Sensory quality of cured-smoked loins from carriers and non-carriers of the RN⁻ allele in Hampshire crosses with low and high lean meat content

Maria Johansson[1], Åsa Josell[1] Kerstin Lundström[2], Ann-Charlotte Enfält[2], Ingemar Hansson[2] and Eva Tornberg[1]
[1]Swedish Meat Research Institute, PO Box 504, S-244 24 KÄVLINGE, Sweden, [2]Department of Food Science, Swedish University of Agricultural Sciences, PO Box 7051, S-750 07 UPPSALA, Sweden

Background

Technological and sensory quality traits are of major importance to pork meat. In Sweden, the Hampshire breed is used in pig meat production as terminal sire in three-breed crosses, where the dams are Landrace-Yorkshire crossbreeds. The specific characteristics of the Hampshire breed, including low pH and technological yield and high glycogen content (e.g. Monin & Sellier, 1985) have been attributed to the presence of the dominant RN⁻ gene (Rendement Napole) (Naveau, 1986; Estrade *et al.*, 1993; Le Roy *et al.*, 1995; Lundström *et al.*, 1996; Enfält *et al.*, 1997). In comparison with Yorkshire, pure-bred Hampshire has been found to produce more tender and juicier meat (Jensen *et al.*, 1967; Fjelkner-Modig and Persson, 1986) having a better flavour (Jensen *et al.*, 1967). In Sweden, about 50 % of pork loins are processed into cured-smoked loins. However, no data is available on the eating quality of cured-smoked loins from three-breed crosses compared to cured-smoked loins from pure breeds. Pigs that are too lean may produce tough meat, as earlier reported by Tornberg *et al.* (1994) who showed that lean meat content significantly affects the tenderness of pork loins. No data is available on the tenderness of cured-smoked loins from pigs with a different lean meat content.

Objectives

The purpose of this investigation was to study the effects of the RN⁻ allele on the sensory quality of cured-smoked loins in Hampshire crossbred pigs, in carcasses containing low and high lean meat content.

Methods

The material used in this study consisted of 90 pigs from commercial herds slaughtered at one abattoir. The pigs were selected from herds producing crossbred pigs for slaughter using pure-bred Hampshire or Hampshire x Yorkshire boars and Swedish Landrace x Yorkshire sows. The experimental material was chosen from low lean and high lean carcasses (<61 or ≥61 percent meat at grading) from the same herd, having a slaughter weight of 71 to 88 kg (head included). Only female pigs were selected to avoid confounding between meatiness and sex. *M. longissimus dorsi* (LD) from 20 pigs were selected for the processing of cured-smoked loins. Muscles were selected based on RN-genotype (content of glycogen), pH and content of lean meat. LD muscles were vacuum-packed upon cutting, frozen after 4 days of ageing and kept frozen for a maximum of 3 months before being processed. The processing was done in a commercial plant (see proceeding of Lundström *et al.*).

Processed loins were kept vacuum-packed at -1.5°C for a maximum of 3 weeks before sensory analysis. The cured-smoked loins were cut into 5 mm thick slices, which were randomly served to the panellists at room temperature. The panel consisted of 14 experts and each sample was judged in duplicate. The intensity of the following parameters was judged on an unstructured scale from 1 to 9 (1=no or very little; 9=very much): inhomogeneity in surface appearance, lightness, hardness, stringiness, consistency, initial juiciness, ultimate juiciness, crumbliness, salinity, smoked flavour and fat flavour. The results were statistically evaluated using SYSTAT (Wilkinson, Leland version 7.0) and The Unscrambler (version 6.11). Two-way ANOVA was used in SYSTAT. PCA was used in The Unscrambler.

Results and discussion

Genotype significantly ($p \leq 0.05$) affected the sensory parameters inhomogeneity in surface appearance, hardness and initial and ultimate juiciness in cured-smoked loins according to two-way ANOVA, where genotype and content of lean meat were category variables (Table 1). Inhomogeneity in surface appearance and hardness were significantly lower, whereas juiciness (initial and ultimate) was higher in cured-smoked loins from carriers of the RN⁻ allele than in cured-smoked loins from non-carriers. The degree of explanation in the model was high for these parameters; R^2=33, 53, 52 and 46 % for inhomogeneity in surface appearance, hardness and initial and ultimate juiciness, respectively. Lean meat content had no effect on the sensory quality of cured-smoked loins according to ANOVA. No significant interaction effects were seen for genotype and lean meat content.

A multivariate data analysis using principal component analysis (PCA) was performed. Loading and score plots, where PC1 is plotted against PC2, are shown in Figure 1. The variation was explained by 2 PCs to 56 %, where the first PC explained 44 %. Juiciness (initial and ultimate), fat flavour and consistency belonged mainly to PC1 and were positively correlated to each other. The parameters were negatively correlated with hardness, inhomogeneity in surface appearance, lightness and crumbliness, which in turn were positively correlated to each other. Smoke flavour and salinity belonged mainly to PC2. As seen from the score plot, cured-smoked loins from carriers of the RN⁻ allele (1, 2) were predominantly found on the right side of the plot in the direction of high juiciness (initial and ultimate), fat flavour and consistency and in the opposite direction of crumbliness, hardness, inhomogeneity in surface appearance and lightness. Cured-smoked loins from carriers of the RN⁻ allele (1, 2) were characterized by good consistency and high juiciness, whereas cured-smoked loins from non-carriers of the RN⁻ allele (3, 4) were characterized by low juiciness, great hardness and lightness. The lean meat content had no influence on the eating quality of cured smoked loin muscle, according to PCA, and samples from both groups (1, 3 and 2, 4 respectively) were evenly distributed in the plot.

To our knowledge, this is the first study elucidating the eating quality of cured-smoked loins from carriers and non-carriers of the RN⁻ allele as well as cured-smoked loins from carcasses of low and high lean meat content. Earlier studies have reported the RN⁻ allele as having no significant effect on the tenderness of pork loins (Lundström *et al.*, 1998), whereas the tenderness of pork loins was reported to decrease with increased lean meat content (Tornberg *et al.*,1994). This discrepancy due to processing will be further elucidated in the future.

Conclusions

Genotype had a significant effect on the sensory quality of cured-smoked loins, whereas the lean meat content had no effect. Cured-smoked loins from carriers of the RN⁻ allele had significantly higher juiciness and lower hardness and inhomogeneity in surface appearance than cured loins from non-carriers, according to ANOVA. Cured-smoked loins from carriers of the RN⁻ allele were juicier than cured-smoked loins from non-carriers, even though the process yield was lower for loins from carriers of the allele (see proceeding of Lundström *et al.*).

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Table 1. Differences in sensory parameters among cured-smoked loins from pigs with or without the RN⁻ allele (least-square means±standard errors, n=10).

	Genotype		Level of significance
	rn⁺rn⁺	RN⁻rn⁺	
Inhom.appearan.[1]	2.79±0.1	2.40±0.1	*
Lightness	5.68±0.2	5.28±0.2	#
Hardness	5.53±0.2	4.88±0.2	***
Stringiness	2.82±0.1	3.04±0.1	#
Crumbliness	3.60±0.1	3.38±0.1	ns
Consistency	5.41±0.2	5.70±0.2	#
Initial juiciness	4.25±0.2	4.88±0.2	***
Ultimate juiciness	5.80±0.2	5.93±0.2	**
Salinity	5.69±0.2	5.67±0.2	ns
Smoke flavour	4.84±0.1	4.83±0.1	ns
Fat flavour	1.58±0.1	1.67±0.1	ns

Levels of significance: ns=p>0.10; #=p≤0.10; *=p≤0.05; **= p≤0.01; ***=p≤0.001.
[1]Inhom.appearan.=inhomogeneity in surface appearance.

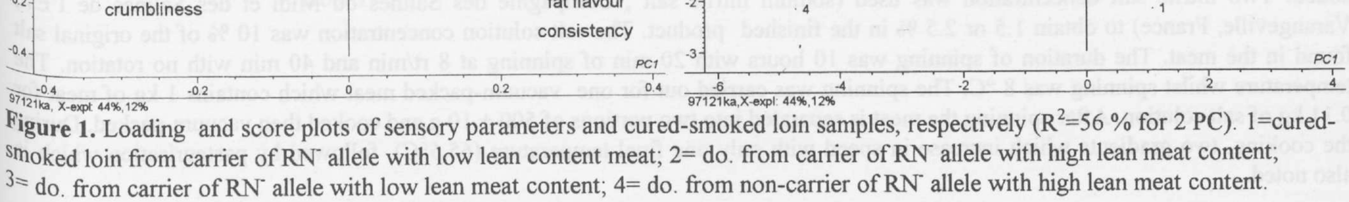

Figure 1. Loading and score plots of sensory parameters and cured-smoked loin samples, respectively (R^2=56 % for 2 PC). 1=cured-smoked loin from carrier of RN⁻ allele with low lean content meat; 2= do. from carrier of RN⁻ allele with high lean meat content; 3= do. from carrier of RN⁻ allele with low lean meat content; 4= do. from non-carrier of RN⁻ allele with high lean meat content.