

## INFLUENCE OF SEX, MALE/FEMALE RATIO AND LAIRAGE TIME ON CARCASS AND MEAT QUALITY OF PIGS

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**Background**

The handling of pigs prior to slaughter can significantly affect the carcass and meat quality (Warriss and Brown, 1985; Murray and Jones, 1992; Lambouij *et al.*, 1996). During the lairage period, the maintenance of pigs in their social groups, although desirable, is fairly unusual (Warriss, 1996). Unfamiliar pigs fight and the situation worsens if there are entire males in the group (Warriss and Brown, 1985; Sather *et al.*, 1994), giving rise to greater skin damage on carcasses and to a higher incidence of DFD meat (Babol and Squires, 1995). Sather *et al.* (1994) suggested that behaviour of pigs when faced with *ante-mortem* stresses and, consequently the skin blemish occurrence on carcasses or the development of abnormal meat quality depended on the genetic background, and meat-type sire lines led to greater incidences than in those used for maternal lines.

**Objectives**

The aim of this work was to study, under commercial conditions, the influence of sex on the incidence of skin blemishes in carcasses and the PSE/DFD status of meat, in socially mixed, stress susceptible crossbred pigs, penned in lairage for short periods of time at 20°C. The effect of the relative number of entire males and females within the population was also evaluated.

**Materials and Methods****Population and preslaughter treatment**

385 commercial crossbred pigs (Belgium Landrace-Large White x Pietran-Duroc-Hampshire), including 230 boars and 155 gilts, submitted to a fasting period between 18-24 h before being loaded and transported to the slaughterhouse were studied. For experimental purposes, the pigs travelling on two pens from the lower deck of the vehicle were mixed together (to form a group of about 30 pigs), providing a stocking density of 0.66 m<sup>2</sup>/pig in lairage. Such social and sex mixed groups were held for 0.5 and 3 hours, and after these lairage periods, pigs were driven out of the lairage (electrical goads used on the last phase of the race) and electrically stunned in a restrainer (420 V/ 2-3 seconds).

**Skin blemish evaluation**

Front (head and shoulder), middle (loin and ribs) and hind (ham) regions of the carcass were evaluated according to a 4 point scale (1- no skin damage; 2- slight skin damage; 3- moderate skin damage; 4- severe skin damage) (Barton-Gade *et al.*, 1996). Those rated with skin damages score less than or equal to 2 or greater than or equal to 3, were classified as acceptable and unacceptable, respectively.

**Pork quality measurements**

pH<sub>i</sub> - *Semimembranosus* (SM) and in *Longissimus dorsi* (LD)

pH<sub>u</sub> - *Biceps femoris* (BF), *Semimembranosus* (SM), Adductor (Ad) and *Longissimus dorsi* (LD).

Internal muscle reflectance - *Biceps femoris* (BF), *Semimembranosus* (SM), Adductor (Ad) and *Longissimus dorsi* (LD) (P4000 Fibre Optic Meat Probe, U.K.) (Barton-Gade *et al.*, 1996).

Muscles were classified as PSE when the FOP mean value was higher than 60 (Santos *et al.*, 1996). When the mean pH<sub>u</sub> value in the same muscles was above 5.9, they were classified as more or less DFD.

**Results and Discussion****Carcass skin blemish**

The skin blemish  $\geq 3$  frequency on the different areas of the carcass, according to the sex of individuals and the lairage conditions under testing are shown in Table 1.

Differences between sexes only appeared significant ( $p < 0.01$ ) for the front region, irrespective of holding time, with males denoting a higher mean incidence of skin lesions than females. These results confirm the trend obtained by Warriss (1984), Warriss and Brown (1985) and Moss and Trimble (1988). The lairage holding time also significantly influenced ( $p < 0.05$ ) the frequency of unacceptable skin damage carcasses being such influence again mainly noticed in the front area. The holding of the animals up to 3 hours instead of 0.5 hours produced, as expected, an increase of the frequency in both sexes.

It is also notable that groups with different male/female ratios showed, at this concern, different trends (Table 2). The group I, which had the lowest ratio between males and females (13/17), the frequency of carcasses classified as unacceptable in the different regions, as well as, the incidence of those affected concomitantly in the three areas, is higher than in other groups. In addition, the percentage of carcasses classified as severely skin blemished in the different areas was also higher. Comparing group I and III, respectively with a proportion between males and females of 13/17 and 21/8, the tendency is the latter to present less skin damaged carcasses, mainly in front and hind regions. Nevertheless, further work is required to confirm or not the influence of this handling factor. Apparently, these data disagrees with the generally accepted view that entire males are more excitable and aggressive (Moss and Robb, 1978, Warriss and Brown, 1985).

**Meat quality**

The influence of lairage holding time on meat quality is exerted on pH<sub>u</sub> and FOP of all evaluated muscles (Table 3). The effect on pH<sub>u</sub> mean values appeared, in general, directly related with the time pigs spent in pens. Conversely, FOP mean values decreased with the holding time, irrespective of the sex. However, males were more sensitive than females, since the later appeared significantly affected for both quality parameters only in BF and Ad muscles. The less relevance of sex on meat quality parameters, traduced just by FOP ( $p < 0.05$ ) mean value modification in SM muscle, was just associated with groups held 3 h in lairage. Despite

this, the frequency of the PSE, Normal and DFD status in the BF, SM and LD muscles is significantly affected by this experimental factor (Table 4). Concerning the PSE meat category, groups penned for 3h showed a significantly lower frequency ( $p<0.01$ ) in males than in females (20.1% vs. 30.4%). In relation to the number of carcasses implicated (results not included), this difference between sexes is mainly noticed in the incidence of those exhibiting this meat quality status either concomitantly in the LD, SM and BF or just in two muscles of the group, where the first class of carcasses almost doubled in females (13.0% vs 7.6%).

On the other hand, the DFD status frequency was generally higher in males than in females ( $p<0.001$ ), irrespective the holding time pigs have been submitted (Table 4). Based on similar short pre-slaughter treatments, Barton-Gade (1987) did not find significant sex effects on the frequency of PSE and DFD meat in Danish pigs. Differences in genetics between the tested populations as well as in the stunning technique used in both studies could very much account to the discrepancy in the results.

## References

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Table 1 - Percentage of carcasses skin blemished with a score  $\geq 3$  in different regions, in relation to the sex of individuals and the time spent in lairage at 2

Holding time, h	Front		Middle		Hind	
	male	female	male	female	male	female
0.5	x8.1 <sup>a</sup>	x1.6 <sup>b</sup>	14.0	6.4	4.7	1.6
3	y14.6 <sup>a</sup>	y9.8 <sup>b</sup>	18.8	13.0	8.3	8.7
Overall chi-square						
Sex	**		ns		ns	
Holding time	*		ns		ns	

ns=not significant, \*= $p<0.05$ , \*\*= $p<0.01$ , \*\*\*= $p<0.001$

a-b For each region, means with identical superscripts in the same row are not significantly different (test LSD,  $p<0.05$ )

x-y In the same column, means with identical superscripts are not significantly different (test LSD,  $p<0.05$ )

Table 2 - Effect of the relative number of males and females in the population at 20°C/3h on the frequency of unacceptable blemished regions (upper) and on the incidence of carcasses showing 1, 2 and 3 regions affected.

Group	I (13M/17F)			II (17M/13F)			III (21M/8F)		
n	2			2			4		
Sex	male	female	Total	male	female	Total	male	female	Total
Front	10	7	17 (7)	13	7	20 (3)	7	3	10 (0)
Middle	13	13	26 (17)	7	3	10 (3)	14	3	17 (3)
Hind	10	10	20 (3)	7	3	10 (0)	3	0	3 (0)
Skin blemish $\geq 3$									
1 region	23			17			17		
2 regions	10			10			10		
3 regions	7			0			0		

Numbers in brackets represent the frequency of those classified as severely damaged

Table 3 - Effect of sex of pigs and lairage holding time on meat quality parameters mean-values.

	Holding Time				F values		
	0.5 h		3 h		HT	S	HT x S
	male	female	male	female			
pH1							
SM	5.92	5.94	5.95	5.95	0.712 ns	0.27 ns	0.12 ns
LD	5.90	5.99	5.97	5.95	0.14 ns	1.78 ns	3.40 ns
FOP							
BF	61.0 <sup>a</sup>	60.2 <sup>a</sup>	51.3 <sup>b</sup>	52.6 <sup>b</sup>	24.26***	0.02 ns	0.34 ns
SM	53.0 <sup>a</sup>	55.4 <sup>a</sup>	49.3 <sup>b</sup>	52.8 <sup>a</sup>	5.32*	4.79*	0.16 ns
LD	57.4 <sup>a</sup>	54.7 <sup>ab</sup>	50.5 <sup>b</sup>	52.1 <sup>b</sup>	7.59**	0.11 ns	1.58 ns
Ad	46.2 <sup>a</sup>	45.7 <sup>a</sup>	38.2 <sup>b</sup>	40.9 <sup>b</sup>	17.01***	0.56 ns	1.09 ns
pHu							
BF	5.73 <sup>bc</sup>	5.71 <sup>c</sup>	5.81 <sup>a</sup>	5.79 <sup>ab</sup>	11.65***	0.82 ns	0.03 ns
SM	5.60 <sup>b</sup>	5.61 <sup>ab</sup>	5.64 <sup>a</sup>	5.66 <sup>a</sup>	7.36**	0.63 ns	0.00 ns
LD	5.53 <sup>b</sup>	5.54 <sup>b</sup>	5.60 <sup>a</sup>	5.57 <sup>b</sup>	13.69***	1.64 ns	1.81 ns
Ad	5.78 <sup>b</sup>	5.78 <sup>b</sup>	5.91 <sup>a</sup>	5.87 <sup>a</sup>	17.88***	0.51 ns	0.72 ns

ns=not significant, \*= $p<0.05$ , \*\*= $p<0.01$ , \*\*\*= $p<0.001$

In the same row, the mean with identical superscripts are not significantly different (test LSD,  $p<0.05$ ).

Table 4 - Incidence of the PSE, Normal and DFD status in the muscle group constituted by LD, SM and BF, in relation to the sex of pigs and lairage conditions.

Muscle Quality	PSE		NORMAL		DFD	
Holding time, h	male	female	male	female	male	female
0.5	x34.1	30.7	x57.8	64.6	x8.1 <sup>a</sup>	x4.8 <sup>b</sup>
3	y20.1 <sup>b</sup>	30.4 <sup>a</sup>	y66.4 <sup>a</sup>	57.6 <sup>b</sup>	y13.4 <sup>a</sup>	y11.9 <sup>b</sup>
Overall chi-square:						
Sex	**		**		***	
Holding time	**		**		***	

\*\*= $p<0.01$ , \*\*\*= $p<0.001$

a-b For each category, means with identical superscripts in the same row are not significantly different (test LSD,  $p<0.05$ )

x-y In the same column, means with identical superscripts are not significantly different (test LSD,  $p<0.05$ )