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# Sensory characterization of meat from pigs vaccinated against gonadotropin releasing factor compared to meat from surgically castrated, entire male and female pigs

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ABSTRACT

Boar taint is a sensory defect mainly due to androstenone and skatole. The most common method to control boar taint is surgical castration at an early age. Vaccination against gonadotropin releasing factor (also known as immunocastration) is an alternative to surgical castration to reduce androstenone content. In this experiment, loins from 24 female (FE), 24 entire male (EM), 24 vaccinated males (IM) and 23 surgically castrated males (CM) were evaluated by eight trained panellists in 24 sessions. Loins were cooked in an oven at 180 °C for 10 min. Furthermore loins were evaluated by consumers and its androstenone and skatole content were also chemically determined. Meat from EM had higher androstenone and skatole odour and flavour than meat from FE, IM and CM and lower sweetness odour scores. High correlations were found between androstenone and skatole levels assessed by trained panelists, chemical analysis and consumers' acceptability. Moreover meat from EM is mainly related to androstenone and skatole attributes.



## 1. Introduction

Boar taint is a sensory defect that affects pig meat quality and it is mainly due to the presence of androstenone, a compound with urine like odour (Patterson, 1968) and skatole, a compound with faecal odour (Vold, 1970; Walstra & Maarse, 1970). Skatole (3-methyl-indole) is the product of the anaerobic degradation of the tryptophan aminoacid in the gut. Androstenone (5α-androst-16-en-3-one) is a steroid synthesized in the testis of the maturing pigs. Its content mainly depends on the slaughter weight/age (maturity of the pig), testis size and genetics and to a lesser extent on rearing and feeding conditions (Brennan, Shand, Fenton, Nicholls, & Aherne, 1986; Claus, Weiler, & Herzog, 1994; Salmon & Edwards, 2006). Elimination of the testes (castration) is the most efficient method to reduce androstenone levels. Surgical castration without anaesthesia is the most common methodology used in Europe (Frederiksen et al., 2009) to control boar taint but it is detrimental from the animal welfare point of view (EFSA, 2004; Prunier et al., 2006; Thun, Gajewski, & Janett, 2006). Vaccination against gonadotropin releasing factor (GnRF) (also known as immunocastration) is an efficient alternative to surgical castration as it reduces androstenone and skatole content (Dunshea et al., 2001; Jaros et al., 2005; McCauley et al., 2003; Zamaratskaia et al., 2008). Moreover it is more friendly from the animal welfare point of view (Thun et al., 2006) and produces the same meat quality for consumers as meat from surgically castrated males and females pigs (Font i Furnols et al., 2008; Hennessy, 2006), or even better quality than meat from surgically castrated males (Silveira et al., 2008).

Sensory characterization of meat from entire males has been reported in different studies. In early studies determination of presence or absence of boar taint was evaluated (Bonneau, Tassencourt, & Desmoulin, 1975; Cliplef & Strain, 1981; Cowan & Joseph, 1981; de Brabender, Verbeke, Dirinck, & Casteels, 1985). Subsequently, sensory descriptors such as pig, urine, stable, naphthalene, sourish, rank, parsnip, nosefeel, sweat, musty, acrid among others have been used (Agerhem & Tornberg, 1994, 1995; Annor-Fremptong, Nute, Whittington, & Wood, 1997a, 1997b; Dijksterhuis et al., 2000) for androstenone and/or skatole description. Most of these studies compared the sensory characteristics of meat from entire male and/or female and/or castrated pigs. Pearce et al. (2008) and Lodge et al. (2008) compared meat and fat from vaccinated and entire male pigs and they found that meat from vaccinated

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pigs had lower abnormal odour and flavour in fat and meat, respectively, compared with meat from entire pigs. Also, Jeong et al. (2008a), using a trained sensory panel, compared loins from surgically castrated and vaccinated pigs. As far as the authors are aware, however, there are no sensory studies in which loins from vaccinated, surgically castrated, entire males and female pigs have been compared. Only Jeong et al. (2008b) compared pork from these four types of animals but these were only meat from bellies. The objective of this study is to sensorially characterize, using a trained panel, meat from immunocastrated pigs compared with meat from entire male, surgically castrated and female pigs.

## 2. Materials and methods

### 2.1. Animals

Four different types of pigs (crossbreeds from Pietrain × (Duroc × Landrace)) were reared in controlled conditions at IRTA's experimental farm in Monells (Spain): females (FE), entire males (EM), surgically castrated (CM) and vaccinated pigs (IM). Twenty three CM pigs and 24 pigs of the other types were used for the sensory evaluation. Vaccine (IMPROVAC © Pfizer Inc., New York) was administered as two doses. The first dose at 77 ± 3 days of age and the second one at 146 ± 3 days of age, approximately 4 weeks before the slaughter following the recommendation of the vaccine manufacturer. Pigs were reared separately by sex type. They were slaughtered under controlled conditions, after being anesthetised with 85% $CO_2$, at IRTA's experimental abattoir in Monells (Spain).

### 2.2. Samples and sample preparation

For the sensory evaluation a *Longissimus lumborum* muscle sample 6 cm long with subcutaneous fat was removed from the carcass, just after the piece used for the consumer test (obtained between the 2nd and 3rd last ribs and proceeding 6 cm cranially).

Sample preparation was similar to those reported by Font i Furnols, Guerrero, Serra, Rius, and Oliver (2000). The loin with subcutaneous fat was thawed for 24 h at 4 °C. Slices of 1.5 cm-thick were cut from the raw loin. Each slice was cut into 1.5 cm-thick pieces (around four pieces per slice) perpendicular to the subcutaneous fat and avoiding extremes. These pieces contained 3 mm of subcutaneous fat. Pieces were placed into a closed glass tube of 10 cm-long and inner diameter of 2 cm. Tubes were codified with a three digit number obtained randomly. Tubes were placed in a preheated convection oven (FAGOR Innovation Class A) at 180 °C for 10 min.

### 2.3. Experimental design

Eight trained panellists, sensitive to androstenone, carried out the sensory analysis. A randomized (complete) block design was used with a total of 24 sessions. In each session four samples, randomly selected within type of animal, were evaluated, one from each type, except for one session where there was not any sample from CM. Samples were served in a blinded fashion to the panellists, in a monadic way. The order of presentation of the samples to the panellists was designed to avoid the first sample and carry over effect (MacFie, Bratchell, Greenhoff, & Vallis, 1989). Moreover, samples evaluated in 20 out of the 24 sessions were also evaluated by consumers (Font i Furnols et al., 2008).

### 2.4. Descriptive profile elaboration

A modified checklist (Moskowitz, 1983), allowing panellists to add new attributes, was used to obtain descriptive profiles. For that purpose panellists evaluated samples from the different types of meat with known levels of androstenone and skatole in three sessions. After discussion among panellists the chosen odour descriptors were androstenone, skatole, sweetness and toast. Flavour attributes were androstenone, skatole, sweetness and metallic. Finally hardness and juiciness were evaluated as texture descriptors. Optionally panellists could add other attributes if they found it necessary and chemical, pig and onion odour were added by more than one panellist.

### 2.5. Sensory evaluation

Descriptors were evaluated in an unstructured continuous 10 cm-long scale. First, panellists evaluated odour, then flavour (in muscle plus subcutaneous fat) and finally texture attributes (in muscle without subcutaneous fat). Evaluation was carried out in a standardized sensory room (ISO 8589, 1988) with red light. Panellists were asked to eat unsalted toasted bread and/or apple and to rinse their mouth with water before tasting each sample, including before the first one.

Furthermore a consumer study was also carried out following the methodology described in Font i Furnols et al. (2008). Briefly, 201 consumers, in 20 sessions with 10 consumers each (one session with 11 consumers), evaluated samples from 20 animals per type, four samples per session. Samples were cooked in the same conditions as for the panellists but placed in an aluminium container instead of the closed glass tube. Consumers evaluated, in a monadic way, the overall acceptability of meat odour and flavour in a 9-point category scale without the intermediate level.

### 2.6. Chemical analysis

Androstenone and skatole levels were measured in the subcutaneous fat following the methodology described by Garcia Regueiro and Rius (1998) and Rius, Hortós, and García-Regueiro (2005).

Moreover the amounts (%) of intramuscular fat of the *gluteus medius* (GM) and *semimembranosus* (SM) muscles were determined with the Near Infrared Transmitance spectroscopy equipment (Infratec 1265 Meat Analyzer, Tecator, AB, Uppsala).

### 2.7. Statistical analysis

Data analysis was performed with SAS (SAS Institute Inc., Cary, NC, USA). An analysis of variance was carried out with the mean of the different panellist scores by attribute and animal. For that purpose the GLM procedure was used. The type of animal was included as fixed effect and session as blocking effect. Significant ($p < 0.05$) differences between least square means were obtained applying Tukey test.

Correlations between panel test data, consumer data and chemical data (levels of androstenone and skatole were obtained. Moreover a principal component analysis (PCA) was performed with these variables plus intramuscular fat by means of FACTOR procedure of SAS.

## 3. Results and discussion

### 3.1. Sensory characterization of the different types of pork

Least squares means of the different attributes evaluated by the trained panel depending on the type of animal are presented in Table 1. Meat from EM had significantly ($P < 0.05$) higher flavour and odour scores for androstenone and skatole and lower scores for sweetness odour and flavour than meat from CM, IM and FE. In fact, the averaged androstenone level were lower than