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# The effect of sensory experience on expected preferences toward a masking strategy for boar-tainted frankfurter sausages

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ABSTRACT

The potential banning of surgical pig castration in the EU is to be announced by 1 January 2018, which may change stakeholder and consumer preferences. This study analysed consumers' expected preferences regarding smoking and applying a mixture of spices to high-level boar-taint frankfurter sausages. Consumers' acceptance through a hedonic evaluation of the masking strategy and its impact on expected preferences were analysed. We carried out two non-hypothetical discrete choice experiments by creating a real shopping scenario before and after a sensory experience test for a sample of 150 consumers from the metropolitan area of Madrid, Spain. The data used in this analysis were obtained from self-completed structured questionnaires following a quota sampling approach. The recently developed generalized multinomial logit model (GMNL) was used for analysis. The results showed the appropriateness of the proposed masking strategy of boar meat for the processed meat industry in Spain. Consumers stated their willingness to pay a premium for this flavour. The sensory experience had an impact on the mean preference and the scale heterogeneity. The degree of randomness and consumer uncertainty decreased significantly after the eating experience of the product.



## 1. Introduction

Although piglet castration is regulated by the European Commission (EC) Directive 93/2001, the voluntary end of surgical castration is to be adopted by January 2018 (EC, 2010). In the EU, 80% of male pigs produced are surgically castrated, of which 49% is carried out without anaesthesia (Fredriksen et al., 2009). During the transition period, surgical castration should only be performed with pain relief, and efforts should be made to facilitate the end of castration (Heid & Hamm, 2013). The main issue surrounding the potential prohibition is its negative impact on pig welfare (Rault, Lay, & Marchant-Forde, 2011). When pigs are castrated, they experience intense pain at any age (Taylor, Weary, Lessard, & Braithwaite, 2001), and their rearing behaviour may change dramatically (Sutherland, 2015). Pig production has received special attention from the European authorities, and several changes regarding the animal welfare regulations have been approved as a result of the increasing societal pressure for more humane production systems (EC, 2007).

However, the castration practice is essential for the pork industry because it removes the boar taint, which is an unpleasant off-odour and off-flavour of pork related to the presence of androstenone and skatole that affects consumers' acceptability (Font-i-Furnols 2012; Heid & Hamm, 2010; Malmfors & Lundström, 1983). Skatole is a breakdown product of the amino acid tryptophan and commonly described as having a faecal-like odour, and androstenone is a male sex steroid pheromone that has a urine-like odour. Castration also leads to fatter carcasses (Tuyttens, Vanhonacker, Verhille, De Brabander, & Verbeke, 2012), which is a major requirement for high quality dry-cured pork products (Bañon, Gil, & Garrido, 2003).

Banning castration to improve pig welfare is controversial because it would negatively impact consumer acceptance of pork products. From one side, consumers are willing to pay a premium to improve animal welfare (Gracia et al., 2011; Napolitano, Girolami, & Braghieri, 2010). However, the sensory experience of consumers during consumption is also a critical aspect in the acceptance of products and development of preferences (Fernqvist & Ekelund, 2014; Heid & Hamm, 2013).

In this context, the study of alternatives to castration remains a relevant topic of research (Font-i-Furnols, 2012; Heid & Hamm, 2012). Many castration alternatives have been explored, of which

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we highlight the following: a) genetic and gender selection for 'low-taint' breeds (De Campos et al., 2015); b) different management and rearing strategies (Wesoly, Jungbluth, Stefanski, & Weiler, 2015); c) slaughtering at an early weight and age (Babol, Zamaratskaia, Juneja, & Lundström, 2004); d) detection of boar taint at the slaughter line (Vestergaard, Haugen, & Byrne, 2006); and f) masking unpleasant odours and flavours with an appropriate strategy such as spices, marinades or heat treatment (Mörlein et al., 2015).

The production of meat from entire males may have a promising future if it is adequately commercialized within the processed pig meat sector (Bonneau, 1998; Bonneau & Chevillon, 2012) because boar-tainted meat would be better accepted in processed products than in fresh retail cuts (Bañón, Costa, Gil, & Garrido, 2003). Thus, masking strategies of boar taint in processed pork products and the preferences of consumers are worthy topics to be investigated. In Spain, there is a need for updated knowledge about processing opportunities for boar meat, particularly if castration is banned in the near future. As commented by Lunde et al. (2008), if castration is banned, the meat industry will need to adjust its recipes to minimize boar taint and maintain its quality commitment to the market. Several studies have suggested different strategies to mask boar taint in processed meat. Liquid smoke and oregano extracts seem suitable in ready-to-eat marinated meat (Lunde et al., 2008). Liquid smoke, starter cultures and spices are also appropriate compounds in fermented sausages (Malmfors & Lundström, 1983; Stolzenbach, Lindahl, Lundström, Chen, & Byrne, 2009). Natural smoking and different mixture of spices in cooked sausages was also recently studied (Martínez et al., 2016).

In analysing consumers' preferences, focusing only on acceptance or liking of the most effective masking strategy gives just a partial view. The relevance of the sensory experience in food choices is not new, and the hedonic experiences have an influence on consumers' willingness to pay (WTP) (Grunert, Bech-Larsen, & Bredahl, 2000; Heid & Hamm, 2013; Maehle, Iversen, Hem, & Otnes, 2015; Napolitano et al., 2010a). The eating experience plays an important role in consumers' repurchase decisions and is in turn a determinant factor along with the information (Combris, Bazoche, Giraud-Héraud, & Issanchou, 2009; Lange, Martin, Chabanet, Combris, & Issanchou, 2002; Napolitano et al., 2010a). Lange, Rousseau, and Issanchou (1998) noticed the importance of the acceptability of products on purchasing behaviour. Showed the impact of hedonic assessment on the willingness to pay for healthy products. Confirmed the importance of sensory experience in preferences towards food products, and Napolitano et al. (2010a) showed that the WTP for beef organic meat depends on the sensory properties along with the external information.

However, the intrinsic attributes of a food product are not the only determinant factors affecting consumers' reaction and their WTP. The extrinsic cues are also highly important (Ares, Giménez, & Deliza, 2010; Asioli, Næs, Granli, & Almli, 2014; Lange et al., 1998; Meier-Dinkel et al., 2013; Napolitano et al., 2010b; Varela, Ares, Giménez, & Gámbaro, 2010). According to the total food quality model (TFQM), many attributes cannot be revealed before a food product purchase, so consumers develop expectations about quality when choosing a food product (Brunsø, Ahle, & Grunert, 2002; Deliza & MacFie, 1996). Napolitano et al. (2010b) mentioned that consumers are forced to form expectations to perform their food choice using intrinsic search attributes (colour, appearance, other visible characteristics of the product, etc.) and extrinsic cues (price, origin, production process, nutritional information, etc.). Before purchasing a product, the extrinsic attributes tend to be key factors in inferring its quality. Consumers tend to create expectations that are essential to decide whether to purchase the product (Banovic, Grunert, Barreira, & Fontes, 2009; Brunsø et al., 2002; Meillon, Urbano, Guillot, & Schlich, 2010; Speed, 1998). These, expectations are mainly framed by information on the label and previous experience with a similar product. Once the product is tasted or consumed, consumers are able to construct their experience quality (Banovic et al., 2009). At the end, expectations are confirmed or rejected, allowing observers to understand consumers' satisfaction and if the consumers will repurchase the product (Banovic et al., 2009; Meillon et al., 2010; Oliver, 1980).

The analysis of the importance of sensory experience on consumer expected preference can be carried out on the basis of the expectancy-disconfirmation model (Oliver, 1980). According to this approach, consumers purchase a new product with some expectations (cognitive state before consumption) about the anticipated eating experience (cognitive state after consumption). Once the product is consumed, the experience may change expectations in several directions. If the experience matches the expectation, confirmation occurs and satisfaction is reached. If there is a mismatch, disconfirmation occurs. In this case, if the experience improves expectations, consumers are satisfied, but if the experience worsens expectations, consumers are dissatisfied.

In this context, in this research, we attempted to mimic consumer behaviour when facing a new product in a purchase point by setting out the following objectives:

a) First, to analyse consumers' expected preferences toward a masking strategy of a high-level boar taint of frankfurter sausages[1] using a flavour developed from different herbs and natural smoking.
b) Second, to study consumers' acceptance through a hedonic test of four different frankfurter sausages: flavoured and original taste obtained from castrated pigs and boars. This step allows consumers to create their specific sensory experience.
c) Third, to assess how the sensory experience affected the expected preferences in a real shopping scenario.

Preferences were analysed following two non-hypothetical discrete choice experiments (DCE) in a real shopping scenario before and after a hedonic sensory test for a sample of 150 consumers in Madrid, Spain. The DCE aims at identifying preferences of products by examining consumers' trade-offs between product characteristics when making choices. Different products that are described by several attributes and levels are presented to respondents in an array of cards. Images are usually used to convey these products to the respondents. Within each card, respondents are then asked to select his/her preferred product, thereby revealing his/her preference for certain attributes and levels. Because one of the attributes is the price, the willingness to pay for the different attributes can be subsequently estimated.

At the empirical level, this study is the first work that analyses consumer acceptance of the proposed masking strategy in frankfurter sausages from boar meat in the Spanish market. In addition, at the methodological level, this paper contributes to the literature of discrete choice modelling (DCM) using the recently developed generalized multinomial logit model (GMNL) by Fiebig, Keane, Louviere, and Wasi (2010). So far, this research is the first application within boar-tainted meat preference studies that analyses the effect of hedonic evaluation on consumer preferences on both the scale and preference heterogeneity.

[1] The Frankfurter sausage was chosen as a case study because it is a worldwide and convenient product with high fat content and usually consumed hot, which allows boar taint to be more perceptible (Barreiro-Hurlé, Gracia, & De-Magistris, 2009; Martínez et al., 2016).