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Consumer acceptance of minced meat patties from boars in four European countries

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ABSTRACT

A consumer study was performed in four EU countries to further clarify the acceptability of meat with boar taint. In Denmark, France, Italy and Poland, a total of 476 female consumers evaluated 8 meat patties from boars with varying levels of skatole (0.10–0.40 μg/g fat tissue) and androstenone (0.47–2.00 μg/g fat tissue), in a pair-wise comparison with patties from castrates. Boar meat patties were always less preferred than the castrate meat patties, regardless of the level of androstenone and skatole. Acceptability of the boar meat patties decreased with increasing skatole level. In samples with low skatole levels, higher levels of androstenone also reduced acceptability among androstenone sensitive consumers. No clear threshold levels for androstenone and skatole could be identified. Maps presenting the reduction in preference due to increasing levels of skatole and androstenone, and corrected for the general acceptance of the meat product were developed, taking into account androstenone sensitivity. Further work is needed, covering the whole range of androstenone and skatole levels found in entire male pigs and for a wider set of meat products.

1. Introduction

Surgical castration of piglets is still performed in many countries to prevent boar taint. However, societal pressure to ban this practice is increasing and several representatives of the pork production chain in EU countries have signed a declaration of intention to ban surgical castration by 2018 (European Commission, 2010). One prerequisite, however, is that consumer acceptance of meat from boars is ensured. Boar taint has been studied for several decades, but reliable cut-off levels for boar taint as well as an operational definition of boar taint have yet to be agreed. Two compounds are mainly responsible for this off-odour: skatole and androstenone. In the literature, cut-off levels vary between 0.15 and 0.25 μg/g for skatole, and between 0.5 and 3.0 μg/g for androstenone (Bonneau et al., 2000; Bonneau & Chevillon, 2012; Lunde et al., 2010; Lundström, Matthews, & Haugen, 2009; Meier-Dinkel et al., 2013). This lack of clarity has many causes: the imperfect link between sensory analysis and chemical analysis of boar taint, the restricted comparability of the chemical analysis of androstenone and skatole between laboratories, individual differences in androstenone sensitivity, the type of product served (percentage of fat, serving temperature, masking ingredients), the attribute that is assessed (cooking odour or flavour), the type of consumer panel used (standardised laboratory conditions versus home-used tests; sensitivity of consumers to androstenone and skatole) and the experimental set-up of the consumer panel (e.g. pairwise, type of reference sample, scale, parameters) (Ampuero et al., 2011; Haugen, Brunius, & Zamaratskaia, 2012; Lundström et al., 2009).

This study aims to further clarify the acceptability of meat from boars presented as meat patties (a standardised meat product with high fat content) for different levels of skatole and androstenone. By combining carcasses with known levels of skatole and androstenone in backfat, meat patties of both boar taint compounds were produced

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presenting a variation in the back fat level of skatole from 0.10 to 0.40 μg/g and of androstenone from 0.47 to 2.00 μg/g. Consumer panel studies were conducted in four EU countries (Denmark, France, Italy and Poland). The samples were offered in a pair-wise design, which aimed at deriving consumer rejection thresholds for androstenone and skatole following the methodology of Prescott, Norris, Kunst, and Kim (2005). The experimental set-up accounted for the level of skatole and androstenone and its interaction, the effect of location (country), consumer sensitivity for skatole and androstenone, sequence of the pair and position in the pair as well as general liking of the product.

2. Material and methods

2.1. Preparation of the minced meat patties

Different batches of minced boar meat were prepared at DMRI (Danish Meat Research Institute, Roskilde, Denmark) as a mixture of meat from various animals to achieve 8 tailored levels of androstenone and skatole in order to produce different types of boar meat patties (B1 to B8). The levels were selected based on the results obtained in a previous pilot trial performed in Germany. Moreover, a batch of minced meat from castrated male pigs was included as reference sample for the paired comparison.

The batches of minced meat were prepared by combining back fat and meat of 3 to 4 boar carcasses with known levels of skatole and androstenone as determined in the back fat of the used carcasses. Carcass selection was performed at Danish Crown (Ringsted, Denmark). First, boar carcasses were sorted based on analyses of the online skatole equivalent detection method (a combination of skatole and indole) (Mortensen & Sorensen, 1984), and a sample of the back fat was excised. Carcasses were then further selected based on the sensory score given by 2 assessors using the boiling water method (Aaslyng, Broge, Brockhoff, & Christensen, 2015; Meinert & Stoier, 2011). Finally, skatole and androstenone level in back fat was analysed using an HPLC method (Aaslyng et al., 2015) and expressed as μg/g fat tissue. The average levels of skatole and androstenone in the back fat of the carcasses used to prepare the eight patties varied from 0.5 to 2.0 μg/g fat tissue for androstenone and from 0.10 to 0.40 μg/g fat tissue for skatole (Table 1). Of the selected carcasses, back fat and pork from the fore-ends of both carcass sides were excised, vacuum packed, frozen at − 20 °C and then kept at − 40 °C until use. For each batch, back fat was added proportionally to the fore-end meat (12% fat content) to achieve minced meat with an average fat content of 20%. Meat and fat were minced using a hole size of 3 mm, then mixed thoroughly and divided into 500 g packages. The packages were vacuum packed and frozen at − 20 °C until evaluation. Level of skatole and androstenone of the minced meat patties (μg/g minced meat) was analysed at the European Commission Joint Research Centre, Institute for Reference Materials and Measurements (JRC IRMM, Geel, Belgium) using LC-MS/MS (Buttinger, Verlinde, & Wenzl, 2014).

Final mean fat content was analysed using gravimetric analysis modified after SBR (Schmid-Bodzinski-Ratzlaff) according to ISO1443 (1973). The method is modified to be run on HydrotecTM 8000 hydrolysis system and SoxtecTM 8000 extraction system as described in the application note 3981 (2013) (FOSS, Denmark). The samples were treated with 8 M hydrogen chloride, dried and the liberated fat was extracted with petroleum ether. The solvent was then evaporated and the fat weighed. Final fat content of the patties was 17.2 ± 1.4% for the boar samples versus 20.1% for the castrate sample. Mean water content was 64.8 ± 1.0% for the boar samples versus 62.3% for the castrate sample.

2.2. Sensory profile

A sensory profiling analysis of the minced meat patties was carried out at DMRI using a trained panel based on ASTM-MNL 13 (Manual on Descriptive Analysis Testing for Sensory Evaluation), ISO 4121 (Sensory analysis - Guidelines for the use of quantitative response scales) and ISO 13299 (Sensory analysis - Methodology - General guidance for establishing a sensory profile). The training was based on ISO 8586-1 (Sensory analysis - Part 1: General guidance for the recruitment, selection, training and monitoring of assessors). Eight assessors were used; all were sensitive to androstenone and skatole. They had received a general training in assessing boar tainted meat using references for the attributes (e.g. sweat, manure) (Aaslyng, Broge, Brockhoff, & Christensen, 2016). The trained panel evaluated the eight boar meat patties with varying boar taint concentrations and the castrate meat patties twice, in two sessions. The attributes scored were pork odour/flavour (fried pork; reference: fried pork chop), piggy odour/flavour (piggy, animal-like odour; reference: melted pig fat), manure odour/flavour, pungent odour/flavour (an odour that “sticks” in the nose), urine odour/flavour, sweat odour, boar odour/flavour and juiciness (amount of juice after 5 chews). Attributes were scored on an unstructured 15 cm line scale going from “no intensity” to “strong intensity”.

2.3. Consumer panels

Consumer tests were performed in four EU countries, with one location per country: at the Danish Meat Research Institute (DMRI) in Roskilde, Denmark, at the ACTALIA sensory lab of the Centre of Expertise for the Food Industry in Caen, France, at the Research Centre

Table 1
Skatole (S) and androstenone (A) content of the boar meat patties based on chemical analysis of the back fat and of the meat patty, and the consumer liking score of the boar meat patties and the castrate meat patty served in the same pair.

	Boar					Castrate
	Back fat		Meat patty			Meat patty[c]
Sample code Boar meat patty	S (μg/g)	A (μg/g)	S (μg/g)	A (μg/g)	Liking score[a,b]	Liking score[a,b]
B1	0.12	0.48	< 0.05	0.25	5.9	6.6
B2	0.10	2.00	< 0.05	0.51	5.8	6.6
B3	0.15	0.90	< 0.05	0.34	6.0	6.6
B4	0.15	1.48	< 0.05	0.85	6.2	6.6
B5	0.28	0.75	0.07	0.38	5.4	6.7
B6	0.33	1.54	0.07	0.39	5.1	6.8
B7	0.40	0.47	0.06	0.13	4.9	6.9
B8	0.39	2.00	0.08	0.85	5.2	6.6

[a] Scored on a scale from 1 (dislike extremely) to 9 (like extremely).
[b] The number of observations for each pairwise comparison varied from n = 224 to n = 247.
[c] Served pairwise with boar meat patty B1 to B8.