



# Consumers' segmentation based on the acceptability of meat from entire male pigs with different boar taint levels in four European countries: France, Italy, Spain and United Kingdom



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## ABSTRACT

Two consumer studies were conducted to know the acceptability of pork with different boar taint levels: test 1 performed in Spain ( $n = 126$ ) and United Kingdom ( $n = 146$ ), and test 2 performed in France ( $n = 139$ ) and Italy ( $n = 140$ ). Each test had 3 types of pork: 'Female meat', 'Low boar tainted meat', and a third type was 'Medium boar tainted meat' or 'High boar tainted meat'. Three main clusters were identified on the basis of 'How delicious do you find this meat?': 1—Pork lovers, 2—Boar meat lovers, 3—Reject boar tainted meat. Additionally, in test 2, a fourth cluster was identified: 'Reject low tainted meat'. A group of 16.2–38.2% of consumers rejected meat from boars, and another group of 12.4–21.7% rated the meat with medium or high levels of boar taint better than the meat from females, identifying a niche for meat from medium and high levels of boar taint, and suggesting the need to select carcasses on the basis of boar taint.

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## 1. Introduction

Nowadays there is a growing concern about the negative effect of surgical castration of pigs without anaesthesia on animal welfare. In 2008, across Europe the majority of male piglets intended for pork production were castrated to avoid potential consumer dissatisfaction because of boar taint. At that time, castration was performed in most of the EU countries on 80–100% of the male pigs in conventional production, and surgical castration without anaesthesia was the most common technique (Fredriksen et al., 2009). The exceptions were United Kingdom and Ireland, where castration was hardly performed, and some southern countries such as Cyprus, Portugal and Spain, where a limited percentage of the male pigs were castrated in comparison to the other European countries. Since then, some countries have taken an action to avoid piglet castration without anaesthesia not only for welfare reasons, but also because the production of entire male pigs decreases production costs and results in higher meat content of the carcass (EFSA, 2004; PIGCAS, 2009). Norway and Switzerland have

already banned piglet castration without anaesthesia by law, and other countries such as The Netherlands and Germany have signed letters of intentions (Declaration of Noordwijk 2007 and Düsseldorf Declaration 2008, respectively) which aimed to avoid the need for piglet castration in the long term. In 2010, at the EU level, representatives of European farmers, meat industry, retailers, scientists, veterinarians and animal welfare NGOs, committed themselves to voluntarily end the practise of surgically castrating pigs in Europe by January 2018 by means of the European Declaration on alternatives to surgical castration of pigs (DG-SANCO, 2010).

Consequently, entire male production is one of the alternatives and therefore, an increase in the production of entire males would result in a positive impact on production efficiency and carcass composition. But as a consequence, more tainted carcasses could enter the meat chain. A number of consumer studies have been carried out in order to ascertain the acceptability of pork from entire male pigs in different countries and using different methodologies as was reviewed in EFSA (2004) and more recently, by Font-i-Furnols (2012). The two main compounds responsible for boar taint are androstenone (Patterson, 1968) and skatole (Vold, 1970; Walstra & Maarse, 1970). The respective contributions of these two compounds vary depending on the characteristics of the meat evaluated, procedures for preparing the meat, the

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ability of consumers to perceive androstenone among others, as has been reviewed by Font-i-Furnols (2012), and also it may vary depending on the habit of eating meat from castrated or entire male pigs.

Therefore, it would be interesting to study the impact that meat from boars could have in the European market (consumer satisfaction), which is traditionally used to eating meat from castrated pigs, and identify if there is any difference comparing to other countries where the utilization of entire male pigs is more common.

The present work had two main objectives: 1) to evaluate and update the results on sensory acceptability of meat from entire male pigs (as an alternative to the production of castrates), involving four European countries that produce a different proportion of castrated pigs in two consumer studies: Spain and United Kingdom, France, and Italy, and 2) to identify potential niche markets for meat with different boar taint levels.

## 2. Materials and methods

### 2.1. Consumer studies

Two consumer studies were conducted in which each consumer assessed pork with various levels of androstenone and skatole. Participants in each study were:

- *Consumer test 1.* Spain (ES, n = 133, performed in Barcelona and United Kingdom (UK, n = 146, performed in Reading); April, 2009.
- *Consumer test 2.* France (FR, n = 139, performed in Cain (n = 74) & Paris (n = 70)) and Italy (IT, n = 140, performed in Matelica (n = 70) & Reggio Emilia (n = 70)); April and May 2009.

Considering the two consumer tests, a total of 558 consumers from the different European countries participated in this project. They were stratified by age (according to each country profile) and sex (approximately 50:50 ratio between men and women). Consumers were required to eat pork on a regular basis.

### 2.2. Animals and samples

The meat and fat samples used for the consumer studies were obtained from populations of pigs slaughtered according to commercial practise. They were collected from boars and gilts in commercial abattoirs from Spain and France. Carcass weights and genotypes were representative of current practise in these countries (carcass weight of 79.4 kg in Spain, and 84.0 kg in France; (2009)). The meat collected in Spain was used for the consumer studies carried out in ES and UK; and the meat collected in France was used for the consumer studies carried out in FR and IT.

A minimum 20 loins from gilts and 20 loins from boars with Low boar taint (LBT) were collected in Spanish and French abattoirs. Furthermore, a minimum of 20 loins from boars with Medium boar taint (MBT) were collected in Spanish abattoirs and a minimum of 20 loins with High boar taint (HBT) were selected in French abattoirs (Table 1).

From each animal, the muscle *Longissimus lumborum* (with the subcutaneous fat) was taken from the 1st lumbar vertebra to the last rib, divided in two sections (min. 15 cm) and distributed in one of the two countries.

### 2.3. Androstenone and skatole measurements in fat

Back fat samples from entire male pigs and females were collected on the day of slaughter at the level of the neck, vacuum packed and deep frozen until analysed for androstenone (AND) and skatole (SKA). The determination of SKA levels was performed using HPLC-FLD and the determination of AND levels using GC-MS (for ES and UK samples; Ampuero et al., 2011) or by HPLC-FLD (for FR and IT samples; Pauly, Spring, O'Doherty, Ampuero, and Bee, 2008). Results were expressed as µg/g, on pure fat basis. Meat samples were classified as FE (meat from gilts), Low boar taint (LBT), Medium boar taint (MBT) or High boar taint (HBT) depending on the sex and the levels of boar taint compounds (Blanch et al., 2012; Table 1, Fig. 1). In each consumer test 3 samples were evaluated in each session: samples from gilts (FE) as a reference, and two more samples with different levels of boar taint: in consumer test 1 (ES & UK) meat from LBT and MTB was used; and in consumer test 2 (FR & IT), meat from LBT and HBT.

### 2.4. Preparation of samples

In each location, loins were defrosted at 2–4 °C during 24 h, and cut into 0.5 cm thick slices with 5 mm of subcutaneous fat (when it was possible). Each slice was cut in two pieces, and cooked using a cooking plate at 180 °C (which was greased with maize oil). A different cooking plate was used for each type of meat presented within a session. The meat was turned upside down regularly up to a core temperature of 80 °C measured with a flexible temperature probe (TESTO, Germany) and the meat was salted after cooking (1 g salt/200 g meat), reproducing home preparation. Samples were then immediately served to the consumers for evaluation.

### 2.5. Sensory evaluation of samples

Sessions of 10–12 consumers were organized for meat evaluation. Each consumer assessed 3 pieces of meat. A 10 min interval was used between each of the three samples presented within a session. The order of presentation of samples was rotated using a partial Latin square design to avoid any first sample and carry-over effect and the identity of the samples was not given to consumers (Macfie, Bratchell, Greenhoff, & Vallis, 1989). Consumers were asked for hedonic questions (questions 1 to 4) and intensity evaluations (questions 5–11) as described in Table 2, using a modified nine-point intensity scale (from 1 to 9). The intermediate level (5) was not included to stimulate consumers to commit themselves and not to allow a neutral assessment which is not informative (Guerrero, 1999). Table 2 also shows the scale used to assess each attribute.

**Table 1**

Mean and standard error of the androstenone and skatole levels on the pure fat basis of the meat used for the consumer test.

	N of loins	Androstenone (ppm pure fat) [range]	Skatole (ppm pure fat) [range]
<i>Consumer test 1: ES &amp; UK</i>			
Gilt (FE)	18	<0.04	0.04 ± 0.02 [0.02–0.07]
Low boar taint (LBT)	18	0.20 ± 0.07 [0.04–0.29]	0.06 ± 0.02 [0.02–0.08]
Medium boar taint (MBT)	18	1.07 ± 0.40 [0.58–2.28]	0.18 ± 0.07 [0.11–0.39]
<i>Consumer test 2: FR &amp; IT</i>			
Gilt (FE)	18	<0.2	<0.03
Low boar taint (LBT)	18	<0.2	<0.03
High boar taint (HBT)	18	2.39 ± 1.07 [0.59–5.18]	0.11 ± 0.07 [0.02–0.28]

ES: Spain; UK: United Kingdom; FR: France; IT: Italy.

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