Effect of transport on porcine stress

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SUMMARY

Pigs were stressed most severely during transport if loaded just before feeding or transported in warm weather (over 10 C). In addition, increased transport time elevated the blood creatine kinase (CK) activity from farm up to the abattoir.

External temperature had a more prominent influence than the number of pigs on the temperature rise of the transport unit. Furthermore, driving speed had a significant effect on the air circulation of the vehicle.

INTRODUCTION

It is well known that there is a close relationship between meat quality and the pre-slaughter treatment of animals (FABIANSSON et al. 1979, von MICKWITZ 1982, NIELSEN 1981). Stress susceptible pigs had ten times the death rate than normal pigs during transport (GRANDIN 1980). Moreover, the death rate plotted against the temperature showed a hyperbolic curve which rised steeply above 18 C and almost vertically above 25 C (WILLIAMS 1985). Transport losses can be reduced by driving early in the morning in summer and by effective ventilation (FABIANSSON et al. 1979, von MICKWITZ 1982, NIELSEN 1981, WILLIAMS 1985).

The financial losses due to transport losses of pigs were about one million Finnish marks per year. The weather is considerably different in Finland than in Central Europe, winter is very cold -30 C whereas summer is warm 30 C. These fluctuations resulted in special demands for animal transportation by road in Finland. The purpose of this work was to investigate the effect of transport on porcine stress and to study air ventilation in a modified transport unit.

MATERIAL AND METHODS

Porcine stress

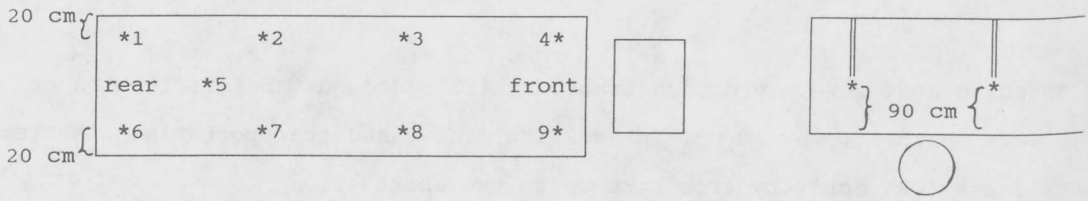
The test animals consisted of 103 pigs of which one died during transport. Air circulation was not measured in these lorries. These pigs were from the following breeds: 39 Finnish Landrace (L) and 8 Finnish Yorkshire (Y) pigs, and 56 LxY crosses. Treatments were repeated 22 times, and the programme of one treatment is described earlier (HONKAVAARA 1988). The study disrupted normal practice as little as possible. Porcine stress was evaluated by the change in the CK activity from the farm up to the unloading:

CK change (%) = 100 x [(CK during unloading - CK on farm) : CK on farm].

Air ventilation

The length, width and height of the modifiable transport unit were respectively 8,50, 2,55

and 2,35 (front) and 1,95 m (rear). There were installed nine anemometer probes (model TA-AH1, Envic, Finland) for air temperature (C) and flow (m/s) measurements in the vehicle. One of the probes was in the middle of the rear and the rest were as presented below:



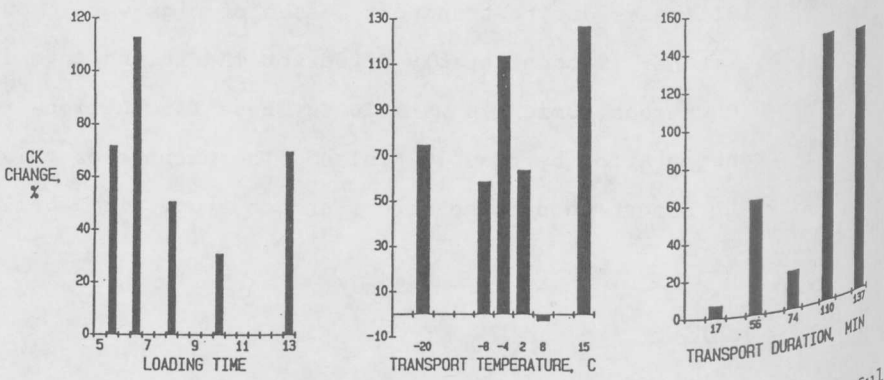
The results were registered with digital displays in the cab. The test truck was used for commercial pig transportation. In order to study the effects of driving speed, external temperature and the number of pigs on the air temperature and flow in the vehicle measurements were done during loading and transport.

RESULTS AND DISCUSSION

Porcine stress during transport

The effects of loading time of day, transport temperature and duration on porcine stress were evaluated by the change in CK activity from the farm up to the unloading (Figure 1). In general pigs were fed a restricted ration twice a day at 8-9 o'clock a.m. and at 2-3 o'clock p.m.. Results suggested that pigs were stressed most severely during transport if they were

Figure 1.
Effect of loading time of day, transport temperature and duration on porcine stress during transport.



loaded just before morning or afternoon feeding. In contrast transport was least stressful when pigs were loaded at 9-10 o'clock a.m. that was between the two feeding periods.

During transport pigs were stressed prominently on heavy frost (-20 C), more prominently on small frost (-4 C) and most prominently in warm weather (above 15 C). Whereas transportation in cool weather (about 8 C) was least stressful for pigs (Fig.1).

In general increasing transport time resulted in elevated CK values (Fig.1). Thus pigs were stressed least during a trip of 17 min, while maximum stress was found during the journeys of 110-137 min. An exception to these findings was the low CK change after a trip of 74 min that could be due to high CK activity of the pigs on farm.

Effect of external temperature

Results showed that internal temperature of the transport unit rised most prominently (on an average 9 C) in cool weather (-1 to 5 C, Table 1). However the external and internal temperatures were almost equalized in warm weather (above 15 C).

Table 1. Effect of external temperature on the temperature rise in the transport unit during loading.

External temperature C	Number of measure-ments	The average number of pigs	The average temperature in the vehicle, C		Temperature rise in the vehicle C
			in the beginning of loading	at the end of loading	
-1 - 5	30	51	3,5	12,4	8,9
6 - 7	58	47	7,3	13,1	5,8
8 - 9	47	48	9,0	15,3	6,3
10 - 11	32	51	10,9	18,1	7,2
12 - 13	32	52	13,3	20,3	7,0
14 - 15	33	50	14,4	20,3	6,0
16 - 19	28	52	13,9	20,1	6,2
20 - 26	39	51	17,3	22,1	4,8

Effect of the number of pigs

In order to study the effect of the amount of pigs on the temperature rise of the transport unit during loading the results were divided into seven classes as shown in Table 2.

Table 2. Effect of the number of pigs on the temperature rise in the transport unit during loading.

Number of pigs	Number of measure-ments	The average external temperature C	The average temperature in the vehicle, C		Temperature rise in the vehicle C
			in the beginning of loading	at the end of loading	
35 - 44	30	8,4	9,5	15,4	6,0
45 - 46	44	9,2	9,9	15,1	5,2
47 - 48	29	11,1	9,6	16,3	6,6
49 - 50	59	14,2	13,4	19,6	6,2
51 - 52	78	10,6	9,7	17,1	7,4
53 - 54	27	13,6	12,2	17,6	5,4
55 - 61	32	12,7	12,2	19,1	6,9

In spite of the number of pigs, the lower external temperature the higher was temperature rise during loading. Thus external temperature had a more prominent influence on the temperature rise in the transport unit than the number of pigs during loading.

Effect of driving speed

Increasing driving speed from 40 to 60 km/h had no significant effect on the air flow in the vehicle. Moreover, air circulation was poorest at the rear. Further increase in driving speed to 80 km/h improved air ventilation throughout the transport unit. However increasing driving speed from 80 to 90 km/h would not improve air circulation. As a consequence, air flow was good, about 2 m/s in the middle, poor in the front and poorest at the rear.

CONCLUSIONS

The present results suggested that high porcine stress in small frost, -6 to 0 C occurred due to fluctuating temperatures and due to closed ventilation slots which were not opened until external air temperature raised over 0 C. Therefore the improved cooling of pigs due to a better ventilation could decrease porcine stress.

The weather is cosiderably colder in Finland than in Central Europe, therefore it is not possible to use so large size of ventilation openings as presented by von MICKWITZ (1982). Air ventilation measurements in a test truck showed that it was possible to achive an adequate and uniform air circulation at the level of pigs head in practice. This was done by mechanical ventilation during loading, and by making the slots in certain places to develop effective and free, unmechanical ventilation during transport. These results are applied to commercially available trucks for animal transportation.

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