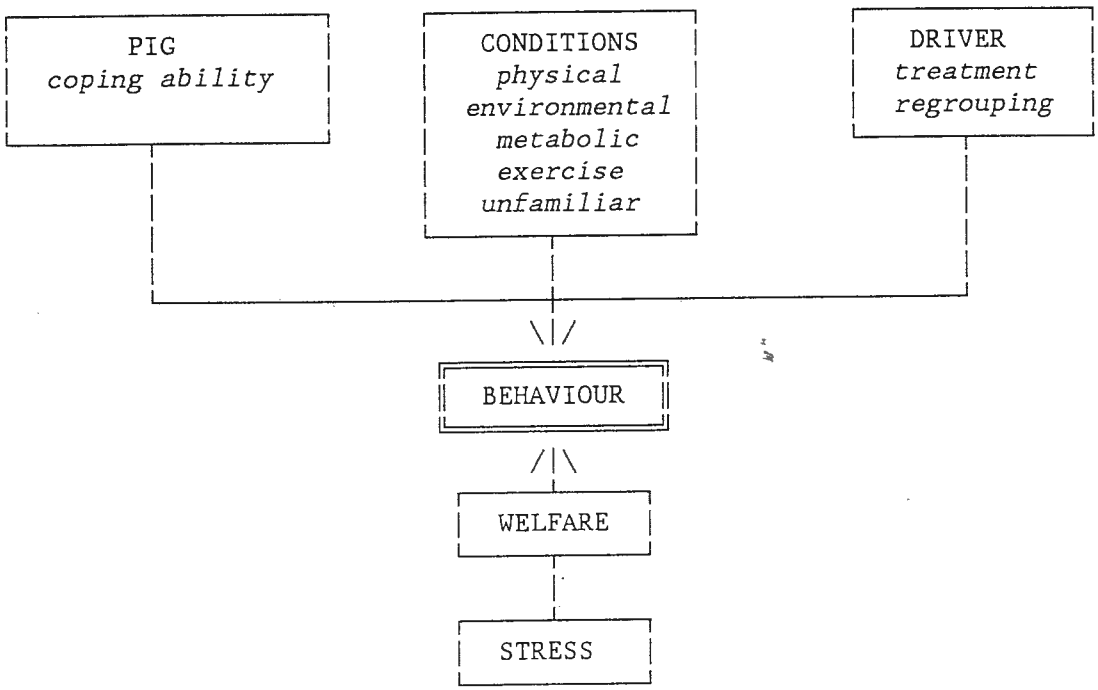

Figure 1: Factors that affect behaviour during transport and associated handling.

Coping style may correlate with response to transport and associated conditions. Transport conditions involve exposure to social stress (eg. mixing with unfamiliar pigs) and non-social stress (rough handling). Individual differences in behaviour in home pen conditions and during mild challenge tests may be related to subsequent reaction during transport, driving and mixing (Geverink et al, 1995). During fattening when the pigs are aged between 14 and 20 weeks the piglets can be tested for social status by scoring the agonistic interactions or by using a "food competition" test. In the first test social ranking of individuals may be determined by allowing a total of 4 hours of focally sampled data on agonistic interactions (bite, head knock, threat, displace, avoid). In the second test the pigs have no access to food for 20 hours prior to the test. At the start of the test a fixed amount of food is placed in the trough. For 15 minutes

interactions (bite, head knock, threat, displace, avoid) and frequency and duration of eating are scored. Finally, an "open door" test may be used to test for individual activity and exploration. In this test the door of a pen is opened and the reaction of pigs is recorded on video. The passage way next to the pen is blocked resulting in an area of about 6x1 m the pigs can enter. After 10 minutes the pigs are gently returned to the home pen. Parameters scored afterwards from video recordings are latency to leave the pen, frequency of crossing particular areas, exploration and social interactions.

LOADING AND UNLOADING

Procedures of loading and unloading, physical design of (un)loading gear and other unfamiliar animals are all factors which affect welfare. Drivers normally use electric goads, sticks or brooms to move the pigs forward while shouting, yelling and hitting. This is seldom done gently, because the drivers are always in a hurry (Connell, 1984; Geverink & Lambooij, 1994). However, drivers should treat the pigs correctly. Pigs should be loaded and unloaded quietly and the use of electric goads should be forbidden. The animals need to be able to observe their environment and walk easily from reduced light levels to better illuminated areas. The passage ways should be of a sufficient width and of a solid structure. Steel projections and channels in the wall are not acceptable. Climbing a loading ramp is difficult for pigs since the situation is often psychologically disturbing. The animals may simply refuse to try and even turn their sides towards the ramps. As a result the heart rate may increase to a level where the heart starts to loose synchronisation (v. Putten & Elshof, 1978). The angle of the loading ramp should not be greater than 15-20° (v. Putten & Elshof, 1978; Fraser & Broom, 1990). Descending a loading ramp steeper than 20° is difficult and should be avoided (Grandin, 1981).
Parameters to be recorded during driving consist of the order the individual pigs proceed along the passageway, and the frequency individual pigs are pushed by the driver. During mixing the frequency and duration of agonistic interactions as well as the identity of the initiator or receiver may be recorded. Data can be analyzed with The Observer / Video Tape Analysis System (Noldus, 1991). The relations between coping style and factors affecting behaviour during loading and unloading are mentioned in another chapter (See Geverink et al, 1995).

TRANSPORT

At the start of a journey pigs will explore the compartment and try to find a suitable place to sit or lie down. Sometimes aggressive interactions (fighting) are observed. It is observed that at a loading density of 235 kg/m^2 pigs lay down within a few hours after the start of a journey. At this loading density 110 kg pigs almost completely covered the floor of the vehicle. They lay

down when the vehicle was stationary and during the night. At a loading density of over 278 kg/m^2 or higher the compartment was clearly overcrowded. The consequence was a continual changing of positions and the pigs were not able to rest (Lambooij, 1988; Lambooij & Engel, 1991). A loading density for slaughter pigs of 235 kg/m^2 is suggested to be accepted as a compromise between animal welfare, meat quality and the economics of transport.

Table 1: Loading densities recommended by the EC-Working group (1992).

kg live weight	<25	60	100	120
m^2/animal	0.15	0.35	0.42	0.51
animals/m^2	6.60	2.80	2.35	1.96

Other aspects that affect the activities are the effects of rough or smooth journeys, duration of transport and the micro-climate. During short journeys pigs are most standing and sitting, while during a rough journey a higher number of pigs remain standing compared to a smooth journey (Bradshaw et al, 1995a; 1995b). Pigs lie down after 2 to 4 hours following the start of transit, thus during longer journeys the main activity is lying down. When pigs are artificially ventilated or well ventilated they are more quiet (Lambooij, 1988; Barton-Gade & Vorup, 1991).
As mentioned above the main activity of pigs during transport is lying down. Video observation during transport may be related to the number of pigs and the duration of pigs standing, sitting or lying down. When possible walking during transit and stops may also be noted.

LAIRAGE

After arrival at the slaughterhouse pigs need to be unloaded carefully and as soon as possible because ventilation in stationary vehicles is often very poor. The passageways need to be solid, while projections and channels should be avoided. The floors must not be allowed to be slippery. Different colours and shadows may frighten the animals and they walk easily from a dark to a lighter place. Electric goads are in common use in lairage, but, they cause stress to the pigs and should be banned (Grandin, 1990; Geverink & Lambooij, 1994; Geverink et al, submitted).
The width of a passage way is sufficient when 4 to 5 animals can walk side by side. Groups of about 10 to 15 pigs should be driven. Pigs may be discouraged from returning by using gates (Grandin, 1990). In Denmark a fully automated system which is controlled by a computer has

now been developed (Barton-Gade et al, 1992).

In front of the restrainer pigs are brought to a single or double file using a step by step design or via a curved crowed pen with an entrance restrictor to prevent jamming (Hoenderken, 1976; Grandin, 1990). In this part electric goads are particularly frequently used to reach the line speed (Geverink et al, 1995).

Despite of these developments and recommend\ations of welfare, handling in lairage is still a major cause of distress to slaughter pigs. To examine the behaviour of pigs special attention should be given to design and handling techniques. Parameters that can be measured are the distance from the unloading platform to the holding pen and further on from the holding pen to the restrainer, design of passage ways, the size of the holding pens and density in pig per m^2. Attention may be given to the use of tools (electric goads, sticks, brooms) and whether the driver uses these tools from the front or the back of the group. Lairage time and duration and frequency of showering may also be recorded along with the treatment of pigs that are unable to walk due to physical damage or exhaustion.

Behaviour of groups in lairage can be recorded on video tape after introduction of the pigs into the holding pen. A GR-M3 camrecorder may be mounted above the pen providing a viewing area which encompasses at least 90% of the area of the pen. Tapes may be subsequently viewed and analyzed with The Observer (Noldus, 1991). Frequency and duration of all aggressive interactions as well as the identity of the initiator and receiver may be recorded. In addition, behaviour can be sampled live for five 10-minute bouts. All aggressive interactions may be recorded with The Observer 2.0 on a Psion Organiser LZ 64 hand-held computer. Duration of the interactions observed may then be calculated and, at the start and the end of each bout, the number of animals sitting or lying may be recorded.

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1.2 Quantification of pig welfare by behavioural parameters (B. Lambooij), (Discussion leader: A. Fisher (Ire))

A. Fisher, Ire: I would like to make a few opening comments to set the scene for the discussion. The environmental and social stimuli that elict the patterns of behaviour that we measure in pigs are different from those, which we may readily perceive when we are observing. For example: the sensitivity to temperature, the poor ability for heat loss, hence the need for environmental measures; the importance of social order, the foundation of social order during mixing, which leads to aggression; the interaction between social order and competition for resources. The important behavioural parameters vary according to which part of the production system we are examining, i.e. we need to identify those behavioural parameters that are most relevant to welfare in the particular interest we are looking at. For example: housing: social order - coping strategy - aggression - fear of humans - feeding behaviour - exploratory behaviour - abnormal behaviour - stereotypy; handling procedures: reaction to stockmen - use of driving instruments by stockmen - order of movement - baulking - vocalisation; transport: basic behaviour patterns - behaviour related to the roughness of the journey - drinking and feeding behaviour - aggression - vomiting - retching; lairage: aggression - resting - cooling behaviour. We need to describe the behavioural response of a pig in relation to endogenous features as well as to external conditions (the environment, the driver, etc.). These endogenous features are influenced by the pigs' genotype, its coping strategy and social status, in a group and its previous experience. Identifying social status or coping strategy will enable to follow different subgroups and assess the welfare of those pigs in the new environment or situation. It is important for example to measure the capability of a pig to cope with a new environment (cfr. the food competition test by Dr. Lambooij). With the increasing sophistication of some livestock transport vehicles, where long journeys are permitted to be made, and where drinking water and feed may be available, these social factors and competition for resources will become more important. Generally behaviour during transport is limited due to space and environment, with resting behaviour being vital to ensure welfare, and aggression and exhaustion to be avoided.

K v. Holleben, G: First, if we have driving-systems in slaughter-plants, in which handling is very poor and electric prods are always used, we must either reduce slaughter-speed or improve the systems. Second, concerning injured or ill animals, which are not able to walk by themselves, in Germany since 1993 we are not allowed to transport these animals, except to medical attendance. We have to kill them where they are, either at the farm, on the transport vehicle or at any place in lairage.

B. Lambooij, NL: There are some contradictions now between welfare and the EU-regulations concerning hygiene. In the Netherlands EC-slaughterhouses are not allowed to slaughter injured animals, they have to be transported to another slaughterhouse, immediately stunned and slaughtered. The ease of driving is also genotype dependent. The speed of the slaughterline is economically important, but the use of electric goads causes 3% drip loss as a mean value.

B. Broberg, DK: Since 1/1/95 injured animals have to be slaughtered immediately according to a new EC-regulation, except when transport is possible without further stress.

P. Vingerling, NL: Future EC-regulations will define that special trucks need to be used for injured animals, depending on the degree of injury. However, what will be the objective method to classify injuries?

S. Holst, DK: In Denmark the injured animals must be killed on the farm, or stunned on the truck before slaughtering.

R.F. Parrott, GB: I want to ask a philosophical question. Is it better to produce stress-resistant animals and then take the risk, that more stress will be put on them during handling and transport or is it better to provide optimal conditions?

B. Lambooij, NL: The best will probably be a compromise of both: more resistant animals and better conditions. I agree that our environmental conditons should refer to the least coping performing animal.

P. Barton-Gade, DK: We have well designed systems, which work up to a slaughter speed of 800 pigs/hour with good welfare and we are now thinking about if all slaughter plants in DK should use these systems. Applying good handling and stunning conditions on less stress sensitive pigs is economically feasible as being proven in Denmark. We should make better use of the available knowledge.

P. Vingerling, NL: From the point of welfare we have to decide where to draw the line. Why is the available knowledge not applied? We need urgently good guidelines through the EC, without changing the animals too much.

T. Jones, GB: With the new EC-regulations at the moment, do you think that pigs will drink during transport if there are drinking facilities provided?

B. Lambooij, NL: Pigs are lying down most of the time during long distance transport. Experiments have shown that drinking behaviour has a low frequency, except in hot conditions. They may be too sick to drink, but I think you have to offer them water, so that they can drink, if they want to.

A. Schütte, G: As the halothane-positive pigs show stress very clearly, we can use them as indicators of whether a system is good or not.

B. Lambooij, NL: The problem is more an ethical question, i.e. what is the percentage of the problems we do accept.

E. Kallweit, G: I want to come back on loading-density. You showed the EU-numbers of 0,42 m^2/ 100 kg pig. In my opinion that is not enough. We advise 0,5 m^2/ 100 kg pig in Germany.

P. Barton-Gade, DK: Loading-density advices are very dependent on transport-conditions. If you have good ventilation and a short distance, you can transport pigs at a loading-density of 0,35 m^2/ 100 kg. This is used in Denmark and we have the lowest transport mortality in the world. For long distance transports where watering is necessary 0,42 m^2/pig is probably appropriate. For longer distances still eg. for breeding pigs, where both watering and feeding on the truck is necessary, 0,6m^2/ 100 kg is often used in Danish transports i.e. the advice we give for lairage.

P. Warriss, GB: You mentioned 'active' and 'passive' animals. Which of them should we produce?

B. Lambooij, NL: Active animals are more easy to drive, but they may stimulate each other, so we should have a mix of both, active and passive. In order to reduce fighting, we should either train the animals in mixing or avoid mixing.