1:2 Watering and feeding pigs during road transport for 24 hours

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Introduction

Transport is stressful for the animals and has implications for their well-being The stressors to which the animals are exposed are many and varied, such as: separation from a familiar environment and familiar animals, loading and unloading, changes in temperature and air movements, noises, vibrations, jolting and deprivation of food and water (Steinhardt & Lyhs, 1974; Augustini, 1976; Dow, 1976; Hails, 1978).

In stressed or fatigued pigs the energy rich posphate stores in the muscle are relatively low at slaughter and these pigs may exhibit high rigor values after death (Sybesma, 1966; Sybesma & Van Logtestijn, 1967; Eikelenboom, 1972). In stress-prone pigs a stress situation results in a rapid depletion of glycogen and consequently a rapid pH fall in the muscle. In fatigued animals the glycogen store is almost exhausted at the moment of slaughter so that the muscle pH remains relatively high. In stress-susceptible pigs, ante-mortem stress results in a high body temperature. This leads to increased muscle temperature post mortem and an accelarated breakdown of energy rich phosphates (Sybesma & Van Logtestijn, 1966).

It is stated in a convention (Council of Europe, 1972), which is accepted by the member countries of the EEC that animals may not be left without water and food for longer than 24 hours during transport. However, it appeared in previous experiments (Lambooy, 1983; Lambooy et al., in prep.) that the water intake in pigs is very much restricted during road transport. It might be possible to increase the water intake by resting the animals off the vehicle during stops in transport.

An investigation was carried out to examine the possibility of watering and feeding pigs in a shed during stops in transport.

Material and Methods

Six journeys with the Institute's vehicle were organised. The pigs were transported 3x8 hours and rested 2x1 hour in a shed at the Institute's farm while they were provided with water (ad lib) during three journeys or provided with water (ad lib) and food (0.4 kg dry pellets/pig/resting period) during the other three journeys.

At a commercial farm, 24 pigs were loaded and transported to the Institute's farm. After weighing, the 24 pigs were transported for 8 hours and rested in the shed for 1 hour. Four pigs were separated in a pen. These 4 pigs remained in the pen while the other 20 pigs were transported again. After the second 8 hour transport the pigs were rested again for 1 hour in the shed. Again, 4 pigs were separated in a pen and remained in the pen while the other 16 pigs were transported for 8 hours. After the third 8 hour transport all pigs were weighed and were transported to a slaughter-house (4 km distance) and slaughtered.

At the end of the resting period the consumed water and food was noted. The pigs which were separated in a pen were provided with water (ad lib) and their ration of food while the other pigs were transported. Every hour the consumed water was noted.

Upon arrival at the slaughter-house the pigs were unloaded and slaughtered as soon as possible. After stunning (300 V) and sticking samples of slaughter-blood were collected in heparinised tubes. During evisceration the bladder was separated and the ureters ligatured. As soon as possible the blood and urine samples were transported to the laboratory for chemical analyses. The meat quality parameters, pH_1 and temperature of the SM (m.semimembranosus) and the LD (M.longissimus dorsi) and the rigor mortis of the SM were measured 45 minutes post mortem. The pH_2 of the SM was measured 20 hours post mortem and the cold carcass weight was recorded.

Heamoglobin was measured colorimetrically with the Hemoglobin Test Combination (Boehringer, Mannheim) and the heamatocrit was determined according to the Wintrobe-method. After deproteinisation, plasma glucose was determined by the glucose oxidase method (GOD-Perid method; Boehringer, Mannheim). Free glycerol in the plasma was determined enzymatically by the Boehringer Triglyceride Test Combination (Boehringer, Mannheim). The density, pH and ketone bodies of the urine were estimated with a N-Multistix (Ames, U.S.A.). The data were statistically tested by an analysis of variance.

Results

Every 8 hours the pigs were transported for about 500 km. During the journey the animals were observed to lie down quietly in the truck. At unloading the pigs always walked easily into the shed and reloading was also easy to perform.

In the shed the pigs went first to the feeder troughs (if available) to eat something and then to the water troughs to drink something after which the pigs observed the environment. Thereafter they ate or drank or laid down in a wet place or in the trough with water. Within half an hour in the first resting period most pigs laid down and sometimes fighting was observed. Once it was observed that a pig vomited after eating.

The pigs which were transported for another 8 hours showed the same described behaviour after being unloaded again. However, they laid down sooner compared with the first resting period and some pigs laid down immediately without eating or drinking. At the end of the second resting period the pigs did not eat all the food which they were offered (Table 1). The total amount of water consumed averaged 1.6 l/pig during the 2x1 hour resting period (Table 1).

The pigs which had remained in the shed during the second 8 hour transport finished their ration of food within about 10 minutes during the second resting period and drank some water afterwards. Most of the time these pigs laid down in the pen. Within the first 3 hours after transport nearly all of the water was consumed. The total amount of water consumed by these pigs averaged 4.1 l/pig (Table 1).

The pigs which were separated after 2x8 hours of transport took many hours (about 6-8 hours) to finish their ration of food. They laid down and ate and drank sometimes (Table 1). The total amount of water consumed by these pigs averaged 2.8 l/pig.

The pigs provided with water and food drank 0.2-0.1 l water more than pigs provided with only water.

The live and carcass weights and measurements made of the meat quality and the blood and urine are summarised in the Tables 2 and 3. Significant differ between fed and non-fed pigs were not observed, however, the glucose level higher and the glycerol level was lower in the blood plasma while the pH of urine was higher in the fed pigs. Significant differences ($p < 0.05$) were observed between pigs transported for 1x, 2x or 3x8 hours in the glucose level of the plasma and the pH of the SM, which were lower and higher respectively in pigs transported for 2x8 hours.

Discussion

The length of the journey in this experiment is comparable with international journeys by road through Europe. Different from international journeys is the resting period in a shed after 8 hours of transport to provide the pigs with water and food.

The pigs transported for 3x8 hours and given a resting period of 2x1 hour in shed (during which water was provided) consumed an average of 1.6 l water while pigs transported for 30 hours (Lambooy, 1982) with water provided in trailer for the last 7 hours only drank 0.65 l water/pig. Pigs transported 6 hours and a resting period of 1 hour (during which water was provided) consumed an average of 2.65 l water/pig (Warris et al., 1983). However, Pigs transported for 1x8 hours consumed during the rest of the period in the shed 2.1 water of which nearly all was consumed within 3 hours after transport. This appear that pigs consume a restricted amount of water during transport, but amount may increase when the pigs are rested in a shed and when the period watering is of sufficient length. However, the amount of water consumed by pigs transported for 1x8 hours is restricted compared with the amount of 20 kg water/day/pig for animals of about 100 kg live weight under normal conditions (The National Research Council, 1979).

Another consideration is that pigs drink insufficient water in the absence food (Stephens, 1979). In our experiment the amount of water consumed was greater (0.1-1.0 l water) in pigs provided with water and food compared with pigs provided with water only (Table 1).

Differences in physiological parameters in relation to more or less water were not observed (Table 2 and 3). However, Warris et al. (1983) found an increased protein concentration in the plasma of pigs transported for 6 hours implying that haemoconcentration had possibly occurred in these animals, but this might have changed after 24 hours transport.

Pigs transported 1x8 hours drank more water and ate more food than pigs transported for 2x and 3x8 hours, moreover the last-mentioned pigs laid down sooner in the second resting period. This observation might point to the pigs being fatigued. An explanation could be the loading and unloading and transport; this treatment is stressful for pigs (Lendfers, 1974; van Putten & Elshof, Hails, 1978; Warris et al., 1983). However, it was easy to load and reload pigs.

At the same time the pH_1 and the temperature of the SM and the LD 45 minutes post mortem were at a rather high level. Although the rigor and ultimate pH values were within normal limits (Table 2), which do not point to exhaustion. A very high (> 6.5) pH in combination with a high (> 10) rigor value of the is thought to be related to exhaustion before slaughter (Sybesma & Van Logtes

1967; Verdijk, 1974). Thus, observations of the live animals and evidence meat quality parameters are conflicting.

The combination of a rather high pH and a low rigor was also observed after transport for 30 hours (Lambooy, 1982). In our experiment the ultimate pH was measured. This ultimate pH was within normal limits (Van Logtestijn, 1965), which suggests that the pigs were not exhausted ante mortem. Augustini (1976) concluded that pigs transported over 300 km were in a better condition than transported over 30 km and Warris et al. (1983) did not observe an effect of transport distance on meat quality as measured by pH and muscle temperature.

Pigs may maintain the glucose level during fasting and acetonaemia does not occur (Swiatek et al., 1968; Van den Bergh, 1977; Kertiles et al., 1979). In our experiment the glucose level was higher and the glycerol level was lower in the blood plasma in fed pigs compared to non-fed pigs. However, both blood parameters did not differ significantly.

In conclusion:
The results of these experiments suggest that during long distance transport road (3x8 hours) of pigs with resting periods of 2x1 hour in a shed, the water intake is very much restricted, but the water intake may increase when the resting period is at least 3 hours. At the same time the food consumption is restricted and slow.

The observations of fatiqued pigs are in conflict with the meat quality parameters as indicators of stress.

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Table 1. The water and food intake of pigs during the resting period. The water was available ad lib and the food restricted (0.4 kg dry pellets/pig/resting period). After the first 8 hour transport the 24 pigs were unloaded and rested for 1 hour in a shed. Four pigs were separated and remained in a pen in the shed during the second transport of the other 20 pigs. After the second 8 hours transport the pigs were rested for 1 hour and again 4 pigs were separated and remained in a pen in the shed during the third transport of the other 16 pigs.

Journey no.	Weather conditions during transport temperature (°C)			humidity (%)	Water intake per pig (litre) hours of transport			Food intake per pig (kg) hours of transport		
	min.	average	max.		1x8	2x8	3x8	1x8	2x8	3x8
1	2	7	13	75	3.0	1.7	1.2	-	-	-
2	2	9	13	77	3.1	4.4	1.5	0.80	0.80	0.60
3	8	12	16	76	4.3	2.8	1.8	-	-	-
4	14	17	21	77	6.4	3.6	1.6	0.80	0.75	0.70
5	11	15	19	75	3.5	1.2*	1.6	-	-	-
6	16	23	29	70	4.5	2.9*	2.0	0.80	0.80	0.78

* Trough was turned over.

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Table 2. The mean (± s.d.) live and carcass weights and meat quality parameters of pig groups provided with water or water and food and transported 1x8, 2x8 or 3x8 hours. For details see Table 1 ($a=p < 0.05$, according to the analysis of variance)

Treatment	Live weight (kg) at start	Live weight (kg) at finish	Slaughter weight (kg) (cold)	pH_1 SM	pH_1 LD	Meat quality rigor temperature (°C)		pH_2 SM	pH_2 LD
watered	104.9±9.2	100.0±9.2	79.5±7.7	6.51±0.31	6.56±0.27	4.7±0.3	40.8±0.5	40.5±0.8	5.79±0.23	5.67±0.22
watered and fed	106.5±6.5	101.8±6.3	80.3±5.5	6.57±0.28	6.60±0.27	3.9±0.3	41.0±0.8	41.0±0.6	5.76±0.28	5.68±0.30
1 x 8	106.6±7.7	101.7±7.2	80.5±6.3	6.45±0.24[a]	6.47±0.29	4.5±0.2	40.8±0.7	40.8±0.7	5.77±0.26	5.68±0.19
2 x 8	107.8±7.7	103.9±8.2	82.2±6.5	6.60±0.29[a]	6.53±0.28	4.6±0.3	40.9±0.7	40.9±0.6	5.77±0.27	5.65±0.35
3 x 8	104.9±8.0	100.0±7.8	79.1±6.7	6.54±0.30[a]	6.61±0.26	4.2±0.3	41.0±0.9	40.7±0.8	5.78±0.25	5.68±0.25

Table 3. The mean (± s.d.) levels for blood and urine parameters of pig groups provided with water or water and food and transported 1x8, 2x8 or 3x8 hours. For details see Table 1. ($a=p < 0.05$, according to the analysis of variance).

Treatment	Blood haemoglobin (g/100 ml)	Blood haematocrit (%)	Blood glucose (mg/100 ml)	Blood glycerol mmol/l)	Urine density (kg/l)	Urine pH	Urine ketone bodies (mg/100 ml)
watered	11.9±1.2	44.0±3.4	56.8±20.6	0.26±0.08	1.023±0.007	6.25±0.46	4.8±7.6
watered and fed	12.4±1.3	43.0±3.9	73.3±35.9	0.21±0.06	1.023±0.006	6.50±0.63	3.9±5.1
1 x 8	12.0±1.0	44.2±3.6	66.9±34.2[a]	0.26±0.09	1.024±0.006	6.33±0.54	6.0±9.3
2 x 8	12.4±1.2	43.9±2.7	58.8±26.1[a]	0.22±0.06	1.021±0.007	6.46±0.69	4.4±4.7
3 x 8	12.1±1.3	43.3±3.9	66.0±30.3[a]	0.24±0.08	1.023±0.007	6.36±0.54	3.9±5.9