PORK FLAVOUR – SENSORY PROFILING OF PORK OF DIFFERENT QUALITIES IN DENMARK AND SWEDEN

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Key words: pork; meat quality; sensory profiling

Background

This study was performed as a part of the Nordfood project "Pork flavour" partly funded by the Nordic Industrial Fund and the meat industries of Denmark, Norway and Sweden. The overall aim of the project is to identify consumer responses to pork flavour measurable using sensory and instrumental methods.

A survey of consumer attitudes to pork in Denmark, Norway and Sweden showed flavour to be the single most important attribute for liking pork (Agerhem *et al.*, 2000). The prerequisite for transferring consumer attitudes to measurable quality parameters is finding out and quantifying the sensory attributes and key chemical components governing pork flavour. This paper presents results from the sensory profiling performed in two laboratories in Denmark and Sweden, using equal pork samples of three distinct qualities. Consumer preferences for identical pork qualities, as well as instrumentally measured contents of volatile components in the samples, will be published elsewhere.

Objective

The objective of this investigation was to perform sensory profiling on 96 pork samples of different qualities in two sensory laboratories in Denmark and Sweden using harmonised methodology.

Materials and methods

Ninety-six female slaughter pigs (DD x LY) reared at the Danish Institute of Agricultural Sciences, Research Centre Foulum, were treated in order to produce meat of three distinct qualities, i.e. normal meat quality, DFD (ultimate pH 6.1-6.2) and RSE, slaughtered at an average weight of 102 kg. *M. longissimus dorsi* was aged for 1 and 7 days. The meat was cut into 2 cm slices and fried at 155±5°C to an end-point temperature of 65 and 80°C. In order to develop warmed-over flavour, the cooked samples were stored at +4°C for 48 h and then reheated to 65°C at 80°C before serving.

Sensory profiling was performed in two laboratories using a harmonised method, which involved training the panels with the same meat reference samples prior to sensory evaluation. Sensory profiling was performed using an unstructured scale from 0 to 100. Pork samples were judged in duplicate by 8 and 9 panellists. The following attributes were included in the profiling: meat aroma, pork aroma, metallic aroma, sweet aroma, acrid/old aroma, aroma of reheated meat, acidic aroma, meat flavour, pork flavour, metallic flavour, sweet taste, acrid/old flavour, flavour of reheated meat, acidity, bitter taste, brown colour, juiciness, tenderness.

The results were evaluated using principal component analysis (PCA) and The Unscrambler (Camo, version 7.5) and general linear model using SAS. The results were evaluated as two separate experiments. The first part was a full factorial design of DFD pork, with temperature (65°C; 80°C) and the reheating of chill-stored pork (no chill-storage/no reheating; chill-storage/reheating) being the main effects. Panellists were included in the model. In addition, the interaction between all the factors was included. The second part was a fractional design with temperature and reheating as in the first part, being the main effects. In addition, ageing (1 day; 7 days) and meat quality (normal quality; RSE) were the main effects. Panellists were included in this model only as interaction with other factors.

Results and discussion

The results of the evaluation of data using PCA are shown in Figures 1a and b. A reheated meat flavour was the predominant characteristic of the first principal component. As shown in the score plot (Fig. 1b), the two laboratories judged the samples in the same way as regards the attributes constituting the first principal component (PC). The first PC explained 68% of the variation in the data set, which implies that the warmed-over flavour was the main effect in the pork samples.

The second PC explained 17% of the variation and separated the results of the two laboratories. As seen in the Figure (Fig. 1b), the samples were parallelly shifted due to laboratory. The result of the Swedish panel tend towards juiciness, bitter taste and acrid/old aroma, whereas the Danish judgements tend towards brownness. However, the order of the samples is identical, which indicates that there might have been a systematic difference in the frying conditions used by the two laboratories. As seen in Figures 1a and b, pork samples cooked to an end-point temperature of 65°C scored higher for juiciness than samples cooked to 80°C, which were more intensely brown. The exclusion of chill-stored and reheated samples from data evaluation, reveals that juiciness and brownness dominated the first PC, and samples cooked to 65 and 80°C, respectively, were separated (data not shown). DFD samples were characterised by a high tenderness and a high intensity of sweet taste, pork aroma and pork flavour.

The results of the analysis of variance showed that sensory attributes related to chill-storage and reheating were significant contributors to the obtained results. The results of the ANOVA are illustrated in Table 1.

Conclusions

Warmed-over flavour was the main factor contributing to the flavour differences obtained in the pork samples, according to PCA and ANOVA. The two sensory laboratories judged the samples in a similar way as regards the warmed-over flavour related attributes (PC 1). The second PC separated the results of the two laboratories by a parallel shift, whereas the individual order of the samples was identical.

Acknowledgement

Funding by the Nordic Industrial Fund and the meat industries of Denmark, Norway and Sweden is acknowledged.

References

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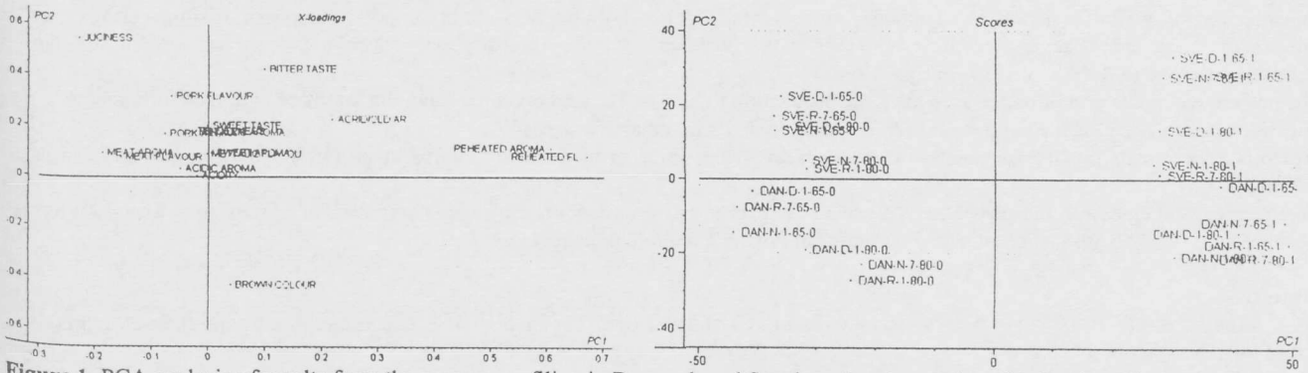

Figure 1. PCA analysis of results from the sensory profiling in Denmark and Sweden of pork samples of defined quality: a) loading plot and b) score plot[1]. [1]Code: SVE/DAN=laboratory (Sweden and Denmark, respectively); N/R/D=meat quality (normal meat quality, RSE and DFD, respectively); 1/7=ageing (1 and 7 days, respectively); 65/80=end-point temperature (65 and 80°C, respectively); 0/1=chill-storage and reheating (0=no chill-storage and reheating; 1=chill-storage for 48 h and reheating).

Table 1. Results of ANOVA of the two experimental designs. Significant positive (↑[1]) and negative (↓) effects of designed variables on sensory attributes are shown ($p<0.05$).

Attribute	Part 1 (DFD pork)				Part 2 (normal meat quality; RSE)							
	Denmark		Sweden		Denmark				Sweden			
	Reheat[2]	Temp	Reheat	Temp	Reheat	Temp	Ageing	Qual[3]	Reheat	Temp	Ageing	Qual
Meat aroma	↓	↑	↓	↑		↓			↓			
Pork aroma			↓		↓			R>N			↑	R>N
Metallic aroma										↓		
Sweet aroma		↑				↑			↑	↑	↓	
Acrid/old aroma	↑		↑		↓				↑			R>N
Acidic aroma		↓			↓					↓		
Aroma of reheated meat	↑		↑		↑				↑			
Meat flavour	↓	↑	↓	↑					↓			
Pork flavour		↓	↓		↓		↑			↓		R>N
Bitter taste	↑	↑	↑				↑		↑			
Acidity					↓		↓	N>R			↓	N>R
Metallic flavour										↓	↓	
Flavour of reheated meat	↑		↑		↑				↑			
Sweet taste									↑		↓	
Brown colour		↑		↑		↑			↑	↑		R>N
Juiciness	↓	↓	↓	↓	↓	↓		N>R	↓	↓		N>R
Tenderness	↓			↓	↑	↓	↑		↓	↓	↑	N>R

[1]Significant effects (↓=decrease; ↑=increase) of designed variables (chill storage/reheating; end-point temperature; ageing time) on sensory attributes. [2]Reheat=chill storage/reheating (0 h/no reheating; 48 h/reheating to 65°C); Temp=end-point temperature; Ageing=ageing for 1 or 7 days; Qual=Meat quality (Normal meat quality, RSE). [3]R=RSE; N=normal meat quality.