MAPPING OF ENTIRE PIG CARCASS MUSCULATURE TO DETERMINE MEAT CUTS MOST AFFECTED BY PSE.

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Background

Poor pork quality can result from many different factors but one of the most common nowadays is due to the high incidences of the PSE (pale, soft and exudative) condition. PSE is caused by a rapid rate of muscle metabolism stimulated by ATP depletion in the early *postmortem* period. It can develop as a result of stress to sensitive pigs before and during the slaughtering process (Honikel and Kim, 1986). Within the carcass, muscles that differ in fibre type also differ in their susceptibility to develop PSE. Some muscles are also more commercially viable than others. PSE meat is pale and uneven in colour and exudes fluid, making it extremely unappealing to the consumer when held under retail display. The PSE condition is a significant cause of financial loss, causing the Australian Food Industry $20 million and the U.K. pig sector £20 million annually (Casssens *et al.*, 1992).

Objectives

Previous studies have examined the prevalence of PSE in the whole carcass but very little work has been done on the relationship between PSE and individual pork muscles. Therefore, the main objective of this study was to determine how selected muscles of the pig carcass were affected by varying degrees of the PSE condition.

Methods

Six normal and six PSE carcasses were selected and purchased from Galtee Meats, Mitchelstown, Co. Cork, Republic of Ireland. Selection of carcases was based on pH values (Mettler Toledo 125 pH meter and an Inlab 427 spear probe) recorded at 45 minutes *postmortem* at the 4th rib region; carcasses with pH<5.5 were considered PSE while those with pH>6.2 were placed in the normal category. Carcasses were held at 4°C for 24 hours. The left side of each carcass was then removed from the chill, the entire skin was removed and each individual muscle (Table 1) was located and carefully removed, using a scalpel. pH and Hunter "L", "a", "b" (Minolta chrometer Model CR-100) colour values of each muscle were recorded at 24 hours *postmortem*. Drip loss of some of the muscles was also measured using three different methods. The hanging bag method (Honikel *et al.*, 1986) was used for whole muscles of suitable size while the coring method (Rasmussen; 1996) was employed for the larger more commercial muscles. The exudate on remaining muscles was simply blotted dry with absorbent tissue paper (Taylor *et al.*, 1990). All drip loss samples were dried and reweighed following storage at 4°C for 24 hours.

Results and Discussion

The *M. longissimus dorsi* and *M. gluteus medius* were most sensitive to the symptoms of PSE. These muscles exhibited the highest drip losses, using the core method. The muscle fibres are aligned in the same direction with this method, therefore giving an accurate reading. The *M. longissimus dorsi* was also most sensitive to pH. The *M. longissimus dorsi* in both the normal and PSE category had the lowest pH value at 24 hours *postmortem*. The average pH of two muscles, *M. brachialis* and *M. diaphragma* in the normal category was lower than that recorded on the PSE carcasses. The average "L" lightness values were also greatest in the *M. gluteobiceps*, *M. semimembranosus*, *M. gluteus medius*, *M. vastus lateralis*, *M. longissimus dorsi*, and *M. brachiocephalicus* of the PSE carcasses. These muscles also exhibited the lowest "a" redness values.

The larger muscles of the pig carcass, namely *M. longissimus dorsi*, *M. semimembranosus, M. gluteobiceps*, *M gluteus medius* and *M. psoas major* are considered the most expensive meat cuts and go on to become high quality cured meat products. Borzuta *et al.*, (2001) found that PSE symptoms were most frequent in the *M. longissimus dorsi*, *M. gluteus medius*, *M. psoas major*, *M semimembranosus* and *M. biceps femoris*. It is therefore important to recognise that these are the muscles which were most affected by the PSE condition in this study also.

This study has highlighted the muscles which are most sensitive to PSE, but we can also deduct from the results, that there are quite a few muscles of the carcass which do not show any symptoms of the condition. These muscles, in fact, can go on to become a wide range of high quality products without any adverse affects.

Pertinent Literature

Borzuta, K., Strzelecki, J., Grzeskowiak, E., Lisiak, D. and Wichlacz. (2001). Quantitative share and topographic distribution of PSE meat in pork carcasses. In 47th Int. Congress of Meat Sci. and Tech., Krakow, Poland, 196.
Cassens, R.G., Kauffman, R.G., Scherer, A. and Meeker, D.L. (1992). Variations in pork quality: A 1991 U.S.A survey. In 38th Int. Congress of Meat Sci. and Tech., Clermont-Ferrand, France, 237.
Honikel, K.O and Kim, C.J. (1986). Causes for the development of PSE in pork. Fleischwirtsch, **66**, 349.
Honikel, K.O., Kim, C.J. and Hamm, R. (1986). Sarcomere shortening of prerigor muscles and its influence on drip loss. Meat Sci., **16**, 267.
Rasmussen, A.J. (1996). Method for determination of drip loss in pork. Danish Meat research Institute (Personal Communication).
Taylor, A.A., Down, N.F. and Shaw, B.G. (1990). A comparison of modified atmosphere and vacuum skin packaging for the storage of red meats. Int. J. Food Sci. and Tech. **25**, 98.

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Table 1. pH, colour "L" and "a" measurements and drip loss values of Normal and PSE carcasses.

Muscles from carcass	Normal Carcasses				PSE carcasses			
	pH	"L"	"a"	Drip loss	pH	"L"	"a"	Drip loss
M. Gracillus	6.13	42.24	7.84	1.35**	5.94	46.31	7.40	1.27**
M. Gluteobiceps	5.78	50.22	4.41	1.51***	5.75	55.44	4.67	2.15***
M. Semimembranosus	5.77	46.55	4.90	1.70***	5.56	53.74	5.04	3.03***
M. Gluteus medius	5.81	50.39	4.47	2.40***	5.65	56.21	3.81	4.48***
M. Vastus lateralis	5.79	49.92	3.89	1.22***	5.76	55.56	3.33	1.50***
M. Gastrocnemius	6.07	46.49	6.21	0.92**	5.94	46.78	7.03	0.98**
M. Flexor digitorum superficialis		40.04	9.15			45.62	10.59	
M. Deltoideus	6.32	44.99	7.61	1.08*	6.16	49.97	6.56	1.17*
M. Tensor fasciae antebrachii	6.21	50.82	7.61	2.09*	5.74	53.36	7.04	2.61*
M. Infraspinatus	6.35	44.19	8.54	1.18**o	6.15	49.64	8.41	1.03**
M. Supraspinatus	6.05	46.59	8.21	0.89***	6.05	47.70	9.22	0.99***
M. Triceps brachii caput laterale	5.85	47.68	5.78	0.79**	5.82	49.34	5.78	0.96**
M. Triceps brachii caput longum	6.15	47.39	5.54	1.74***	5.72	52.49	4.81	1.77***
M. Biceps brachii	6.51	44.70	6.17	0.95*	6.15	47.69	7.20	1.41*
M. Subscapularis	6.23	39.59	9.22	1.10**	6.12	45.18	9.33	1.67**
M. Teres major	6.57	45.46	7.06	1.03*	6.04	49.34	8.82	1.63*
M. Brachialis	5.56	41.65	7.88	1.00*	5.83	49.64	8.43	1.45*
M. Coracobrachialis	6.62	44.14	7.22	2.41**	6.15	44.14	9.43	1.78**
M. Triceps brachii caput medial	6.14	44.30	9.82	1.01*	6.11	43.77	11.89	1.02*
M. Brachiocephalicus	5.63	47.24	6.51	1.51**	5.63	53.40	5.68	1.62**
M. Diaphragma	5.90	41.91	6.85	0.99**	5.96	47.90	7.51	1.51**
M. Transverses abdominis	5.97	40.80	7.23	1.51**	5.78	48.70	7.50	1.46**
M. Longissimus dorsi	5.71	50.08	3.99	2.80***	5.50	54.34	6.66	5.67***
M. Psoas major	5.78	45.34	7.14	1.95***	5.64	48.48	9.89	1.97***
M. Psoas minor	5.81	41.58	9.77	2.00**	5.69	43.19	13.32	2.31**

*Hanging bag method **Blotting method ***Coring method