Sensory assessors' ability to detect androstenone in pork meat products.

E. Skuterud[1*], K. Lunde[123], A. Nilsen[2] and B. Egelandsdal[3]

[1]*Norwegian Meat Research Centre, Lørenveien 38, P.O.Box 396 Økern, N-0513 Oslo, Norway*
[2]*Matforsk, Norwegian Food Research Institute, Osloveien 1, N-1430 Ås, Norway*
[3]*Institute of Chemistry, Biotechnology and Food Science, University of Life Science, P.O.box 5036, N-1432 Ås, Norway*

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Introduction

Castration of entire male pigs is widely used in many countries to prevent boar taint. Boar taint is a sensory defect of pork coming mainly from entire males, and is associated with the presence of two components, skatole and androstenone. Skatole is associated with a manure-like flavour (Vold, 1970). Androstenone has been associated with a urine-like flavour (Patterson, 1968). Studies suggest that both skatole and androstenone are important in boar taint perception when samples are served to trained sensory assessors (Dijksterhuis et al., 2000; Frempong et al., 1997). Font I Furnols et al. (2000) related the urine attribute, both flavour and odour, to samples which were high in androstenone and low in skatole. However, Dijksterhuis et al. (2000) reported that the scoring of boar taint attributes were complex and could be confusing even for a trained panel, and that the perception and detection of androstenone in meat seemed to be more difficult than that of skatole. The aim of the present study was to elaborate on humans' ability to detect relatively high (up to 6ppm) androstenone levels in the meat products using a trained sensory panel. Only consumption of meat products in a situation where these are served to the panellists is addressed here. The ability of consumers to sense androstenone is still debated, and the Danish commercial experience (Jensen, 1998) with entire male carcasses, where no measurement of androstenone was deemed necessary, was actually based on the assumption that consumers could not sense androstenone. Skatole levels were ≤ 0. 30 ppm in the samples investigated here.

Material and Methods

Slices of fresh belly sides and wiener sausages were served to a trained sensory panel to evaluate the sensory sensation of boar taint. The sensory panel consisted of 10 assessors with 11 years (average) experience. The panel was screened for sensory abilities as well as their ability to communicate sensory descriptors of products as recommended in ISO. The sensory laboratory was designed according to guidelines in ISO with separate booths and electronic registration of data. The assessors were all capable of sensing skatole and androstenone in pure form (Lunde et al., 2007; in preparation). The assessors used intensity scores from 1-9; where 9 corresponded to the highest intensity score. The training of the assessors was done using boar meat with different combinations of skatole and androstenone. The assessors were trained using all attributes in the profile defined by Dijksterhuis et al. (2000). This profile uses urine and manure as specific attributes for androstenone and skatole.
The attribute flavour is here used as a combined attribute of odour and taste as the panellists used both senses.
Slices of fresh belly sides: Four different samples from entire male pigs were selected based on skatole (range 0.03 – 0.45 ppm) and androstenone (range 0.37 – 3.81 ppm) values obtained in pure pork back fat. The sensory panel evaluated the samples (thickness 3mm) with respect to sensation of boar taint. The flavour attributes were evaluated in the booths. The samples were evaluated warm (approx. 60˚C). The samples were served in randomised order.
Wiener sausages: Twelve wiener sausages with different combination of skatole (≤ 2.5 ppm back fat value) and androstenone (≤ 6.00 ppm back fat value) were produced. Fat from different boars were mixed to obtain the right levels of skatole and androstenone. The recipes were maximised with fat from boars (20% total fat) through the use of lean meat and back fat in the recipe. The skatole and androstenone values in the sausages were ≤0.05 and ≤1.2 ppm respectively. A 50% reduction of, compared to a standard recipe, spices and smoking time were used. The flavour attributes were evaluated in the booths. The wiener sausages (3cm, approx. 60˚C)) were served in a cup with a lid, so that each assessor could perceive the smell from the warm sausage directly. The samples were served in randomised order.

Results and Discussion

The results from the sensory analysis (boar attributes) of fresh belly sides are presented in Table 1. The Table shows that the samples with the highest skatol levels have the highest mean values for both urine and manure flavour. Skatole then seemed to be related to both manure and urine. The Table also shows that changing skatole from 0.03 to 0.28 ppm affected urine flavour more than increasing androstenone from 0.37 to 3.81 ppm at a skatole level of 0.03 ppm.

It surprised us that the panellists could not significantly detect 3.81 ppm androstenone using urine as a descriptor. However, the panellists' did not agree well using this attribute and this lead to large standard deviations both for manure and urine (Table 1). It is possible that the assessors had different thresholds for androstenone, or that they found it difficult to use the attribute urine for androstenone in food samples as compared to the sensation they experience from pure androstenone.

Table 1. Mean values of the assessors for the boar attributes manure and urine in slices from fresh belly sides.

Skatole (ppm)	Androstenone (ppm)	Urine flavour	St.dev	Manure flavour	St.dev
0.03	0.37	3.88^{b}	2.46	3.08^{b}	2.22
0.28	0.83	6.63^{a}	3.47	5.79^{a}	3.46
0.30	2.31	6.3^{ab}	2.77	5.25^{ab}	3.18
0.03	3.81	5.65^{ab}	3.15	3.18^{b}	2.43

Different letters within the same column indicate significant differences ($p \leq 0.05$)

Table 2 presents the results from the sensory analysis of wiener sausages. Only the samples with the highest level of skatole, the highest level of androstenone and the highest combination of skatole and androstenone are shown in relation to a reference sample. For both boar attributes urine and manure, no significant differences between any of the samples were found. This indicates that skatole levels ≤ 0.05 ppm and androstenone levels ≤ 1.25 ppm (sausages values) can be used in wiener sausages production. In this case it meant making use of pork back fat having 6 ppm androstenone.
Our results support the Danish view that androstenone will not create negative flavour problems among consumers, at least not if the meat has androstenone below 3.81 ppm and is served to assessors at ~60 °C.

Table 2. Mean values of the assessors for the boar attributes manure and urine for the wiener sausages.

Skatole (ppm)	Androstenone (ppm)	Urine flavour	St.dev	Manure flavour	St.dev
0.00	0.00	2.76^{a}	1.212	1.73^{a}	1.198
0.25	0.75	3.82^{a}	2.081	2.85^{a}	1.543
0.05	6.00	4.10^{a}	2.667	2.04^{a}	1.611
0.25	6.00	4.97^{a}	2.671	2.59^{a}	1.905

Different letters within the same column indicate significant differences ($p \leq 0.05$)

Conclusions
Served slices of fried fresh belly sides with 3.8 ppm androstenone were not differentiated from those with 0.37 ppm using urine as sensory attribute. Sausages with 20% fat can be prepared with back fat of 6 ppm androstenone. The assessors detected skatole using manure as flavour attribute at 0.28 ppm for fried slices of belly sides.

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