EFFECT OF IGF-II AND HALOTHANE GENOTYPE ON CURED COOKED LOIN PRODUCTION

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Keywords: halothane gene, PSE, IGF-II allele, stress genotype, ham

Introduction

During the last decades, pig breeding programs have strongly focused on selection for fast growth of lean meat. However, this may be accompanied by negative effects on certain meat quality characteristics. It is well known that the halothane gene increases the carcass lean content but equally increases the risk of development of PSE (Pale, Soft and Exudative) meat. Cooking and curing of PSE hams results in lower technological yields. This may be associated with aberrant colour development and texture defects (Fernandez *et al.*, 2002; Leach *et al.*, 1996), particularly in polyphosphate-free cooked ham production (Martoccia *et al.*, 1994). The gene in its heterozygous form (Nn) is believed to have mainly intermediate effects on carcass and meat quality.

On the other hand, Van Laere *et al.*, (2003) recently identified a paternally expressed mutation located in the regulatory sequence of the IGF-II gene (insulin-like growth factor-II). The mutation is known as the IGF-II intron3 G3072A mutation and has a similarly large effect on carcass lean content and apparently no negative effects on meat quality (Nezer *et al.*, 1999). However, the effects on curing and cooking of meat have not yet been assessed. Therefore, the aim of this study was to investigate the effect of the IGF-II allele (Apat vs. Gpat) in combination with the stress genotype (Nn vs. NN) on the properties of cured and cooked loin. For practical reasons, loin samples were used to simulate this type of processing, although cured cooked ham production from hind-leg muscles is more common

Materials and Methods

Animals: The animals (n = 53) were the progeny of one sire and 13 sows and consisted of castrates and females (n = 26 and 27 respectively). The sire (Rattlerow-Seghers) was heterozygous for IGF-II and homozygous negative for halothane. The sows were heterozygous for the halothane gene. Because of the paternal imprinting of the IGF-II gene, offspring were only considered with known paternal allele of interest. The number of Nn animals was 13 Apat and 17 Gpat, whereas there were 10 Apat and 13 Gpat NN animals. Apat animals inherited the IGF-II mutation which is related to the higer muscle mass versus the Gpat animals carrying the paternal wild type allele. Pigs were fed ad libitum on a conventional diet. After overnight fasting, they were slaughtered following CO_2 stunning in a private abattoir. The average live weight at slaughter was 109 ± 7 kg.

Cured cooked loin preparation: At 24 h post mortem, the left loin was taken from the carcass and backfat was removed. The dorsal end of the *Longissimus* between the 3rd and 4th vertebra (between 0.9 and 1.5 kg) was used for curing and cooking the day after. A protocol for the preparation of high-quality cooked ham was followed. With a multi-needle injection system, 15% brine (20.2% salt, 5.6% dextrose, 1.1% ascorbate and 1.1% flavourings) was injected, followed by 30 minutes of tumbling (15 rpm, 4°C, 85°, not-vacuum) in a Rhüle PR15. Afterwards, the meat was individually vacuum-packed in a shrink-bag and cooked until a nucleus temperature of 67°C. After 2 h of cooling, the samples were stored at 2°C for 48 h. The curing yield was calculated as the percentage difference between the weight after curing and tumbling and the initial weight. Similarly, cooking losses were calculated from the weight difference before and after cooking. The overall yield is defined as the final weight relative to the initial weight.

Analyses: Colour and colour stability was measured with a Hunterlab Miniscan apparatus (D65 light source, 10° standard observer, 45°/0° geometry, 1 in. light surface, white standard) after 2 h and 5 days of display. Samples were wrapped in oxygen-permeable foil and stored at 4°C under fluorescent light. L*, a*, b* values were measured in quadruplicate. Reflection values at 630 and 650 nm were measured in duplicate to estimate the concentration of nitrosylhemochrome pigment (% NH = R650/R630). A texture profile analysis was done with a Lloyd TA 500 Texture Analyser directly after cutting. Samples of 3 cm thickness were compressed two times at the same place to 70% of its initial thickness. Several texture traits (hardness, gumminess, chewiness and stiffness) were derived from the resultant time versus force (load) curve.

Data were analysed with a univariate general linear model with gender, IGF-II and halothane genotype as fixed factors. Preliminary analysis revealed no significance of the interaction terms, and no effect of carcass weight as covariate. Statistical analyses were done using SPSS 12.0 for windows.

Results and Discussion

No effect of IGF-II genotype and gender on curing yield, cooking losses and overall yield was found (Table 1). However, overall yield was significantly higher in Nn animals compared to NN animals. This is in accordance with

literature data (Fernandez *et al.*, 2002; Leach *et al.*, 1996). It should be stressed that the effects of differences in fresh meat quality on processing yields is highly dependent on the type of processing, e.g. on the use of additives in the brine. Texture parameters of the cooked samples were not influenced by the IGF-II genotype. However, significant effects were found for the halothane genotype and gender. Gumminess and chewiness were significantly higher in samples from halothane carriers. Samples from gilts had significantly higher values for all texture traits. Texture traits were negatively related to overall yield and positively related to carcass lean meat content ($|r| \approx 0.4$). Carcass lean meat content and overall yield were negatively related ($r = -0.26$). In this study, the differences in lean meat content between the two IGF-II genotypes and gender were much larger (> 5%) than between the two halothane genotypes (< 2%). Hence, differences for yield and texture traits that were observed may be partly, but not entirely, associated with differences in fat content.

The IGF-II mutation and gender did not influence colour and colour stability of the cooked ham as well as the nitrosylhemochrome concentration. Nn pigs had slightly but significantly higher b* values compared to NN pigs after 2 hours of exposure to light.

Table 1: Least square means ± SE for technological yield, texture and colour traits.

	IGF-II genotype			Halothane genotype			Gender		
	A	G	P	Nn	NN	P	Barrow	Gilt	P
				Technological yield traits					
Curing yield (%)	14,1 ± 0,4	14,4 ± 0,3	ns	14,1 ± 0,3	14,4 ± 0,4	ns	14,1 ± 0,3	14,4 ± 0,3	ns
Cooking losses (%)	12,6 ± 0,6	12,0 ± 0,5	ns	13,5 ± 0,5	11,0 ± 0,6	**	12,0 ± 0,6	12,5 ± 0,5	ns
Overall yield (%)	99,7 ± 0,8	100,7 ± 0,7	ns	98,7 ± 0,7	101,7 ± 0,8	**	100,4 ± 0.8	100,0 ± 0,8	ns
				Texture traits					
Hardness (N)	49,1 ± 1,4	48.0 ± 1,3	ns	49,9 ± 1,3	47,2 ± 1,4	ns	45,0 ± 1,4	52,1 ± 1,3	**
Gummines (N)	13,7 ± 0,5	13,5 ± 0,4	ns	14,3 ± 0,4	12,9 ± 0,5	*	12,6 ± 0,4	14,6 ± 0,4	**
Chewiness (N.mm)	154,2 ± 5,3	151,5 ± 4,6	ns	161,0 ± 4,6	144,7 ± 5,3	*	140,3 ± 5,0	165,4 ± 4,8	**
Stiffness (N.mm)	5,3 ± 0.2	5,3 ± 0,2	ns	5,4 ± 0.2	5,3 ± 0,2	ns	4.8 ± 0.2	5,9 ± 0,2	**
				Colour traits					
L* 2h	76,14 ± 0,32	76,02 ± 0,28	ns	75,92 ± 0,28	76,24 ± 0,32	ns	76,31 ± 0,31	75,85 ± 0,30	ns
a* 2h	5,84 ± 0,11	5,99 ± 0,10	ns	5,86 ± 0,10	5,97 ± 0,10	ns	5,96 ± 0,11	5,87 ± 0,10	ns
b* 2h	12,39 ± 0,06	12,43 ± 0,05	ns	12,56 ± 0,05	12,23 ± 0,05	**	12,34 ± 0,06	12,48 ± 0,05	ns
% NH 2h	1,06 ± 0,01	1,05 ± 0,01	ns	1,06 ± 0,01	1,05 ± 0,01	ns	1,05 ± 0,01	1,06 ± 0,01	ns
Δ a*	3,91 ± 0,10	3,86 ± 0,09	ns	3,87 ± 0,09	3,90 ± 0,10	ns	3,81 ± 0,09	3,96 ± 0,09	ns
Δ Chroma	0,67 ± 0,08	0,62 ± 0,07	ns	0,66 ± 0,07	0,62 ± 0,08	ns	0,53 ± 0,08	0,75 ± 0,08	ns
Δ % NH	0,02 ± 0,01	0,03 ± 0,01	ns	0,03 ± 0,01	0,02 ± 0,01	ns	0,02 ± 0,01	0,04 ± 0,01	ns

*, ** = significantly different at $P < 0,05$ and 0,01 respectively, ns = not significant

Δ a*, Δ Chroma, Δ Hue and Δ % NH is calculated as the difference between 2 h and day 5 as measures for colour stability

Conclusions

The IGF-II genotype has no influence on the technological yield, texture and colour traits of cured cooked loin. Also no interaction effect with the halothane genotype is to be expected. However, the halothane genotype affected technological yield and texture, and gender also had an effect on the texture of cured cooked loin.

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Acknowledgements

This research is financially supported by the Institute for the Promotion of Innovation through Science and Technology, Brussels. The authors thank S. Lescouhier and T. Luyten for their excellent technical assistance.