E EFFECT OF MIXING, FASTING AND GENOTYPE ON CARCASS SHRINKAGE AND PORK QUALITY

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MARY

effects of genotype (NN=homozygous normal, Nn=heterozygous, nn=homozygous recessive) for stress susceptibility, fasting and ing during the 24h prior to slaughter on carcass and muscle quality traits was investigated. Pigs of the nn genotype had higher carcass ds and a greater lean content in the major cuts than those of the NN genotype. Pigs of the Nn genotype tended to have intermediate ues for yield parameters compared to the other two genotypes. The net result of fasting and mixing for 24h was a loss in carcass yield ging from 12-19 g kg^{-1}. Pigs of the nn and Nn genotypes produced poorer quality muscle than those of the NN genotype. Fasting of s for 24h had minor effects on muscle quality. Mixing, with or without fasting, improved muscle quality in pigs of the Nn and nn otypes. It was concluded that the improvements in meat quality attributed to preslaughter treatment were probably negated by the reases in carcass yield, carcass damage due to fighting and finally by the possible detriment to animal welfare.

RODUCTION

riction of feed intake in pigs for up to 48h prior to slaughter has been found to reduce the incidence of PSE pork in nn and Nn otypes for the PSS gene (Murray et al. 1989) and also increase carcass shrinkage (Jones et al. 1988). Other reports have shown that ing periods of 2-6h at the abattoir prior to slaughter have a beneficial effect on lean muscle quality (Warriss 1985; Eikelenboom et al. 91). Barton-Gade (1984) concluded that nn pigs are relatively insensitive to changes in the pre-slaughter environment, while the meat lity of Nn and NN pigs was considerably improved if pre-slaughter stress was minimized. However, mixing of pigs and/or fasting may reduce glycogen levels in muscle from pigs of the Nn or nn genotpye leading to an improvement in muscle quality. The present eriment was designed to determine the interactive influence of mixing and fasting prior to shipping and slaughter for pigs varying in PSS genotype.

TERIAL AND METHODS

mals and design. A total of 229 pigs of three PSS genotypes (NN, Nn, nn) were assigned to one of two mixing treatments (unmixed or ed) and one of two feed restriction treatments (0 or 24h off feed). Approximately equal numbers of female and castrated male pigs e assigned to each treatment. The number of pigs in each of the 12 genotype/mixing/fasting treatment subclasses ranged from 17 to 22. s were raised in pens of four and at a weight between 95-100 kg were allocated to treatment. Pigs designated to be mixed were re- uped into new pens of four in the same barn so as to have no more than two pigs of each PSS genotype and no more than two pigs ich had previously been together. Pigs which were not to be mixed were moved to a new pen. Half of the mixed and unmixed pens e kept off feed, but not water, for 24h prior to slaughter; the remaining pens were kept on full feed and water. Pigs were transported pen group approximately 200 m from the barn to the abattoir and were killed within 1h of arrival. All pigs were weighed at the start of e treatment and 24h later in the barn and also immediately before slaughter.

ughter and carcass measurements. Pigs were stunned by electricity using a head to back electrical stunner (400V, 60Hz) and dressed ording to commercial practices. Warm carcass weight included the kidney fat, kidneys and head. All carcasses were chilled for 24h at C. Fighting following mixing was assessed by the number of lacerations or bruises on the carcasses using a 4 point scale (0=no erations or bruises, 4=extreme number of lacerations and bruises). The left side of each carcass was divided into primal cuts which e separated into fat, lean and bone. Lean yield was expressed as the proportion of lean in the major primal cuts (picnic, butt, loin and m). Measurements of pH were made in the longissimus thoracis (12th rib) at 45 min and 48h post-slaughter. On the day following ughter, the longissmus thoracis was removed between the 4th and 12th ribs. Drip loss was recorded on a 2cm pork chop placed on a rofoam tray overwrapped with oxygen permeable polyvinyl film and stored for 48h at 1°C. Two days post-slaughter the subjective colour and structure of the longitudinal surface (4-12th ribs) and cross section (12/13th rib) of the longissimus thoracis were evaluated three raters and the results averaged. A second 2cm pork chop was used to determine meat colour (CIE L*) and cores were removed the cooked chop to determine shear value. The portion of the muscle between the 6th and 10th ribs was ground for the measurement of expressible juice, protein solubility and chemical composition (water, protein and fat). The data was analysed as a 3 (genotypes) x 2 (mixing) x 2 (fasting) factorial.

RESULTS AND DISCUSSION

Fighting. Most fighting was complete within an hour of mixing the pigs. Neither genotype or fasting influenced the degree of fighting expected, the mixing of pigs resulted in a significantly higher level of fighting than the other treatments. Pigs that were mixed had sl moderate levels of lacerations and bruises compared to virtually no carcass damage in unmixed pigs. Similar results have been found others (Warriss and Brown 1985; Guise and Penny 1989).

Weight losses. There was a significant mixing x fasting interaction for live weight changes before slaughter. Unmixed, non fasted pigs gained 10.5 g kg^{-1} in weight, whereas all other treatments caused a loss in weight ranging from 24-49.4 g kg^{-1}(Table I). The greatest in weight was in pigs that were mixed and fasted for 24h (-49.4 g kg^{-1}). However, mixing alone without fasting resulted in a signific weight loss (-24 g kg^{-1}). On an overall basis genotype had no effect on live weight changes in the 24h prior to slaughter. The live wei changes in response to fasting and mixing are similar to those reported by Jones et al. (1985) and Warriss (1986).

Carcass yield and composition. Genotype influenced carcass yield (carcass weight/plant weight * 1000) with pigs of the nn and Nn genotypes having 44 and 35 g kg-1 greater carcass yields than pigs of the NN genotype. There was an interaction for the effects of fas and mixing on carcass yield. Fasting for 24h, with or without mixing increased carcass yield by 30 g kg^{-1}, while mixing in the absence fasting increased carcass yield by 14 g kg^{-1}. These increases in carcass yields however do not reflect the weight losses which occurred the 24h period prior to slaughter. When carcass weights were expressed as a proportion of treatment yield (Table I), pigs that were fas and mixed had a lower carcass yield than unmixed, non-fasted pigs by 19 g kg^{-1}. Eikelenboom et al. (1991) only reported fasting for 24h to influence carcass yield in one of three experiments. These same authors concluded that there was little economic loss in carcass weight in pigs through the use of fasting periods of 16-24h prior to slaughter. Fasting and mixing had no effect on carcass lean content, but this trait was significantly influenced by genotype. Nn and NN pigs had similar carcass lean contents which were lower (by 41 g kg than those of nn pigs. Similar results have been reported previously (Jones et al. 1988; Aalhus et al. 1991).

Lean muscle quality. With no mixing, fasting decreased the frequency of pale (subjective score=2) pork from 84 to 47% for nn and fr 24 to 18% for Nn pigs (Figure 1). Mixing for 24h prior to slaughter had a large effect on muscle colour, decreasing the frequency of p pork from 84 to 20% for the nn genotype and from 24 to 11% for the Nn genotype. Mixing also caused 5 pigs to produce darker than normal muscle colour. Figure 2 presents the effect of PSS genotype, mixing and fasting on the subjective structure score of the longissumus thoracis. For pigs of the nn genotype, the 24h fasting treatment decreased somewhat from 85 to 65% for the frequency of pigs having meat with a soft and exudative structure, but fasting had little effect on pigs of the Nn genotype. Mixing for 24h without fasting caused the lowest incidence of soft, exudative pork (25 and 11% for the nn and Nn genotypes, respectively). A combined mixing and fasting treatment resulted in a higher frequency of soft exudative pork than just mixing with no feed restriction. For 5-11% of the p in each of the three genotypes, the combined mixing and fasting treatment resulted in dark, firm pork. This tendency for exhausted and fasted pigs to produce DFD pork has been reported by several others (Neilson 1981; Warriss 1986; Guise and Penny 1989). Genotype, fasting and mixing also influenced the objective measurements of muscle quality (Table II). Genotype significantly affected muscle colo pH, drip loss, expressible juice, shear force and muscle composition with nn pigs having meat with a much lower quality than NN pigs. Nn pigs tended to have intermediate values for meat quality compared to the other two genotypes (Table II). Mixing for 24h prior to slaughter tended to have a beneficial effect on muscle quality but fasting time had few effects on muscle quality (Table II). Genotype x mixing interactions were significant for several parameters of muscle quality (Table III). The results indicated that mixing resulted in an provement in meat quality for the Nn and nn genotypes, but had little effect on the NN genotype. Eikelenboom et al. (1991) concluded fasting for 16-24h prior to slaughter improved meat quality in 3 way cross pigs of unknown genotype with respect to the PSS gene. However, few details were given concerning the handling of these pigs prior to slaughter and some of the improvement in meat quality could have been realized through mixing since the pigs were slaughtered in a commercial abattoir.

CONCLUSION

The control of PSE pork continues to be the goal of swine industrues in many countries. Pigs of both the nn and Nn genotypes produce poorer muscle quality than do pigs of the NN genotype. Fasting of pigs for 24h pre-slaughter will alleviate the PSE problem to a small extent. The mixing of pigs, with or without fasting, will improve muscle quality of pigs of the Nn and nn genotypes. Such gains in muscle quality due to mixing and/or fasting may be negated by the decreases in carcass yield, the additional carcass damage due to fighting and finally the detriment to animal welfare.

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Table 1. Effects of mixing and fasting on live weight changes prior to slaughter

	Unmixed		Mixed	
	Fasted 0h	Fasted 24h	Fasted 0h	Fasted 24h
Treatment yield g kg-1	1010.5a	958.7c	976.0b	950.6d
Weight change g kg-1	10.5a	-41.3c	-24.0b	-49.4d
Warm carcass g kg-1	805.2a	836.1c	819.3b	835.9c
Liver g kg-1	19.0a	15.4b	17.4c	15.6b
Alimentary tract g kg-1	98.7a	71.9c	85.6b	66.3d

abcd Means with different letters are different at P<0.05.

Treatment yield is a proportion of initial weight. Warm carcass yield, liver and alimentary tract are a proportion of plant weight immediately prior to slaughter

Table II. Effect of PSS genotype, fasting and mixing on lean muscle quality

Trait	Genotype			Mixing		Fasting time h	
	NN	Nn	nn	Unmixed	Mixed	0	24
pH 45 min	6.10a	5.83b	5.51c	5.81	5.82	5.82	5.82
pH 48h	5.52a	5.49b	5.52a	5.48a	5.54b	5.49a	5.53b
CIE L*	48.7a	50.5b	54.7c	52.3a	50.3b	51.3	51.2
Drip loss g kg^{-1}	21.0a	31.5b	34.1b	31.7a	26.0b	29.9	27.9
Expressible juice g kg^{-1}	234.5a	270.0b	285.0c	273.0a	253.5b	267.0	259.5
Soluble protein g kg^{-1}	184a	163b	128c	153a	164b	156	160
Shear force kg	5.4a	6.6b	7.5c	6.3a	6.7b	6.5	6.5
Intramuscular fat g kg^{-1}	3.8a	2.7b	2.6b	3.0	3.0	3.0	3.0

abc Means with different letters within treatment are different at $P<0.05$.

Table III. Effect of mixing within genotype on pork muscle quality

Trait	NN		Nn		nn	
	Unmixed	Mixed	Unmixed	Mixed	Unmixed	Mixed
pH 48h	5.51	5.53	5.45a	5.53b	5.48a	5.56b
Drip loss g kg^{-1}	20.7	21.2	36.7a	26.3	37.6a	30.6b
Soluble protein g kg^{-1}	183	185	157a	168b	117a	139b

ab Means with different letters within genotype are different at $P<0.05$.

Figure 1. The effect of PSS genotype, fasting and mixing of pigs on the frequency of pale pork.

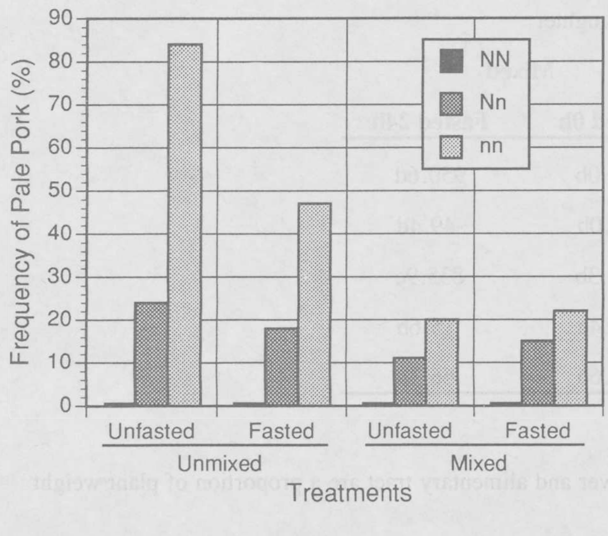

Figure 2. The effect of PSS genotype, fasting and mixing of pigs on the frequency of soft, exudative pork.