

## THE EFFECTS OF ADVERSE HANDLING OF PIGS ON FARM AND AT THE ABATTOIR ON MEAT QUALITY.

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## ABSTRACT

Thirty-six crossbred (Large White X Landrace) boars were used to investigate the effects of positive and negative handling of pigs on farm and negative and minimal handling pre-slaughter at the abattoir on the subsequent meat quality. Pigs that were negatively handled on farm had lower muscle glycogen at 5min and 40min post-slaughter in the LD and BF but no differences in surface lightness or % drip loss of the LD were observed. Pigs negatively handled at the abattoir had lower muscle glycogen at 5min post-slaughter in both the BF and LD but there were no meat quality differences. Pigs that were negatively handled on farm and at the abattoir had lower muscle glycogen at all times post-slaughter, lower pH<sub>u</sub>, higher % drip loss and a higher incidence of PSE compared to pigs handled positively at the farm and given minimal handling pre-slaughter. These data demonstrates the potential for handling procedures at the production unit to influence the pigs response to pre-slaughter handling and to have an impact on the final meat quality.

## INTRODUCTION

Pigs are exposed to a variety of stressors from leaving the farm to slaughter at the abattoir. Moss (1984) has shown that handling of pigs before slaughter can 'stress' the pigs and influence meat quality by influencing the rate and extent of acidification of the muscles post-slaughter and thus the occurrence of PSE (pale, soft, exudative) or DFD (dark, firm, dry) meat. The majority of the studies investigating the effects of handling pigs on meat quality have examined handling during transportation from the farm to the abattoir or at the abattoir itself. However there is little information regarding the effects of handling pigs on farm in relation to their response to handling from farm to slaughter and subsequent meat quality. Previous research has shown that the growth and reproductive performance of commercial pigs are reduced in situations where the pigs are aversively handled (Hemsworth *et al.*, 1987). This study investigated the influence of handling pigs on farm and pre-slaughter handling at the abattoir on subsequent meat quality.

## MATERIALS AND METHODS

Thirty-six crossbred (Large White X Landrace) boars averaging 64 +/- 15 kg were randomly allocated to treatments in a 2X2 design with 3 replicates. The treatments were (a) a positive (F-POS) and negative (F-NEG) handling treatment imposed 2min/day, 5days/week for 5 weeks on-farm and (b) minimal (A-MIN) and negative (A-NEG) handling treatments which were imposed at the abattoir between pen and stunning. On farm the negative handling treatment involved shocking the pig with an electric prod and the positive handling involved patting the pig, whenever the pig approached the experimenter. At the abattoir, the minimal handling treatment involved using minimal force (no use of electric prod) to move the pigs from the holding yards to the slaughter area and the negative handling treatment involved applying 10 prods with the electric prod just prior to slaughter. Pigs were stunned by CO<sub>2</sub> inhalation and then exsanguinated at which time blood samples were collected for the determination of plasma cortisol. Adrenal glands were removed after evisceration, cleaned of connective tissue and weighed. A 1g muscle sample for muscle glycogen analysis was collected at 5min, 40min and 24h post-slaughter from the *Longissimus dorsi* (LD) (12th/13th) rib and *Biceps femoris* (BF), frozen in liquid nitrogen and stored at -20°C. The pH of the LD and BF was measured at 40min post-slaughter (pH<sub>i</sub>). At 24 h post-slaughter, ultimate pH (pH<sub>u</sub>) was measured in the LD & BF and surface lightness (L\*) and % drip loss (suspension for 48h at 4°C) were measured in the LD. The results were analysed by restricted estimate of maximum likelihood (REML) analysis using the GENSTAT program.

## RESULTS AND DISCUSSION

The means, standard error of difference (sed) and treatment effects are given in Table 1. There were no differences in adrenal weight or in plasma cortisol at slaughter indicating that the handling treatments imposed on farm and at the abattoir did not induce chronic stress. Chronically stressed animals can have higher levels of plasma cortisol and heavier adrenal glands, predominantly due to an enlarged adrenal cortex (Gonyou *et al.*, 1986). The pigs negatively handled on farm had lower muscle glycogen at 5min and 40 min post-slaughter in both the LD and BF muscle, however there were no differences at 24h post-slaughter. Pigs negatively handled on farm also had a lower pH<sub>u</sub> in the LD but not in the BF but there were no differences in surface lightness (L\*) or % drip loss of the LD muscle. Muscle glycogen levels were lower at 5min and 24h but not 40min post-slaughter in pigs handled negatively at the abattoir and the pH<sub>u</sub> at 24h post-slaughter was lower in the BF. Using drip loss > 5% and L\* > 50 to define PSE, the incidence of PSE for the handling treatments were 12.5% (F-POS & A-MIN), 22.2% (F-POS & A-NEG), 25% (F-NEG & A-MIN) and 33.8% (F-NEG & A-NEG). While, there were no significant (P < 0.10) interactions between on-farm and abattoir handling procedures for any of the meat quality measures. Pigs that were negatively handled at both the farm and the abattoir had lower muscle glycogen, higher % drip loss and lower pH<sub>u</sub> and a higher incidence of PSE than pigs handled positively on farm and minimally pre-slaughter.

The majority of studies that have examined the effects of handling on meat quality have divided the handling into transit from the

production unit to the slaughter plant and transit from lairage to slaughter (Warriss, 1987). However there is little published data regarding the influence of adverse handling of pigs on farm in relation to meat quality. These data show that negative handling on-farm or at the abattoir can influence the post-slaughter levels of muscle glycogen although there were no effects on meat colour or drip loss. Furthermore, pigs which were handled negatively on farm and at the abattoir exhibited inferior meat quality compared to pigs handled positively on the farm and at the abattoir.

This experiment has demonstrated the potential for handling procedures at the production unit and at the abattoir to influence the pigs response to pre-slaughter handling and to have an impact on the final meat quality. In many cases these responses are additive.

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TABLE 1 Effect of on-farm and abattoir handling treatments on muscle glycogen, pH, meat quality and stress indicators.

	F-POS		F-NEG		sed	F	A
	A-MIN	A-NEG	A-MIN	A-NEG			
LD Glycogen (mg/g) 5min	10.08	9.49	8.46	7.55	0.55	**	+
40min	7.24	7.53	6.28	4.98	0.66	**	ns
24h	1.73	1.19	1.91	0.70	0.38	ns	*
BF Glycogen (mg/g) 5 min	9.88	8.80	8.39	7.27	0.59	**	*
40min	6.14	6.73	6.23	4.85	0.40	*	ns
24h	1.28	1.05	1.40	0.60	0.29	ns	*
LD Surface Lightness (L*)	50.01	48.31	49.64	50.33	2.84	ns	ns
LD Drip loss %	4.70	4.07	3.90	6.10	0.25	ns	ns
pH <sub>i</sub> LD	6.47	6.46	6.57	6.36	0.13	ns	ns
pH <sub>a</sub> LD	5.60	5.58	5.49	5.48	0.04	**	ns
pH <sub>i</sub> BF	6.31	6.52	6.48	6.28	0.11	ns	ns
pH <sub>a</sub> BF	5.60	5.57	5.61	5.52	0.03	ns	+
Cortisol concentration (nM)	56.5	66.1	78.8	48.0	0.31	ns	ns
Adrenal gland weight (g)	4.73	4.76	5.22	4.84	0.31	ns	ns

+ P < 0.1, \* P < 0.05, \*\* P < 0.01, ns not significant

F = Farm handling treatments, A = Abattoir handling treatments

POS = positive handling, NEG = negative handling, MIN = minimal handling