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NEW LOW STRESS SYSTEM FOR PIG SLAUGHTER: EFFECT ON PIG BEHAVIOUR AND MEAT QUALITY

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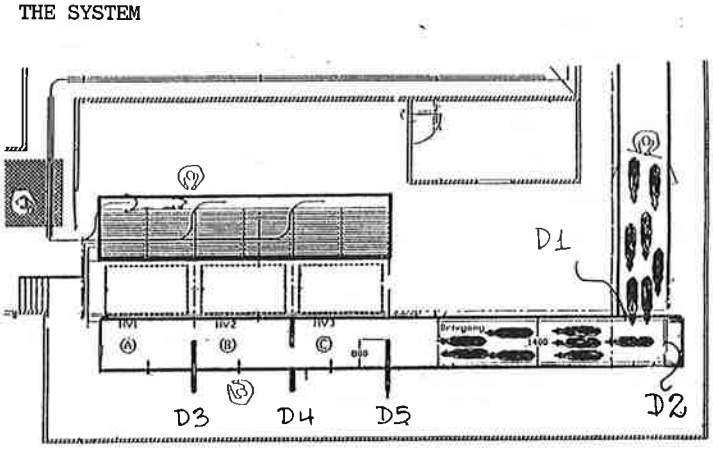
OBJECTIVES

Lining up pigs for stunning is a stressful area in pre-slaughter handling and problems increase with higher slaughter speeds. The aim of this work was to compare a new low stress system for pig slaughter with the conventional system with respect to pig behaviour and meat quality. The new system includes:

- no use of force other than guidance by moving gates
- utilisation of pig behaviour to facilitate forward movement
- no use of restraint during stunning/group stunning with co_2

The experimental set up was designed for 400 pigs per hour.

THE SYSTEM



Pigs are driven manually in groups of 15 into the system using a pig board and a sliding door, D1, is activated to close off the system. Pigs advance into areas A, B and C and at the same time push hoist gate, D2 moves behind the pigs. Video cameras are mounted above areas A and B. The number of animals are counted and when 4½ have entered A then sliding gate D3 closes and similarly for B and D4. The remaining pigs are brought up to C by D2, when D5 is closed.

In any group of 15 pigs there are 2-3 leaders, a number of followers and 2-3 timid pigs and it is important that the leaders do not lose contact with the followers or the flow will be interrupted. The labyrinth design slows down the lead pigs and keeps the group together.

Push hoist gate, D2, ensures that timid pigs will enter area C. All moving gates/parts are, incidentally, designed to stop at a counter pressure of 100 kg so that pigs are not forced forward or trapped in the system.

After subdivision, hoist gates HV1 HV2 and HV3 are raised and the opposite wall in the dividing area guides the pigs into the stunning box. When the walls reach their final position, the box side is raised from the floor to close off each box and the boxes lowered sequentially into CO_2. After stunning, pigs are tipped out, shackled and stuck.

METHOD

112 pigs lairaged in conventional pens (45 pigs per pen, 0.50 m^2/pig) and slaughtered via a conventional double race using a CO_2-compact equipment, where pigs are restrained singly during stunning, were compared with 113 pigs lairaged in groups of 15, 0.50 m^2/pig and slaughtered using the new system. The CO_2 concentration in the compact equipment was 80%, throughtime 60 seconds, in the new system 90% CO_2, throughtime 120 seconds. The material was balanced for producer and lairage time, which on average was 1 hour 15 minutes.

Pig behaviour was observed in both systems and 30 min. after sticking rigor development was evaluated in the shoulder area according to a scale 1 = not in rigor; 2 = slightly in rigor, and 3 = in rigor. 45 min. after sticking pH was measured in longissimus dorsi (lumbar region) and semimembranosus (centre portion) using a KNICK 655 pH-meter with a combination electrode, Ingold LOT 406-M6. Rigor in semimembranosus was measured using a rigormeter (Sybesma, 1966). 20-22 hours after slaughter internal reflectance was measured in the above 2 muscles and biceps femoris (centre portion) using the MQM equipment (Barton Gade & Olsen, 1984, Borggaard et al, 1989) as well as pH in these 3 muscles and semispinalis capitis. The results were evaluated using an analysis of variance.

RESULTS

Behaviour. As expected, pigs moved through the new system easily, without apparent stress and with no vocalisation. The excitation phase of stunning, which occurs after pigs have lost consciousness, started at 15.8 to 17.2 sec. after immersion in the gas for first and last pig respectively. Movement before excitation was minimal with no apparent distress to the animals. In the conventional system pigs were driven via a U-formed driveway to a double race system and, as many pigs were unwilling to enter the race/stunning box, goads had to be used to maintain pig flow. Stress levels and vocalisation were therefore much higher than in the new system. Due to the design of the compact equipment it was not possible to observe time to excitation for these pigs.

Meat Quality. Rigor development in the shoulder and pH-fall were significantly slower in pigs slaughtered in the new system (Table 1). However, meat quality the day after slaughter was similar.

Table 1 - Average Values for the new and conventional System

*** = p<0.001; * = p<0.05

Description	Rigor		pH 30 min.		MQM-value			pH 20-22 hours			
	shoulder	semim.	semim.	l.dorsi	b.fem.	semim.	l.dorsi	b.fem.	semim.	l.dorsi	s.cap.
New	1.18	3.83	6.62	6.63	75	59	44	5.62	5.56	5.68	5.94
Conven.	1.40	4.53	6.53	6.50	76	60	44	5.64	5.58	5.68	5.99
Signif.	*	ns	***	***	ns	ns	ns	ns	ns	ns	ns

6.2% of the traditionally stunned animals were PSE in biceps femoris (MQM-value ≥90) compared to 3.8% in the new system. No pigs showed PSE in longissimus dorsi or semimembranosus, i.e. MQM-values higher than 80 and 85 respectively. In addition there were more pigs with slightly elevated pH-values in the traditional system for 3 of the muscles measured:

	l.dorsi (pH 5.90-6.09)	b.femoris (pH 5.90-6.09)	s.capitis (pH 6.30-6.49)
New, % of pigs	2.9	1.9	4.8
Conventional, % og pigs	5.4	5.4	8.0

None of the pigs were considered DFD, i.e. had higher pH-values than 6.1 in longissimus dorsi, biceps femoris or higher than 6.5 (semispinalis capitis).

DISCUSSION & CONCLUSION

Pig slaughtered in the new system were less visibly affected during the driving to stunning than pigs slaughtered via the conventional system. They moved willingly through the system with no intervention from slaughterhouse personnel. Post mortem glycolysis was slower in pigs slaughtered in the new system but this had minimal effect on meat quality the day after slaughter. There was only a slight tendency for conventionally stunned pigs to have a higher PSE-incidence and more cases with slightly elevated pH-values. Pigs in Denmark are, however, not stress prone and the general level of meat quality was excellent in both experimental groups.

Stress measurements (cortisol, lactate and CK) have been carried out on a subset of this material as well as other pigs and these results will be reported separately. There is no doubt, however, that the new system gives a much better handling of slaughter pigs and improves working environment considerably by reducing noise levels. Capacity measurements have shown that division of pigs into smaller groups can be carried out at speeds of at least 800 pigs per hour and work is now going on to develop a prototype for high speed slaughter. This system, when combined with the fully automatic small-pen lairage system (Barton Gade et al., 1992), will ensure optimal handling with minimal human intervention at high slaughter rates and hence be an option for many meat plants world wide.

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KEY WORDS
Pigs, pre-slaughter handling, welfare, meat quality.