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Studies on Pre-slaughter Handling of Pigs and its Relationship to Meat Quality

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1. Summary

Two quality defects of pork which are affected by pre-slaughter handling are PSE (Pale Soft Exudative) and DFD (Dark Firm Dry) meat.

The incidence of PSE pork is mainly a function of the breed of pig but short-term stressful handling before slaughter and feeding too close to slaughter are also involved. DFD meat is a result of prolonged stressful handling. PSE meat is pale and uneven in colour and exudes fluid making it unattractive in the retail display while dark meat appears stale and is prone to bacterial spoilage. After slaughter muscle metabolism continues and muscle glycogen is converted to lactic acid reducing meat pH. Prolonged stress results in glycogen depletion, pre-slaughter feeding results in elevated levels. Colour may be assessed subjectively by eye or objectively by a meter colour but pH of the meat is closely related to colour and measurement of pH at 45 minutes post-slaughter is frequently used to predict ultimate colour and pH.

The objective of this study was to examine pre-slaughter handling practices and their relationship with meat quality (pH, colour).

In the first trial, a survey of the amounts of stomach contents in pigs at slaughter in two factories found similar amounts to comparable surveys in France and the UK. It was concluded that most pigs had been fasted for an adequate time before delivery. The relationship between the amount of stomach contents and meat quality in this survey was poor.

In the second trial, pigs from the Moorepark herd fed by either a computerised wet feeding system or an ad libitum dry feed system were slaughtered after overnight fasting or with feed available up to loading for transport to the factory, two to three hours before slaughter. There was no difference between feeding systems in meat colour or pH but fasted pigs, on both feeding systems, had darker meat and meat of a higher pH.

In the third and fourth trials a survey of transport vehicles was carried out and meat quality of pigs delivered in modern and old-

type vehicles was compared. Most trucks examined (78%) were four years old or more. Few had modern hydraulic lifting gear for the top decks. Space allowances during transportation were generally adequate but delays in unloading could, in warm weather, cause stress on pigs. There was little evidence for an effect of vehicle on meat quality parameters but day to day variation in carcass temperature and pH suggested a need for further research on factory influences on meat quality.

Feeding of Magneium Aspartate to pigs for the last 5 days prior to slaughter has been shown, in Australia, to have a beneficial effect on meat colour and drip loss. In the final trial in this study Mg Asp had no effect on meat quality parameters.

Fasting from the evening before slaughter resulted in darker meat

2. Introduction

Pigmeat appearance is an important determinant of quality and meat which is excessively dark or pale is downgraded. The two principal conditions of abnormal colour are PSE (Pale Soft Exudative) and DFD (Dark Firm Dry). Both are strongly influenced by pre-slaughter handling though PSE is primarily determined by genotype.

In the case of PSE, which is characterised by a rapid drop in pH after slaughter and a low final pH, high levels of glycogen in the muscle at slaughter, high temperature of the carcass after slaughter and rate of chilling are all important. Acute stress shortly before slaughter is a major predisposing factor. Affected meat is pale in colour, may be of uneven colour and exudes fluid during storage.

DFD is associated with a slow pH drop and a high final pH. Long term stress (e.g. prolonged fasting) which depletes muscle glycogen stores is a predisposing factor. DFD meat is also prone to bacterial spoilage.

Feeding of pigs too close to slaughter has a number of undesirable effects; an increased death rate during transport, a greater risk of contamination of the carcass by perforation of the intestines during evisceration and an increased incidence of pale, soft and exudative meat (PSE) which is downgraded at sale. In addition, undigested feed is wasted and the quantity of effluent to be disposed of by the factory is increased.

An interval from last feed to slaughter of 12 to 18 hours, during which water should be available is usually recommended. In France pigs with excessive amounts of stomach contents at slaughter are subject to a price penalty. Too long a fasting interval results in carcass shrinkage pre-slaughter.

The work described here was carried out in three pigmeat plants (Coded A, B, C) in the South of Ireland in order to document current pre-slaughter handling practices and assess their effect on meat quality.

3. PRE-SLAUGHTER HANDLING OF PIGS

3.1 Survey of pre-slaughter feeding of pigs: Relationship between amount of stomach contents at slaughter and meat quality.

The objective of this trial was to survey pigs to determine the amount of undigested feed present in the stomach at slaughter and to assess the relationship between quantity stomach contents and carcass meat quality (pH, colour).

Pigs were selected at random on the slaughter line in two pigmeat plants. In each plant samples were taken during 10 slaughtering sessions, over a 5 week period. In each session the first pig was selected at random within 15 minutes of commencement of slaughtering and from then every 50th or 60th pig was selected (Factory A - n=155; Factory B - n =124).

Viscera were removed and the stomach contents collected, weighed and then dried in an air oven for 72 hours at 75°C. Carcass pH was measured in the collar region at 45 minutes (pH_{45}), 90 minutes (pH_{90}). and 24 hours (pH_{24}) after slaughter. At 24 hours post-slaughter one side was cut at the last rib and colour was assessed using a Minolta Colourimeter (Hunter L.a.b scale) and colour was also visually scored, by three people, on a scale 1 to 6 using a set of Japanese pork colour comparison blocks.

The amount of stomach contents in pigs at slaughter was similar in the two factories.. In Factory A, the average weight of wet stomach contents was 430 g (Table 3.1.1) with a range from 50 g to 1504 g. In Factory B, the average stomach content weight was 464 g, with a maximum of 1564 g and a minimum of 24 g. These values compare well with a study by Guise et al. (1995) where the average wet stomach contents in a British abattoir was 550 g and a French survey where average weights of stomach contents at slaughter was 480 g (Chevillon, 1994).

Table 3.1.1: Average, maximum and minimum weight of stomach contents collected in Factory A and Factory B

	Average Wet Wt (g)	Min. Wet Wt (g)	Max. Wet Wt (g)
Factory A	430	50	1504
Factory B	464	24	1564

The average dry weight (DM) of the stomach contents in Factory A was 53.5 g, with a maximum of 447 g and a minimum of 1.2 g, while the mean in Factory B was 87.6 g, with a maximum of 558 g and a minimum of 14 g. The frequency distribution of the amount of stomach contents is shown in Tables 3.1.2 and 3.1.3.

Table 3.1.2 : Distribution of pigs by quantity of wet stomach contents (no. pigs and percentage) for each factory

	0-200 g	200-400 g	400-600 g	600-800 g	800-1000g	>1000 g
Factory A	32 (20%)	64 (41%)	24 (15%)	12 (8%)	14 (9%)	9 (6%)
Factory B	31 (25%)	36 (29%)	25 (20%)	12 (10%)	7 (6%)	13 (10%)

Table 3.1.3 : Distribution of pigs by quantity of dry stomach contents (no. pigs and percentage) for each factory

	0-25 g	25-50 g	50-100 g	100-150 g	150-200 g	>200 g
Factory A	89 (57%)	20 (13%)	22 (14%)	9 (6%)	8 (5%)	7 (5%)
Factory B	34 (27%)	34 (27%)	22 (18%)	12 (10%)	9 (7%)	13 (11%)

In factory A there was a significant ($P<0.01$) effect of day of the week in which pigs were slaughtered on the amount of material in the stomach. Values ranged from an average of 14 g dry matter per pig on Tuesday to 80 g/pig on Wednesday, and the variation is probably related to the management practises of the suppliers scheduled to deliver to the factory on those days.

In factory A also, pigs slaughtered early in the morning had less dry stomach contents (30g) than those slaughtered in the late morning (89g) or afternoon (55g) ($P<0.01$). These pigs were kept in the factory lairage for, on average, 18, 7 and 2 hours respectively ($P<0.01$).

Pigs categorised as having large medium or small stomach contents showed no significant difference in pH or in meat colour measurements (Table 3.1.4). These results support Fischer et al. (1988) who found that pre-slaughter fasting, did not help to alleviate PSE in pigs. However, most studies suggest that ultimate pH can be altered by manipulating the feeding time between last feed and slaughter (Eikelenboom et al., 1991).

The day of the week on which the pigs were slaughtered also had an effect on all pH readings ($P<0.05$) with the exception of pH_{45} at the last rib ($P<0.052$) and pH_{90} at the collar ($P>0.05$).

Table 3.1.4: Comparison of stomach contents in three categories against meat quality indicators

	Low (< 150 g)	Normal (150-750 g)	High (> 750 g)	s.e.	F-Test
No. pigs	18(11%)	117(72%)	27(17%)		
pH_{45} Collar	6.07	6.02	6.05	0.04	NS
pH_{90} Collar	5.86	5.77	5.82	0.04	P=0.17
pH_{24} Collar	5.58	5.65	5.68	0.13	NS
Colour	2.88	2.76	2.74	0.28	NS
Mean L	47.5	47.6	48.1	0.73	NS

It is concluded that, with a few exceptions, the pigs surveyed had been fasted for an adequate period before slaughter. While the relationship between stomach contents and meat colour or pH was poor, this may be a reflection of the very small amount of stomach contents present in the pigs at the time of slaughter. It also suggests that under the experimental conditions used in this trial, other genetic and environmental factors play a greater role in determining pH and colour in pork.

Bruising due to rough handling can be reduced by using canvas/plastic paddles instead of goads.

3.2 Pre-slaughter fasting of pigs and its effect on meat quality.

The objective of this study was to assess the effect of feed withdrawal on meat quality (colour, pH), in pigs fed on wet and dry feeding systems. This trial involved 40 groups of 6 pigs (six pigs selected at random for carcass assessment from a pen group of 13 to 16), fed either:

A. Ad libitum on a dry pelleted feed or
B. Wet on a computerised wet feed system to a liberal feeding scale, where feeding was three times daily of a 3 litre water: 1kg feed mix.

Pigs were subjected to the following 4 treatments.

A: Dry feeding with feed available up to loading for transportation to the factory.
B: Dry feeding with feed withdrawn 15-16 hours before loading.
C: Wet feeding with the last feed given about on hour before loading.
D: Wet feeding with the last feed given approximately 14 hours before loading.

Pigs were from Teagasc, Moorepark Research Centre. The trial was conducted over a twelve week period and all the animals were slaughtered at the Galtee Meats abattoir Mitchelstown, Co.Cork. Pigs were loaded for sale at about 10:00h, transported 12km and slaughtered after a rest period of about 1 hour. Stunning was by CO_2 inhalation. Stomach contents were collected and meat quality assessed as in Experiment 3.1.1 above.

Results are shown in Table 3.2.1. There was no significant effect of feeding system on any variable ($P>0.05$), and no significant interaction between feeding system and fasting time.

Pigs fasted over night before slaughter had a significantly ($P<0.05$) higher killing out percentage and had less wet stomach contents and dry stomach contents ($P<0.01$).

Pigs fasted for a longer time had significantly darker meat (Hunter a - $P< 0.05$; Hunter L - $P< 0.05$; Hunter b - $P<0.01$) and pH in the rib area at 24 hours post-mortem was higher ($P< 0.05$).I

It is concluded that overnight fasting before slaughter (12 - 15 hours) will improve colour of pig meat.

Table 3.2.1: Effect of feeding method and fasting time on carcass traits.

	Dry Feed A,B	Wet Feed C,D	F-test	Fasted B,D	Fed A,C	F-test[1]
Stomach Contents						
Wet wt. g	1991	1962	0.91	876	3077	**
Dry wt. g	487	419	0.43	123	784	**
KO %	73.8	73.64	0.96	75	72.3	**
pH and Temperature						
pH_{45} Rib	6.31	6.26	0.20	6.31	6.25	P=0.17
pH_{90} Rib	6.17	6.13	0.17	6.18	6.12	NS
pH_{24} Rib	5.7	5.74	0.59	5.76	5.68	*
Temp 45 Rib	34.6	33.8	0.15	34.3	34.1	NS
Colour						
Colour average	3.00	3.06	0.76	3.15	2.91	P=0.15
Colour L	45.0	44.6	0.85	43.5	46.3	*
Colour a	7.00	7.34	0.26	6.81	7.61	*
Colour b	7.58	7.65	0.63	7.15	8.10	**

1 * = P<0.05; ** = P<0.01.

3.3 Survey of haulage vehicles and pre-slaughter handling methods

The objective of this study was to assess the characteristics of vehicles used for transporting pigs to the slaughter houses. The experiment was conducted over a one week period in Factories A and C. Each haulier delivering to the plant was interviewed on arrival. The number and percentages of pigs delivered by each vehicle type to the two factories are shown in Table 3.3.1.

Table 3.3.1: Type of vehicle used in transportation of pigs and percentages of pigs arriving in each type

	Articulated unit	Rigid body	Farm tractor
Truck type (no and % of vehicles			
Factory A	20 (22%)	52 (58%)	17 (19%)
Factory C	38 (54%)	25 (35%)	8 (11%)
No and percentage of pigs by vehicle type			
Factory A	3826 (42%)	4209 (46%)	1020 (12%)
Factory C	6167 (68%)	2371 26%)	514 (6%)

In the present survey, 78% of vehicles were over 4 years old. At Factory A, only 15% of the vehicles were less than 4 years old, while in Factory C, 31% were under 4 years old. This figure for Factory C compares well with British figures which indicate that 28% of haulage vehicles were under 4 years of age according to Riches et al., (1996).

In recent years, the trend, internationally, has been towards vehicles fitted with hydraulic decks for ease of loading and unloading. Only 12% of vehicles in the present survey were equipped with hydraulic decks. The most common form of loading a second deck was an internal ramp, with which 29% of the vehicles were equipped. The remaining vehicles were single deck type.

Factory had a significant effect on the number of farms represented in the load, with Factory A having a larger number on farms represented in each load compared to Factory C (1.27 v. 1.02; P<0.01).

The factory also had a significant effect (P<0.05) on the distance pigs had to travel to slaughter. The average distance from farm to slaughter was 53.3 km (range 2 km to 320 km; A - 74.2 km, B - 36.4 km; P<0.01). This is considerably less than the average distance travelled in Britain which was 106 km (Riches et al., 1996). Furthermore, the type of vehicle had a significant relationship with the distance to slaughter (Articulated truck - 76 km, Rigid truck - 53 km, Farm trailer 23 km; P<0.01).

The average travel time to the abattoir was 1 hours 37 minutes (range of 10 minutes to 6 hours 35 minutes). The difference between factories (A - 1hour 34minutes, Factory C - 1hour 39minutes) was not significant but the factory did have a significant effect (P<0.05) on the time pigs had to wait in the vehicles on arrival (A - 34 minutes, B - 26 minutes; P<0.05).

While average waiting time was short at both factories, even a 30 minute wait in hot and humid weather could expose the pigs to heat stress, thus affecting meat quality. The waiting period could be reduced by a better matching of the delivery schedule to lairage capacity and also more space in the unloading bay.

Stocking density on the truck did not differ in the two factories and there was no significant difference between vehicle type. The average stocking density was 0.4 m^2 per pig (range 0.23 to 1.86 m^2 per pig). Almost all deliveries had 0.35 to 0.50 m^2 floor area per pig.

Similar mean stocking densities were recorded by Riches et al., (1996).

It should be noted that the design of the ventilation system on the truck is likely to be critical in preventing stress and losses at high stocking densities.

The incidence of deaths in transit (DIT), which can be as high as 3% for stress susceptible genotypes, is a result of the cumulative effect of many factors, but (apart from genetics) is mainly attributed to inadequate ventilation relative to the stocking density and timing of last feed (Eikelenboom et al., 1991).

Factory and vehicle type had no significant effect ($P>0.05$) on DIT which averaged 0.04% (4 pigs per 10,000 delivered) which is well within the range of international estimates reported by Warriss (1996), which varied from 0.03% in Denmark to 0.3% in Germany and Belgium. These differences are related to the greater usage of stress-susceptible Pietrain pigs in Germany and Belgium.

Factory had a significant effect on the number of casualties (i.e. pigs subjected to emergency slaughter on arrival) with Factory C having more casualties than Factory A (0.33 v. 0.10; $P<0.01$). The level of casualties may reflect differences between the strictness of veterinary inspection at the two factories rather than differences in pig health.

Overall, the data from this survey suggests that Irish pig haulage practices compare favourably with other European countries There are however, some areas where action is needed. Distances travelled to the abattoir and long hauling times are not as much a problem as in other countries, but there is a need to improve loading methods and equipment.

The area of most urgency is overloading which can cause severe stress to the animals and can be overcome with least expense. Secondly, there is a real need to modernise the design of the transport vehicles and use of single deck trucks should be encouraged. Multi-deck trailers should have hydraulic decks for easy loading and unloading of pigs, and scheduling of truck arrivals at the plants.

Guise (1987) reported on a containerised transport system as a less stressful alternative than either the conventional internal ramp or the hydraulic deck. It was suggested that if pigs were loaded in their farm pen social groups they could settle before the towing vehicle arrived. This would reduce stress, with an improvement in pork quality and is the system favoured in Denmark.

3.4 Effect of transport on meat quality

The objective of this trial was to compare meat quality in pigs conveyed to slaughter in two different transport vehicles, which were a modern truck and a traditional trailer. The truck was a rigid chassis type fitted with an aluminium transport container (9m x 2m x 3m) equipped with two floating hydraulic decks and air suspension. The trailer was made from wood, equipped with an internal ramp for loading the second deck and was mounted on spring suspension and was towed behind the truck described above.

The experiment was conducted between October 1997 and January 1998 and in all, 240 pigs were assessed. Pigs were fasted from the evening before slaughter and loaded between 0800h and 0930h, after which pigs were transported circa 160 km to Factory A. On arrival the pigs were unloaded immediately and were slaughtered (CO_2 stunning) without a rest period in the lairage. The order in which the pigs from the modern truck and traditional-type trailer were slaughtered was alternated between weeks

A sample of 6-12 pigs from the truck and a similar number from the trailer were selected at random for carcass assessment - pH_{45}, pH_{90}, pH_{24} and, both objective and subjective colour measurements, as outlined previously.

Pigs experienced the same minimal handling techniques in each transport system. However, an electrical goad was used in the unloading process, but only on the hind quarters of stubborn pigs whose path was clear.

The day on which the pigs were slaughtered also had a significant effect ($P<0.05$) on the carcass temperature at 45 and at 90 minutes after slaughter. There are three possible explanations for this:

1. High ambient temperature, which is unlikely as the trial was carried out from October to January
2. Handling practises which varied from day to day
3. Variable scalding tank temperatures and rate of post-slaughter chilling.

Transport vehicle had no significant effect ($P>0.05$) on the pH of the meat at 45 minutes or 90 minutes after slaughter. However, it did have a significant effect on pH_{24} in the collar and while the

carcasses from pigs transported in the trailer had a higher pH in the collar, 24 hours after slaughter, mean pH values for carcasses from pigs transported in both the truck and trailer were well within the acceptable range (mean values 5.64 and 5.70 respectively; P<0.05). The day on which the pigs were slaughtered had a significant effect on all the pH readings except pH_{24} Collar e.g. pH_{24} rib varied from 5.50 to 5.64 (P<0.01) for the extreme days.

The transport vehicle had a significant effect (P<0.01) on objectively assessed colour, on the Hunter 'L' value and on subjective colour scores as judged by the Japanese colour comparison blocks (Table 3.4.1). The meat from carcasses of pigs transported in the trailer was judged to be darker by both methods.

Table 3.4.1: Effect of transport vehicle on meat colour

	Trailer	Truck	s.e.	F-test
Colour	3.26	2.58	0.13	**
Hunter 'L'	45.2	47.5	0.56	**
Hunter 'a'	7.84	7.76	0.29	P=0.10
Hunter 'b'	7.75	8.25	0.20	P=0.10

The day on which pigs were slaughtered also had a significant effect (P<0.05) on meat colour as judged using the Japanese colour comparison blocks with average values ranging from 2.54 to 3.23 for the extreme days. Assessment was carried out in the same room each day under the same artificial lighting so variation in background lighting level or colour is unlikely. Examination of temperature and humidity data for a meteorological station 14 km from the factory did not provide evidence for a relationship with weather.

The two transport systems produced similar proportions of carcasses with PSE. However, the trailer, or more traditional vehicle produced five times more DFD carcasses than the truck. From a review of published literature, Tarrant (1989) concluded that PSE was caused by acute stress just prior to slaughter while DFD was a result of prolonged stress. This would suggest that the pigs transported in the trailer were being exposed to a chronic stress. Possible contributory factors may be climbing the ramp, the effect of the truck suspension system on vibration while being driven and descending the ramp on arrival, as well as differences in ventilation rate and temperature during transportation. The reason for variation between slaughter dates in meat temperature, pH and colour merits further investigation.

3.5 Effect of short-term pre-slaughter feeding of Magnesium Aspartate (MgAsp) on pigmeat colour and pH

A recent report by D'Souza et al, (1998) found that feeding Magnesium Aspartate (MgAsp) to pigs during the final week before slaughter had a beneficial effect on pigmeat pH and colour. The objective of this trial was to assess the benefit of feeding MgAsp for five days pre-slaughter.

Pigs were selected at approximately 85 kg liveweight and formed into single sex groups of three of even weight. Groups were blocked on sex and weight and one of each block assigned at random to each of the following treatments:

A. Control diet
B. Control diet with 1.5% Mg Asp added

The diet used was based on barley, wheat and soya bean and was fed ad libitum as a dry pelleted feed from the Thursday morning (1000h-1200h) before slaughter to 2000h Monday evening, with the pigs then fasted up to slaughter on Tuesday. The control diet had previously been fed to all pigs from c. 35 kg liveweight. Pigs were weighed at 1000h, transported 14 km to the factory at a stocking density of 0.4 to 0.45 m^2 per pig and slaughtered after a 2-3 hour lairage period. pH and colour were measured as in Experiment 2.1.1.

Drip loss was measured by two methods. Firstly, the method of Honikel (1987) which involved weighing a cube of meat, suspending it in a plastic pouch at 4°c and removing, drying by wiping using tissue paper and weighing it at 48 hour intervals (24, 72, 120 and 168 hours post slaughter). The second method was a modification of the method of Honikel and involved placing a weighed core of meat in a plastic vial with an attached collection tube for the drip. The meat core was dried and weighed every 48 hours as described above.

Magnesium aspartate was incorporated into the diet at a level of 1.5% and as a result the test diet contained 0.295% magnesium while the control diet contained 0.148% magnesium from the ingredients.

This experiment was similar to the trial carried out by D'Souza. et al (1998) in which they found a positive effect of dietary magnesium aspartate on meat quality. However, their's was a 2x2 factorial design, where in each dietary treatment half of the pigs were minimally handled and the other half were negatively or roughly handled. All pigs in the present trial were minimally handled.

In the present study, dietary magnesium aspartate had no significant effect ($P > 0.05$) on pH measured at the rib 45 minutes, 90 minutes or 24 hours after slaughter (Table 2.5.1), whereas D'Souza et al. (1998) found a significant effect on pH measured 40 minutes and 24 hours after slaughter. As found in previous experiments in this project the date on which the pigs were slaughtered had a significant effect ($P<0.05$) on pH_{45}, pH_{90} and pH_{24} hours post slaughter.

Table 3.5.1: Effect of magnesium aspartate supplementation on meat pH

	Control	MgAsp	s.e.	F-test
pH_{45} Rib	6.18	6.15	0.04	NS
pH_{90} Rib	5.96	6.00	0.04	NS
pH_{24} Rib	5.62	5.62	0.03	NS

Colour was measured using Japanese colour comparison blocks and a Minolta colorimeter. It was necessary in the present experiment to cut the M. longissimus dorsi. The colour of the freshly cut meat was assessed using the Japanese colour comparison blocks referred to as internal colour or (Colour I). Supplementation with magnesium aspartate had a significant effect on internal colour but did not have a significant effect on any other colour measurement (Table 3.5.2).

Table 3.5.2: Effect of magnesium aspartate supplementation on meat colour

	Control	MgAsp	s.e.	F-test
Colour	3.82	3.99	0.17	NS
Colour I	2.14	2.47	0.09	**
Hunter L	43.4	44.0	0.95	NS
Hunter a	7.58	7.80	0.35	NS
Hunter b	7.29	7.60	0.32	NS

The date on which the pigs were slaughtered had a significant effect only on meat which had been freshly cut (colour I). D'Souza et al. (1998) measured colour in the Longissimus thoracis (LT) and the Biceps femoris (BF) and reported that magnesium aspartate supplementation had a significant effect ($P<0.05$) on the lightness component of colour (Hunter 'L'). They concluded that magnesium asparate incorporated into the diet produced significantly darker meat.

Supplementation with magnesium aspartate had no significant effect on drip loss, as measured by either of the two methods (Table 3.5.3, Table 3.5.4). On the other hand, D'Souza et al. (1998) found that treatment with magnesium aspartate significantly reduced drip loss ($P<0.05$).

Table 3.5.3 : Effect of magnesium aspartate supplementation on drip loss as measured by the Honikel et al. (1987) method

	Control	MgAsp	s.e.	F-test
Drip loss 0-48 h %	4.66	6.88	0.41	NS
Drip loss 0-96 h %	4.69	7.52	0.57	NS
Drip loss 0-144 h %	9.23	8.42	0.69	NS

Table 3.5.4 Effect of magnesium aspartate supplementation on drip loss as measured by the adapted Honikel method.

	Control	MgAsp	s.e.	F-test
Drip loss 0-48 h %	2.07	2.34	0.17	NS
Drip loss 0-96 h %	3.67	3.92	0.30	NS
Drip loss 0-144 h %	4.81	5.27	0.36	NS

In addition, the date on which the pigs were slaughtered had no effect on drip loss measured by either method.

It is concluded that dietary supplementation with magnesium aspartate in the finisher pig diet has little influence on meat quality of pigs, where good handling practises have been employed during transport. Where handling practises are poor the evidence from D'Souza et al. (1998) suggests that it may improve meat quality. However this topic warrants further research.

CONCLUSIONS

1. The practice of fasting pigs pre-slaughter appears to be carried out well at farm level, with most pigs having only small amounts of residual feed in the stomach at slaughter. As a result the relationship between amount of stomach contents and meat colour and pH was poor.

2. A comparison of fed and fasted pigs on both wet and dry feeding systems showed that fasting from the evening before slaughter (c. 15 hours)resulted in darker meat and meat of a higher pH.

3. Space allowances during transportation were generally adequate but delays in unloading were recorded which could, in warm weather, cause stress on pigs.

4. Feeding of Magneium Aspartate to pigs for the last 5 days prior to slaughter has previously been shown to have a beneficial effect on meat colour and drip loss. Under conditions of careful handling of pigs during transport there was no evidence of an effect.

5. Day to day variation in carcass temperature and pH suggested a need for further research on factory influences on meat quality.

Space allowances during transportation were generally adequate.

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