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IDENTIFICATION OF VARIATIONS IN MEAT QUALITY IN LIVE HALOTHANE HETEROZYGOTES USING BIOPSY SAMPLES OF M. LONGISSIMUS DORSI

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INTRODUCTION

Variations in meat quality were reported for halothane heterozygotes (Nn) of various breeds (Sellier, 1987). For example, the meat quality of Nn was shown to be closer to that of the homozygote (NN) in Dutch Landrace (Eikelenboom *et al.*, 1980), intermediate (Lundstrom *et al.*, 1989; Murray *et al.*, 1989; Sather *et al.*, 1991) between homozygotes (NN and nn) and closer (Sather *et al.*, 1991; Pommier and Houde, 1992) to nn in crossbred pigs. Carcass weights were also reported to influence the meat quality of crossbred Nn, which produced meat closer to NN at 65 to 75kg but closer to nn at 95 to 105kg (Sather *et al.*, 1991).

The objectives of our research were:
(1) to investigate the meat quality of Nn pigs, and
(2) to devise a procedure for identifying variations in meat quality in Nn pigs using small biopsy samples of LD.

MATERIALS AND METHODS

Eighteen British Landrace and fifty-one Landrace x Large White Nn pigs were used in our studies. The British Landrace Nn pigs were kindly supplied by Dr A.J. Webb, Agricultural and Food Research Council (AFRC), Animal Breeding Research Organization, Edinburgh. The Nn pigs of Landrace x Large White (n=40) from the Animal Research Institute, Queensland Department of Primary Industry were identified by a combination of halothane testing (Eikelenboom and Minkema, 1974) and blood typing (Gahne and Juneja, 1985; Kramer *et al.*, 1991), and those from the University of Melbourne (n=11) by a modified version of the PCR (polymerase chain reaction) genotyping test (Hughes *et al.*, 1992).

The post-mortem meat quality was assessed on LD samples by pH_1, water-holding capacity (WHC), colour (Hunter L), fibre optic probe (FOP) and drip measurements (Cheah *et al.*, 1984; 1986). The WHC of LD samples was determined using a Grau-Hamm type press and its value was expressed as an average ratio of the value of muscle area/fluid area from three samples of muscle (Cheah *et al.*, 1984). Meat was classified by using the combined measurements of pH_1 (normal, >6.00; PSE, ≤6.00), colour (Hunter L; normal, 45-50; PSE, >50), WHC (normal, >0.6; PSE, ≤6.0) and FOP (normal, 25-50; PSE, ≥55). The potential meat quality in live Landrace x Large White Nn pigs was determined by the measurements of pH and the weight of the 12,000g supernatant, referred to as fluid (F), after incubation of 500mg biopsy LD samples with an equal volume of 150 mM KCl at 39°C for 45 minutes (Cheah and Cheah, 1991; Cheah *et al.*, 1991; 1993). The potential meat quality of Nn pigs was classified as PSE [(F), ≥0.50g/0.5g wet weight LD and pH(F), ≤6.00], intermediate [F, 0.44-<0.50 and pH(F), >6.00 and <6.20] and normal [F, <0.44 and pH(F), ≥6.20] from the biopsy data obtained from LD samples. The British Landrace Nn pigs were slaughtered

at 65 to 70kg live weight by electrical stunning (90V, 50Hz) and exsanguination in an experimental abattoir under controlled conditions at the AFRC Food Research Institute, Langford, Bristol (UK), and the Landrace x Large Whites (80 to 95kg) at a local commercial abattoir.

The results in the tables and text are expressed as means ± s.e. The correlation coefficient (r) was determined using Cricket Graph (Version 1.3.2), and the means ± s.e. and P values using StatWorks (Version 1.1).

RESULTS AND DISCUSSION

The values for meat quality assessments based on pH_1, WHC, FOP, colour and drip showed that British Landrace Nn pigs produced both normal and PSE-carcasses post-mortem (Table 1).

Figure 1 illustrates the potential meat quality of live Landrace x Large White Nn pigs (n=51) determined from biopsy LD samples. A high correlation coefficient (r=-0.92) was observed between pH(F) and F, an indicator of WHC. The data based on pH(F) and F implied that Nn pigs could produce a range in potential meat quality from normal (n=13) through intermediate (n=11) to PSE (n=27). The mean values for pH(F) and F used for assessing the potential meat quality in live Nn pigs were significantly different (Table 2) between normal [pH(F), 6.31±0.07; F, 0.40±0.03], intermediate [pH(F), 6.07±0.3; F, 0.47±0.01] and PSE [pH(F), 5.79±0.02; F, 0.62±0.01] carcasses.

In our previous studies on halothane positive (n=37) and halothane negative (n=55) Landrace x Duroc, predictions of potential meat quality from biopsy LD samples were confirmed by assessments of post-mortem LD (Cheah *et al.*, 1993). This supports the application of the measurements of the amount of fluid (F) and pH(F) from biopsy LD samples after incubation with an equal volume of 150mM KCl at 39°C for 45 minutes for selecting pigs with differences in WHC to improve meat quality. In those studies, very high correlation coefficients were observed between pH(F) and F (r=-0.944) in the biopsy LD samples, and also between biopsy pH(F) and post-mortem pH_1 (r=0.951), and post-mortem pH_1 and biopsy F (r=-0.956).

In our present studies on Landrace x Large White Nn pigs, predictions of normal and PSE carcasses from biopsy LD samples were also confirmed from assessments on post-mortem LD samples (Table 2). Significant differences were observed in the biopsy data [pH(F) and F] between animals classified as PSE, intermediate and normal. The differences in the post-mortem data for pH_1 and FOP between PSE and normal carcasses were also significant. No differences were however observed between pH(F) and pH_1 for the PSE and normal Nn pigs, indicating that the pH(F) of biopsy LD samples is a good assessment of post-mortem pH_1. No DFD carcasses were observed since the values for pH_{ult} were below 6.0.

CONCLUSION

Our studies demonstrated the occurrence of variations in meat quality in Nn pigs. In Landrace x Large White Nn pigs, meat quality could range from normal (26%) through intermediate (21%) to PSE (53%). The predictive meat quality test performed on small biopsy LD samples could be applied to select Nn pigs with a potential to produce pork of normal WHC, and could also be applied by the pig industries to identify Nn pigs prone to producing PSE carcasses post-mortem.

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Table 1. Post-mortem meat quality characteristics (PSE, n=10; Normal, n=8) of LD samples from British Landrace heterozygotes.

Quality	PSE	Normal	t-test
pH_1	5.62 ± 0.04	6.13 ± 0.03	P<0.001
WHC	0.43 ± 0.01	0.64 ± 0.01	P<0.001
FOP	67.9 ± 2.3	44.3 ± 3.0	P<0.001
Hunter L*	55.5 ± 1.2	47.3 ± 1.2	P<0.001
Drip (%)	4.2 ± 0.6	2.0 ± 0.4	P<0.02

Table 2. Muscle biopsy and meat quality characteristics of Landrace x Large White Nn pigs.

Quality	PSE	Inter-mediate	Normal	t-test
pH(F)*	5.79 ± 0.02	6.07 ± 0.03	6.31 ± 0.07	P<0.001
F g/0.5gLD*	0.62 ± 0.01	0.47 ± 0.01[a]	0.40 ± 0.03[a]	P<0.001
pH_1#	5.80 ± 0.03	NA	6.06 ± 0.09	P<0.01
FOP#	57 ± 3	NA	43 ± 3	P<0.05 P<0.01[a]