

THE STRESS SYNDROME AND MEAT QUALITY

DEATHS DURING AND AFTER TRANSPORTATION

OF PIGS IN GREAT BRITAIN

Authors: W. M. Allen and L. P. Smith,
I.R.A.D., Compton, Berkshire,
and Meteorological Office, Bracknell.

In one British processing plant which received 6.8 million pigs during a 13 year period, 1961-73 inclusive, study of the deaths on arrival and during subsequent lairage confirmed a marked seasonal effect on the rate of losses which varied annually from 0.092 to 0.115% of pigs transported. There was a close correlation, when the mean daily temperature was above 8°C, between the proportion of total deaths and daily temperature. It appeared that the losses during transport appeared to be independent of the total hours of sunshine and relative humidity. This data was compared with pigs transported to several other factories and it was concluded that the total distance travelled and the bodyweight of pigs destined for slaughter did not affect the rate of deaths. An increase of the holding time of pigs in lairage subsequent to transport appeared to increase losses.

Refrigeration of transporters or transport during the cooler night period would result in decreased losses. Economically, however, the rate of loss - approximately 3p for a £30 pig - would not justify such extensive alterations in transport practice. A considerable reduction in losses following tranquilisation reported on the continent would be of limited value in Britain because of the short-term effect of these drugs and the greater distances that pigs are transported. Their use cannot be advocated because of residue hazards.

MORTALITÉ AU COURS ET À LA SUITE DU TRANSPORT

DE PORCS EN GRANDE BRETAGNE

W. M. Allen et L. P. Smith,
I.R.A.D., Compton, Berkshire et
Meteorological Office, Bracknell, Berkshire.

Une étude sur la mortalité de porcs à l'arrivée et pendant le logement dans une entreprise de transformation en Grande Bretagne, qui avait reçu 6.8 millions de porcs au cours des années 1961-1973 inclusivement, a confirmé un effet saisonnier prononcé sur le taux des pertes, qui variait annuellement de 0.092 à 0.115 p.c. des porcs transportés. Il existait une corrélation étroite entre la proportion des pertes totales et la température journalière, quand la moyenne de celle-ci s'élevait au-dessus de 8°C. Les pertes subies au cours du transport paraissaient être indépendantes du total des heures de soleil, ainsi que de l'humidité relative. Ces données furent comparées à celles concernant des porcs transportés à plusieurs autres usines; on a conclu que ni la distance totale parcourue, ni le poids des animaux destinés à l'abattage influençaient sur le taux de mortalité. Une augmentation de la durée du logement, suivant le transport des porcs, semblait augmenter les pertes.

L'utilisation de camions réfrigérants, au lieu du transport nocturne, diminueraient les pertes; mais, du point de vue économique, le taux des pertes - 3p par porc de £30.00 - ne justifierait pas de modifications importantes dans la pratique du transport. La diminution considérable des pertes, signalée en Europe continentale à la suite de l'utilisation de tranquillisants, n'aurait qu'une valeur limitée en Grande Bretagne, à cause de l'effet à court terme de ces produits, ainsi que des distances plus grandes du transport. Les tranquillisants ne peuvent être préconisés à cause du risque de résidus.

TODESFÄLLE WAHREND DES TRANSPORTS UND DER DARAUFFOLGENDEN
AUFSTALLUNG BEI SCHWEINEN IN GROSSBRITANNIEN

Eine Untersuchung der Todesfälle bei Ankunft und während der Aufstallung in einem britischen Fleischverarbeitungsbetrieb, dem in Laufe der Jahre 1961-1973 inklusive 6.8 Millionen Schweine zugeschickt wurden, bestätigte eine markante, saisonbedingte Einwirkung auf die Verlustrate, welche jährlich zwischen 0.092 und 0.115% der transportierten Schweine schwankte. Es bestand eine enge Korrelation zwischen der Proportion der gesamten Todesfälle und der Tagestemperatur, wenn der Mittelwert der letzteren über 8°C betrug. Es stellte sich heraus, dass Verluste während des Transports von den gesamten Sonnenstunden sowie von der relativen Feuchtigkeit unabhängig waren. Diese Ergebnisse wurden mit Werten, die sich auf Schweine in mehreren anderen Fabriken bezogen, verglichen; man schloss daraus, dass weder die zurückgelegte Transportstrecke, noch das Lebendgewicht der Schlachtschweine eine Einwirkung auf die Ziffer der Todesfälle hatten. Eine dem Transport folgende Verlängerung der Stallhaltung schien die Verluste zu erhöhen.

Transport im Kühlwagen oder während der Nacht würde die Verluste vermindern. Vom ökonomischen Gesichtspunkt aus wären aber solche weitgehenden Neuerungen in der Transportpraxis nicht berechtigt, da die Verlustrate nur zirka 3p pro £30.00 Schwein beträgt. Eine erhebliche Verringerung der Verluste mittels Beruhigungstherapie, gemäss den Berichten vom europäischen Kontinent, wäre in Grossbritannien nur von beschränktem Wert, weil diese Arzneimittel eine kurzfristige Wirkung haben, wogegen die Distanzen des Schweinetransports grösser sind. Die Anwendung dieser Beruhigungsmittel ist wegen der Gefahr von Residua nicht zu befürworten.

THE STRESS SYNDROME AND MEAT QUALITY

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DURING AND AFTER THEIR TRANSPORTATION

W. M. ALLEN and L. P. SMITH
Institute for Research on Animal Diseases, Compton, Berkshire,
and Meteorological Office, Bracknell, Berkshire, England.

The increasing incidence of deaths of pigs during transportation has been recognised in several European countries. Thus in the Netherlands (Heutgens, 1970; Lendfers, 1970) and in Germany (Lohr, 1970) an increase has been observed from 200/100,000 (0.2%) to more than 700/100,000 (0.7%) during the 1960's. In the Netherlands the deaths occurred during transport to the factories and within lairage while in Germany deaths occurred during transport to market. Cedervall (1968) in Sweden reported a similar average rate of deaths during transport, of 350/100,000 (0.35%) during the years 1964-66 inclusive. In Britain data from one factory reveal that the proportion of loss during transport and lairage from 1970-72 inclusive was considerably less, averaging 70/100,000 (0.07%) (Allen, Hebert & Smith, 1974). All the observations agree in finding a seasonal increase in the losses which is closely related to environmental temperature and reaches a peak during the hot summer months.

This report uses data from other British factories. These have been compared with our previous observations of the effects on the incidence of deaths of environmental temperature, relative humidity and the total daily hours of sunshine. In addition the data have been studied to assess (i) whether there was a gradual increase in the proportion of deaths during the same period as was observed by Heutgens (1970), Lendfers (1970) and Lohr (1970), and (ii) whether the proportion of losses was influenced by the bodyweight of the pigs or by the distance that the pigs were transported.

The similar pathogenesis of these temperature dependent deaths, the deterioration of meat quality and the susceptibility to the acute stress syndrome has been described by Harrison (1972). During physiological adaptation to stress the susceptible pigs tend to shift energy utilisation from aerobic to anaerobic pathways (Allen, Berrett et al., 1970) with a concomitant increase in heat production (Berman, Harrison et al., 1970). Thus, to control these losses, heat production due to unaccustomed physical exercise and the stress of transport should be reduced to a minimum. Hydraulic lifts to load pigs into transporters and pharmacological tranquilisation have both been utilised in an attempt to control losses (Lendfers, 1970; Devloo, 1970) and the potential use of these methods in Great Britain will be discussed.

Observations

Most of the data for this study were obtained from the daily register of one factory, A, which recorded the number of pigs received, their bodyweight, their geographical origin and also the numbers which were slaughtered or were dead on arrival or found dead in pens. The weight of all pigs transported to this factory was greater than 77 kg. The standard procedure for reception of the pigs was for them to be unloaded and then retained within the lairage for a period of rest before slaughter. This period varied from a few hours to 18 hours but was not recorded precisely.

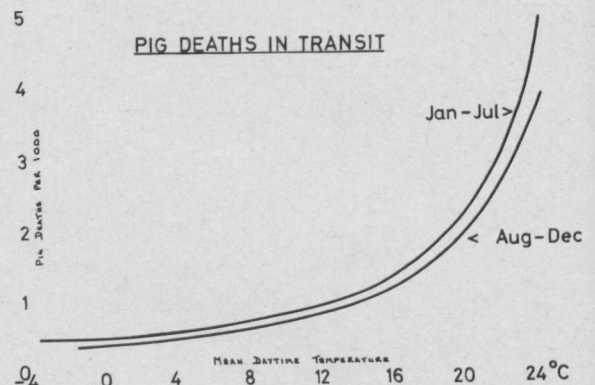
TABLE I
Proportion of pig deaths during transportation and lairage 1961-73 inclusive and the effect of temperature.

No. dying per 100,000	Year	Mean '61-'73		Mean day temperature (°C)	No. dying per 100,000 (a + b)	Jan-July	Aug-Dec
		a) during transportation	b) in lairage				
53	1961	62	47	-3.5	42	42	42
53	1962	62	47	-1.5	57	57	57
62	1963	42	42	+0.5	55	55	55
55	1964	55	45	+3.5	67	67	67
54	1965	54	50	+6.5	62	62	62
54	1966	54	46	+9.5	68	68	68
52	1967	52	45	+12.5	92	92	92
50	1968	50	44	+15.5	117	117	117
52	1969	52	49	+18.5	171	171	171
55	1970	55	42	+21.5	248	248	248
46	1971	46	46	+24.5	655	655	655
37	1972	37	59	+27.5	2029	2029	2029
46	1973	46	60	+27.5	60	60	60

Additional data was obtained for 1972 only from factory B. This factory received some pigs weighing more than 77 kg but the majority weighed less than 77 kg bodyweight. Pigs were transported to this factory from as far as 480 km. Factories C and D also received pigs weighing less than 77 kg bodyweight. Pigs were not usually held in lairage at these three factories for more than a few hours.

During the period 1961-73 inclusive the total number of pigs transported annually to factory A varied between 395,000 and 600,000. The number of deaths per 100,000 pigs in each year is shown in Table I and are subdivided into the number of pigs dying during transportation and the number dying while being held in lairage. During the 13 years the average numbers of pigs dying per 100,000 pigs transported were 55 during transport and 49 in lairage. These proportions did not increase during the period although on some occasions there was a 20% difference between successive years.

As had been observed previously (Lendfers, 1970; Allen et al., 1974) there was a marked seasonal distribution in the losses so that during the summer months of June and July the death rate was approximately two and a half times greater than during the winter period. Fig. 1 demonstrates the relationship between the number of deaths per 1,000 pigs and the mean daytime temperature. With mean daytime temperatures up to 8°C deaths were almost independent of temperature, between 9°C and 16°C there was a slow increase in the number of losses and above 16°C there was a sharp increase. Above a mean daytime temperature of 22°C the proportion of losses increased rapidly. As observed previously (Allen et al., 1974) the effect of high temperatures was less marked during August - December than during January - July.



The rate of deaths occurring during transport was also compared with the variations in external relative humidity. There was no evidence suggesting that high external environmental humidity affected these losses. The humidity inside the transporter is, however, probably more important because of high temperatures the pig produces up to 100% humidity in its local environment. Low humidity may be associated with the slightly increased losses observed at temperatures below freezing when evaporative heat losses may precipitate cold stress. A similar increase in losses at very low temperatures has been described in Hungary (Kostyal, 1964).

The relationship between transport losses and the total daily hours of sunshine was similarly evaluated. It was concluded that the total number of hours of sunshine did not influence the proportion of losses until the mean daytime temperature rose above 17°C. At this temperature the risk of loss is already beginning to increase rapidly.

The data shown in Table II summarises observations at all 5 factories during 1972 and confirms that losses varied considerably between factories and that the bodyweight of the pigs did not influence losses. At factory A, however, there was a significantly greater number of deaths in lairage presumably associated with the longer holding time.

TABLE II
Proportion of pig deaths during transportation and in lairage at 5 separate factories in 1972

Factory	Classification of pigs and bodyweight	No. dying per 100,000	
		a) during transportation	b) in lairage*
A	Heavy hogs >77 kg	37	59
B	Heavy hogs >77 kg	113	12
	Bacon <77 kg	118	18
C	Bacon <77 kg	66*	
D	Bacon <77 kg	86	28
E	Bacon <77 kg	113	21

*Combined figures only available.

The effect of the total distance transported was studied at factory B for 197,000 pigs were collected during August - November from distances of up to 480 km. Table III shows the proportion of losses among pigs collected from 11 areas and demonstrates that the distance transported does not consistently exert any influence on it. Lendfers (1971) reviewed the effect of distance on the proportion of losses. Although he considered shorter distances (0-15 km, 15-30 km, 30-45 km and >45 km) he also failed to demonstrate a consistent increase of losses as the distance transported increased.

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TABLE III

The effect of distance on the proportion of pigs dying during transportation

Area	1	2	3	4	5	6	7	8	9	10	11
Approximate average distance transported (km)	480	480	280	280	175	175	160	130	95	80	50
No. dying per 100,000	230	84	87	100	98	57	22	50	130	40	87

Discussion

From our observations for 1972 the financial cost of the losses in Britain vary from 2p per £30 pig in factory C (Allen *et al.*, 1974) to 4.1p in factory B. On the basis of an annual slaughter of 15 million pigs in the United Kingdom the annual cost to the industry thus lies between £300,000 and £615,000.

Several methods have been suggested to control these losses. The use of refrigerated transport or transport during the cooler night period cannot be advocated on an economic basis. The use of tail hoists to avoid the exertion on entering the lorry does not appear to reduce the incidence of losses for the proportion of deaths in one lorry equipped with a tail hoist was 66 of 30,000 (0.2%) pigs transported in 200 loads. An alternative method which again avoids physical exertion for the pig would use containers and automatic hoists. At the present rate of loss in Britain the necessary capital expenditure cannot be justified. In certain European countries the incidence of both deaths during transport and the more rapid deterioration of meat quality has been considerably reduced by the use of therapeutic agents. In Belgium Devloo (1970) significantly reduced the number of transport deaths and also lowered the incidence of inferior meat quality by means of an injection of Azaperone (Stresnil, Jansen Pharmaceuticals, 40 mg/ml, 1 ml per pig) before transport. This drug has a hypothermic effect which persists for approximately 5 hours (Allen *et al.*, unpublished). Thus the drug may not be so useful in Britain where pigs are transported longer distances than in Belgium. In addition current regulations in Britain forbid the use of tranquilisers during the 24 hour period before slaughter.

The aetiology of these deaths, the majority of which appear to be temperature dependent, suggests that the body heat regulation mechanisms are involved and the pathogenesis is identical to the so-called "acute stress syndrome" (Harrison, 1972). The Pietrain breed is particularly susceptible, certain types and strains of Landrace less so and the Yorkshire breed is relatively resistant. The Pietrain and Landrace breeds predominate in Belgium and the Netherlands, whereas in Britain the Yorkshire and English Landrace breeds predominate. This difference in distribution may explain the higher proportion of losses on the continent. Nevertheless incidents of transport losses reported by our own Veterinary Investigation Service confirm that there are strains of these English breeds which are susceptible. Thus to prevent an increase of deaths during transportation and lairage stress susceptibility should be considered as a selection character during breeding programmes.

Practical conclusions to minimise losses.

1. Transport

a) When the average daytime temperature appears likely to exceed 9°C ensure that the transporter is adequately ventilated. If possible avoid transport when the temperature exceeds 22°C.

b) Ensure that the lorry remains stationary for as short a period as possible on hot sunny days.

c) Avoid excessive physical exertion and the additional stress of excitement for the pigs during loading.

2. Lairage

Shorten rest periods within the lairage to a minimum.

3. Choice of breeds

Avoid the use of particularly stress prone strains and breeds of pigs in commercial breeding programmes.

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