SE IN PORK: THE RELATIONSHIP BETWEEN GENOTYPE, AS DETERMINED BY THE RESTRICTION ENDONUCLEASE SSAY, AND THE ENVIRONMENT

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UMMARY

Four hundred-forty-eight commercial pigs were subjected to one of the following preslaughter treatments under field conditions: ed removal, 44 or 30 hours prior to slaughter; feed removal, 20 or 6 hours prior to slaughter; sorted and weighed, 44 or 30 hours ior to slaughter; sorted and weighed, 20 or 6 hours prior to slaughter. The genotype (NN, Nn) of all pigs was determined by plying the restriction endonuclease assay for porcine malignant hyperthermia on a sample of the LD muscle. The quality of pork SE) was objectively determined using the L^* a^* b^* coordinates as measured by the Colormet Meat Probe. The timing of feed moval relative to slaughter had no impact ($P>0.05$) on the development of PSE in pork. The timing of sorting/weighing, wever, did ($P<0.05$); sorting/weighing 44 or 20 hours prior to slaughter relative to 30 or 6 hours, respectively, improved the ality of pork. Furthermore, the magnitude of the response was higher ($P<0.05$) in pigs of the Nn genotypes. Regardless of the eslaughter manipulations, pigs of the Nn genotypes had poorer ($P<0.01$) pork quality than pigs of the NN genotype. The rrelation coefficient between L^* and genotype was 0.12 ($P<0.01$).

NTRODUCTION

he pork quality defect PSE is discriminated against because of its poor colour, water holding capacity and poor structure. These oor characteristics are costly to the pork industry as they are associated with weight loss, poor yield and extra labour needed for rting carcasses according to quality.

he property of pork meat and, hence, the development of quality defects such as PSE can vary considerably from pig to pig. The velopment of PSE pork can be of genetic origin, of environmental origin (physical activity and/or psychological stress) or a mbination of both. The contribution of a given environmental stressor to the development of PSE largely depends on the nature, he extent and the time of the given stressor prior to slaughter whereas, pigs which have a genetic pre-disposition to stress enotype:nn) will, in most cases, invariably develop PSE regardless of the stressor imposed prior to and at slaughter. Research idence also points to a genotypic-environmental interaction whereby heterozygote pigs (Nn), exposed to a given preslaughter ressor, could develop PSE after slaughter more easily than homozygote pigs (NN).

With the recent discovery of the mutation responsible for the development of malignant hyperthermia in pigs (Fujii et al, 1991) it is now possible to determine the genotype of a large number of pigs, rapidly and relatively inexpensively by a restriction ndonuclease assay (Houde and Pommier, 1992).

This research was initiated to investigate, under field conditions, the genotype-environment interaction in pigs subjected to two preslaughter stressors.

ATERIALS and METHODS

In Canada, there are two types of marketing systems for delivering pigs to the abattoir. After a sale is completed, the sold market pigs can either be transported directly to the abattoir or first delivered to a central point (assembly yard) where they will be assembled with other pigs to form a load of 210-250 pigs and then delivered to the abattoir. In the former case, pigs are usually slaughtered on the same day they leave the farm whereas, in the latter case, these pigs are generally slaughtered on the day following the delivery at the assembly yard.

In this study, pigs were exposed to two preslaughter stressors: 1) feed removal (evening prior to or on the morning of delivery the assembly yard or at the abattoir) and 2) preparation for delivery, i.-e., sorting and weighing (evening prior to or on the morn of delivery at the assembly yard or at the abattoir). Super-imposed to these stressors were the two types of marketing syste perviously described. All pigs were slaughtered at a commercial abattoir after a three hour rest following delivery (Table 1).

TABLE 1. Preslaughter stressors.

Treatment	Type of marketing	Hours between treatment/slaughter
Feed removal	Delivery at yard	44
		30
	Delivery at the abattoir	20
		6
Preparation for delivery	Delivery at yard	44
		30
	Delivery at the abattoir	20
		6

The genotype of 448 commercial pigs obtained in four lots from the same producer was determined by applying the restricti endonuclease assay for porcine malignant hyperthermia on a muscle (LD) sample (Houde and Pommier, 1992). The quality pork (LD muscle) was objectively determined on the hanging carcass using the L^* a^* b^* coordinates as measured by the Colorm Meat Probe (D65/10) (Fortin, 1989). The effects of genotype, the timing of feed removal and of delivery preparation on t quality of the LD muscle were evaluated using the GLM procedure of Statistical Analysis System Institute Inc. (SAS, 1985).

RESULTS and DISCUSSION

Timing of feed removal

The effects of the timing of feed removal and of the genotype on the colour (L^*) of pork are presented in Table 2. Irrespecti of the type of marketing system under which pigs were marketed, the timing of the feed removal (evening prior to vs the morn of delivery) did not result in a change in colour as measured by L^* ($P=0.1$ to 0.9). Previous research (Eikelenboom et al 199 Murray et al 1989) has shown that prolonged fasting has generally a positive impact on the quality of pork. In these researc reports, however, duration of fasting was always compared with no fasting at all; i.-e., access to feed until slaughter. The presen

TABLE 2. The effects of timing of feed removal and genotype (NN, Nn) on the L^* value of the LD muscle.[1]

Genotype	Delivery at the yard[2]		Delivery at the abattoir[2]	
	Feed removal	L*	Feed removal	L*
NN	44 h	25.6	20 h	28.5
	30 h	26.1	6 h	28.7
Nn	44 h	27.7	20 h	29.9
	30 h	28.0	6 h	30.2

[1] Least-squares means.
[2] Effect of treatment: $P>0.05$; Effect of genotype: $P<0.05$.

search differs from others in that the timing of feed removal was compared rather than the duration of fasting per se; i.-e., ning prior to vs morning of delivery. For both types of marketing, the additional period of feed removal was approximately hours and feed was removed for a minimum of 6 or 30 hours depending on the type of marketing considered. It would then ear that under the marketing conditions seen in Canada whether feed is removed the evening prior to delivery or on the ning of delivery does not have an impact on the quality of pork. Pork from pigs of the NN genotype had a lower L* value <0.05) than pork from pigs of the Nn genotypes.

ning of delivery preparation

Table 3, the effects of the genotype and the timing of delivery preparation, and the genotype-environment interaction are

TABLE 3. The effects of timing of the delivery preparation relative to slaughter and the genotype (NN, Nn) on the L* value of the LD muscle.[1]

Genotype	Delivery at the yard[2]		Delivery at the abattoir[2]	
	Delivery preparation	L*	Delivery preparation	L*
NN	44 h	26.2	20 h	27.4
Nn	30 h	28.3	6 h	29.8
	44 h	28.7	20 h	28.9
	30 h	32.5	6 h	34.3

[1] Least-squares means.
[2] Effects of genotype, treatment and interaction: $P<0.05$.

sented. Irrespective of the type of marketing considered, sorting and weighing the evening prior to delivery improved the lour of pork (L*).

e genotypes (NN, Nn) had also an impact ($P<0.05$) on the quality of pork. Furthermore, the magnitude of the improvement en the sorting/weighing took place the evening prior to delivery was larger ($P<0.05$) in pork from pigs of the Nn genotype; 4 units of L* vs 2 units of L* in pork from pigs of the NN genotype; hence, demonstrating not only lower quality in pork from terozygote (Nn) pigs but also a genotype-environmental interaction.

notype and the quality of pork

Table 4, the results were combined across treatments and experiments. Pork from pigs of the NN genotype was of better <0.01) quality (lower L* value) than pork from pigs of the Nn genotype. The coefficient of correlation between the genotype d L* was 0.12 ($P<0.01$). In a study of the effect of the genotype on the quality (the genotypes NN, Nn, nn were determined by lothane testing and blood typing), Lunsdström et al (1989) also showed a negative effect of the Halothane gene on the quality pork from pigs of the Nn genotypes.

TABLE 4. The effect of the genotypes (NN, Nn) on the L* value of the LD muscle when the preslaughter treatments are ignored[1].

Genotype[2]	L*
NN	26.4
Nn	30.7

[1] Least-squares means.
[2] Effect of genotype: $P<0.01$.

CONCLUSIONS

In the present study, commercial pigs were subjected to two preslaughter stressors under current Canadian marketing conditi in order to investigate the effect of the genotype (NN, Nn) and the genotype-environment interaction on the quality of pork

In one case, the preslaughter stressor under investigation (timing of feed removal) did not impact on the quality of po Nevertheless, pork from Nn pigs had much lower quality. On the other hand, the response to another preslaughter stressor (tim of delivery preparation) depended very much on the genotype of the pig. In all cases and irrespective of the stressor u consideration, the quality of pork from Nn pigs was poorer then the quality of pork from NN pigs. Furthermore, the heterozyg pigs (Nn) were more responsive to a preslaughter manipulation.

The suggestion, then, of promoting a breeding strategy whereby specialized homozygote nn terminal sire lines and homozygote N dam lines are maintained to produce heterozygote Nn market pigs is completely erroneous. On the contrary, complete elimina of the gene should be the main objective of any breeding strategy aiming at improving the quality of pork.

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