



This is an author produced version of a paper published in  
Meat Science.

This paper has been peer-reviewed but may not include the final publisher  
proof-corrections or pagination.

Citation for the published paper:

Javier García-Gudiño, Isabel Blanco-Penedo, Marina Gispert, Albert Brun,  
José Pereac, Maria Font-i-Furnols. (2020). Understanding consumers'  
perceptions towards Iberian pig production and animal welfare. Meat  
science. Volume: 172, Article number: 108317.

<http://dx.doi.org/10.1016/j.meatsci.2020.108317>

Access to the published version may require journal subscription.

Published with permission from: Elsevier.

Standard set statement from the publisher:

© Elsevier, 2020. This manuscript version is made available under the CC-BY-NC-ND  
4.0 license <http://creativecommons.org/licenses/by-nc-nd/4.0/>

Epsilon Open Archive <http://epsilon.slu.se>

## Journal Pre-proof

Understanding consumers' perceptions towards Iberian pig production and animal welfare

Javier García-Gudiño, Isabel Blanco-Penedo, Marina Gispert, Albert Brun, José Perea, Maria Font-i-Furnols



PII: S0309-1740(20)30749-X

DOI: <https://doi.org/10.1016/j.meatsci.2020.108317>

Reference: MESC 108317

To appear in: *Meat Science*

Received date: 2 May 2020

Revised date: 13 September 2020

Accepted date: 14 September 2020

Please cite this article as: J. García-Gudiño, I. Blanco-Penedo, M. Gispert, et al., Understanding consumers' perceptions towards Iberian pig production and animal welfare, *Meat Science* (2020), <https://doi.org/10.1016/j.meatsci.2020.108317>

This is a PDF file of an article that has undergone enhancements after acceptance, such as the addition of a cover page and metadata, and formatting for readability, but it is not yet the definitive version of record. This version will undergo additional copyediting, typesetting and review before it is published in its final form, but we are providing this version to give early visibility of the article. Please note that, during the production process, errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

© 2020 Published by Elsevier.

# Understanding consumers' perceptions towards Iberian pig production and animal welfare

Javier García-Gudiño<sup>a,11,\*</sup> javier.garciag@juntaex.es; Isabel Blanco-Penedo<sup>a,22</sup> isabel.blanco.penedo@slu.se; Marina Gispert<sup>b</sup> marina.gispert@irta.cat; Albert Brun<sup>b</sup> albert.brun@irta.cat; José Perea<sup>c</sup> pa2pemuj@uco.es; Maria Font-i-Furnols<sup>b</sup> maria.font@irta.cat

<sup>a</sup>Animal Welfare Program, IRTA, 17121 Monells, Spain.

<sup>b</sup>Product Quality Program, IRTA, 17121 Monells, Spain.

<sup>c</sup>Department of Animal Production, UCO, 14007 Córdoba, Spain.

\*Corresponding author.

## Abstract

The Spanish market offers a greater variety of Iberian pork products. The aim of this paper is to determine the perception of consumers on several aspects of Iberian pig production and animal welfare depending on the consumers' characteristics. Consumers from two Spanish regions (n=403) answered a questionnaire about their beliefs and the importance of pig production, their purchase intentions and their willingness to pay. Consumers were segmented according to their level of knowledge about Iberian pig production. The results of this work indicate that consumers have poor knowledge about Iberian pig production. Even so, consumers show a remarkable preference for Iberian products, especially when the animals are reared freely and in natural conditions, giving great importance to animal welfare. Consumer preferences indicate the importance of emphasizing Iberian traditional pig product characteristics on the label to promote their purchase choices.

Keywords: local breed; knowledge; beliefs; animal welfare; purchase choice.

## 1 Introduction

In the past few years, consumers' awareness of the different ways in which food is produced has increased (Pejman et al., 2019). An increasing preference and demand for organic and high welfare animal-based food products have been reported in different studies (Alonso et al., 2020; Kallas et al., 2013; Vietoris et al., 2016). Because of this, consumers are demanding more information on food labels (Pejman et al., 2019). In particular, Spain is one of the EU countries with higher demand for information about food production aspects according to Eurobarometer (2016). At the time of purchase, consumers receive different types of information that can affect their choice among the great variety of products available. This information is used by

---

<sup>11</sup>Department of Animal Production, CICYTEX, 06187 Guadajira, Spain

<sup>22</sup>Department of Clinical Sciences, SLU, 75007 Uppsala, Sweden

consumers to infer the quality of the product because although the quality of some foods, like meat, cannot be directly evaluated before purchase, quality expectations, to some extent, are created by the available internal and external cues (Grunert et al., 2004). The information that consumers may consider most important in the choice of a product depends on personal and situational characteristics and on the product itself (Dimara & Skuras, 2005; Liljenstolpe, 2011; Verlegh & Van Ittersum, 2001).

As a general rule, consumers have low knowledge of livestock production systems (Cardoso et al., 2017; Clark et al., 2019). In this sense, differences between consumers from urban and rural areas can be found (McEachern & Seaman, 2005). Rural consumers are more likely to have contact with livestock and have a more positive attitude towards livestock practices (Krystallis et al., 2009) or simply belong to the livestock community, thereby influencing their opinions as consumers (Te Velde et al., 2002). Furthermore, information about the production system is not always available, although some labels (i.e. Protected Designations of Origin (PDO) and organic) are related to specific production systems. In this sense, production systems influence purchasing decisions, with a preference for outdoors (access to outdoor areas for only part of their lives) or extensive (farming husbandry where the pigs can run around outside on pasture/grasslands and roam freely on a large area) livestock systems (Díaz-Caro et al., 2019; Dransfield et al., 2005; Krystallis et al., 2009; Mesías et al., 2005), probably because consumers expect higher quality in this type of product (Scholderer et al., 2004), although this is not always demonstrated (Bonneau & Lebret, 2010).

The breed or genetics can also influence the quality of meat and meat products (Alonso et al., 2015; Plastow et al., 2005), and its sensory acceptability to consumers (Meinert et al., 2008; Straadt et al., 2013). Breed might also influence the purchase of meat products (Lee et al., 2017). Despite that, information about the breed is not always available. However, in some cases meat products from some PDO like, for instance, Dehesa de Extremadura, Los Pedroches (DOOR, 2019) the breed can be known. In addition, meat from some specific breeds is also labelled. In Spain, for example, meat from certain breeds like Iberian and Duroc is related to higher quality and it is possible to find it labelled. Consequently, breeds can be one of the factors that can affect consumers' purchasing decisions. In fact, previous studies (Díaz-Caro et al., 2019; Mesías et al., 2009) indicate that Spanish consumers have a preference for local breed products.

Furthermore, the price of pork products is an important extrinsic factor that can affect consumers' purchasing decisions (Díaz-Caro et al., 2019; Mesías et al., 2009). One of the reasons is that the quality of meat products cannot be evaluated before purchase and, because of that, when consumers are uncertain or they have more difficulties determining the quality of meat, the price can be used to create a quality judgment (Papanagiotou et al., 2013). In fact, in the same study, the price was slightly more important in the perception of quality than in the intention to buy. Some people associate a higher price to higher quality, especially for some type of products (Gil & Sánchez, 1998). Sometimes, a lower price can be associated with lower quality because decreasing the price is a marketing strategy some supermarkets use to sell meat close to the sell-by date (Schnettler et al., 2008).

Although the intensification of animal production in most farms is increasingly common (Clark et al., 2019), traditional production can still be found in some countries, mainly

related to autochthonous breeds (Čandek-Potokar et al., 2019). For instance, Spain is the fourth largest pig producing country worldwide, the 2<sup>nd</sup> largest in Europe (MAPA, 2019). Spain has developed an export-oriented pork industry that is heavily concentrated. The intensive production system is predominant but coexists with a traditional pig farm model system. The major component is the Iberian traditional pig production that differs considerably from the conventional system. This local breed has been traditionally bred in the SW of the Iberian Peninsula (De Miguel et al., 2015), where it is perfectly adapted to the pasture ecosystem (Benito et al., 2006). This local production is managed extensively if natural resources are available, mainly during the finishing period where pigs are exclusively fed acorns and grass (Lopez-Bote, 1998). This breed is characterized by the high-quality of its cured products, with Iberian acorn-fed ham being the largest component (Mesías et al., 2009). Therefore, local Iberian pig production offers an added value in their products that cannot be found in commercial white pig products (Lopez-Bote, 1998).

Iberian pig production has achieved great success in recent times. The economic development of the country and the globalization of the markets has led to an increase in the demand for traditional and high-quality Iberian pig products (Estévez et al., 2003; Lopez-Bote, 1998; Ventanas et al., 2005). However, the scarcity of existing hectares of *dehesa* and an orientation towards more economically profitable intensive production systems by Iberian pig farmers limit the number of pigs that are produced exclusively with natural resources (Mesías et al., 2009). Because of that, the increase in Iberian pig production has resulted in the use of cross-breeds between Iberian and Duroc and in the more intensive production, expanding even outside the traditional regional framework of this breed (Nieto et al., 2019) and reaching 10% of the total number of Spanish pigs (MAPA, 2019). This has generated the possibility of finding different categories of Iberian pork products with different qualities and production systems in the market (Tejerina et al., 2012).

Previous works have studied consumers' preferences for Iberian pork products (Díaz-Caro et al., 2019; Mesías et al., 2009, 2010), showing a preference for traditional Iberian meat products. These works were carried out in the traditional Spanish region of Iberian pig production. Due to the large expansion outside the traditional production area for Iberian pork products and to the fact that consumers' behaviour towards meat and meat products are affected by multiple factors (Font-i-Furnols & Guerrero, 2014), it is of interest to study the preferences of consumers not only in the traditional Iberian pig production region but also outside it.

The aim of this work is to determine the perceptions of consumers towards several aspects of Iberian pig production and animal welfare depending on the consumers' degree of knowledge about Iberian pig production and their demographic characteristics. Particularly, (a) beliefs towards animal welfare and Iberian pig production, (b) the importance of intrinsic and extrinsic cues when purchasing pork, (c) the purchase intentions for pork depending on management aspects, and (d) the willingness to pay (WTP) for Iberian pork from different production systems will be studied. Furthermore, the work aims to determine the relative importance of the breed, production system and price when purchasing products, depending on consumers' characteristics.

## 2 Material and Methods

### 2.1 Data collection

Data were obtained through paper questionnaires completed by 403 consumers of pork and pork products in four trials, two in 2016 and two in 2017, in Spain. The recruitment was carried out trying to mimic the Spanish National population distribution (INE, 2016). In each of the four trials, 100 or 101 consumers were recruited. Two trials were performed in the North-East region (NE), in Barcelona city, located in the most intensive pig production area of Spain (Catalonia). In this place, consumers were selected randomly from a big consumers' database following the national distribution. The other two trials were performed in the South-West region (SW), one in Córdoba and one in Badajoz cities, corresponding with the traditional Iberian pig production area (MAPA, 2019). In these two locations, the studies were carried out at universities. Consumers were selected by personal contacts trying to reproduce the national population. However, younger consumers were overrepresented and older consumers were underrepresented and this could have an effect on the results obtained and need to be considered as it is shown in Table 1, where consumers' demographic characteristics by region are presented. In each region, 15 sessions were performed with a minimum of 10 and a maximum of 30 consumers per session. The average time for completing the questionnaire was 30 minutes.

### 2.2 Questionnaire design

The design of the questionnaire was based on the existing literature on consumer preferences and perceptions (Feldmann & Hamm, 2015; Lagerkvist et al., 2006; Stolz, et al., 2011; Wägeli et al., 2016; Zagata, 2012) and the questions were adapted to the context of Iberian pig production. Even though the Iberian pork is less present in supermarkets in the NE region than in the SW region, it is possible to find it. Although this difference, additional information was not previously given to the consumers before answering the questionnaire. This allows us to evaluate the opinion of the consumers in a real situation without the effect of the information on their response (Tomasevic et al., 2020), because it has been proved that information can influence consumer's answer (Tuytens et al., 2011). The questionnaire was structured in three parts. The first part assessed the consumers' knowledge about Iberian pig production using three questions about the management criteria for Iberian pigs and three more about the categories of Iberian pig products. These questions have a true or false answer and can be used to classify consumers according to their real knowledge on this subject. Secondly, the questionnaire covers 10 items related to beliefs, 8 items about the importance of pork characteristics when purchasing products and 13 items about purchase intentions and WTP (see Table 2). These questions were answered on a 5-point scale ranging from 1: 'I strongly disagree' to 5: 'I strongly agree'. Finally, the socio-demographic characteristics of consumers (gender, age, education level, and employment situation) were recorded.

### 2.3 Conjoint analysis

Conjoint analysis was conducted to determine the relative importance of three attributes in the purchase of pork in Spain: breed, production system and price of pork. These attributes were selected because they refer to very relevant aspects in Iberian

pig production and pork consumption and it was aimed to see its contribution to the consumers' purchasing decisions. Breed had two levels, white pig and Iberian pig. They were selected based on the interest to determine the importance of the Iberian breed in the purchasing intention in comparison to the most common white pig. The production system had also two levels, extensive and intensive. These two levels were selected because Iberian pig can be produced using these two production systems. Finally, price had also two levels, 7 €/kg and 12 €/kg. The low price is the average price for pork from white pigs while the high price is the average price for pork from Iberian pigs. These attributes were chosen due to the importance of these characteristics in the consumer's purchasing indicated by other authors (Font-i-Furnols et al., 2011; Mesías et al., 2005, 2009). A complete design, considering all the 8 possible combinations were used. Therefore, consumers received 8 labels (one of each combination of the 3 factors) identified with a random code (see example in Figure 1). Consumers were asked to order the labels according to their purchasing preferences from 1 (most preferred) to 8 (least preferred).

#### *2.4 Data analysis*

Data analysis was performed with the software SAS version 9.4 (SAS Institute Inc., Cary, NC, USA).

Initially, a principal component analysis (PCA) was performed with the FACTOR procedure. PCA was performed separately for the questions about beliefs, the importance of pork characteristics and WTP and it allowed finding similarities between questions. Those questions that were close considering the 1<sup>st</sup> and 2<sup>nd</sup> principal components and that had a comparable meaning were averaged for the following analyses (Table 2). As a result, for the final analysis 6 questions about beliefs, 4 questions about importance and 3 about WTP were considered.

For each of the questions, the Generalized Linear Model (GLM) procedure was applied. The model included as fixed effects region, age group, gender, education level and employment situation. Differences between least-square means were obtained at  $P < 0.05$  level by means of Tukey test. A non-parametric Kruskal-Wallis test was performed previously with the NPAR1WAY procedure, but since there were no relevant differences between both statistical analyses, the parametric analysis of variance was considered (O'Mahony, 1986) since it allows us to have more information.

Following, consumers were divided into two groups according to their knowledge about Iberian production and products, which was evaluated in six questions. Three questions about the term "Iberian pig", to determine if it defines this type of pig as a pure breed, raised in free-range and fed acorn. According to Spanish national legislation (Real Decreto 4/2014) the three answers were false. And three questions about how the different types of Iberian products are defined by their management: "bellota" as fed by acorn in the fattening period, "cebo de campo" as fed by compound feed in free-range and "cebo" as fed by compound feed in intensive conditions. According to the Spanish national legislation (Real Decreto 4/2014) all of them are true. Consumers were considered to have knowledge (connoisseurs) about Iberian production if they answered two or three questions about Iberian criteria correctly and two or three questions about Iberian pig management also correctly. Else, they were

considered non-connoisseurs about Iberian characteristics. An analysis of variance was performed for beliefs, importance of pork characteristics at purchase and WTP questions considering the classification of consumers by knowledge about Iberian as a fixed effect.

A nonmetric conjoint data was analysed using the TRANSREG procedure of SAS. The model applied considers the monotonic transformation with the sum of all the part-worth utilities for each attribute equal to zero. This is a general and flexible model, usually used in qualitative data. Although the price is numeric, the objective was to include a low and a high price and thus, it has been considered as qualitative in the analysis. The relative importance of each factor was obtained, as well as the utility values associated with each level. The analysis was performed for the entire sample and also for segments of consumers according to the level of knowledge, the region and city.

### 3 Results and Discussion

#### 3.1 Consumers' characteristics

The sociodemographic characteristics of the consumers by region are shown in Table 1. The proportion of consumers with university studies was higher in the SW region compared to the national statistics, probably because the study was carried out at universities and this was not a selection criterion. This also might explain the higher percentage of public employees included in this region. Another reason for these figures is that the SW region has a higher percentage of public employees compared to the NE region, which has the lowest percentage in Spain (INE, 2019; Spanish Ministry of Finance, 2019). In addition, the unemployment ratio of the respondents was lower than the Spanish average, with unemployed consumers being underrepresented. Since the education level or employment situation did not affect consumers' responses (see the results below), these biases seem to be unimportant and do not have an effect on the conclusions of the study.

Consumers' characteristics based on Iberian pig knowledge (Table 1) show that the percentage of people surveyed who know the characteristics of Iberian pig production was very low (27.05%). Clark et al. (2019) also show that, in general, consumers have a low level of knowledge about animal production systems. In particular, knowledge about Iberian pig production was higher in the SW than the NE region (41.1% vs. 12.9%, respectively). This is probably due to the fact that Iberian pig production is rooted in the SW of Spain. Most of the consumers that stated that they have knowledge about Iberian pig production were men (67.0%). In addition, the knowledge of Iberian pig production increases with the education level. The age group and employment situation were not remarkable in this aspect since they did not make a difference.

#### 3.2 Beliefs about Iberian production and pork products

No significant differences were found in beliefs by the level of education and employment situation while region, age and gender significantly affected some of the beliefs (Table 3).



The majority of consumers that responded to this survey answered that the animal welfare and protection requirements for Spanish farms should increase (average score of 4.1). This finding is in line with the answers obtained from Spanish citizens in the last Eurobarometer (2016). In particular, this demand was significantly emphasized ( $P < 0.05$ ) by women and NE consumers. Several works have shown that women are more concerned about animal welfare than men (Kendall et al., 2006; Pejman et al., 2019; Vanhonacker et al., 2007). Some previous works show that the importance of animal welfare decreases with age (Clark et al., 2017; Cornish et al., 2016), but this was not observed in the present work.

The opinions on the degree of animal welfare for Iberian pigs were generally positive. It supported a better view of the Iberian pig than the commercial white pig. In fact, the score of the consumers regarding the statement "Iberian pigs are reared in better welfare standards than commercial pigs" is 3.78, which is in between 'neither agree nor disagree' and 'agree'. Consumer preferences are influenced by marketing aspects (Font-i-Furnols & Guerrero, 2014) and citizens relate Iberian pigs with an extensive system that is environmentally friendly and fed natural resources, although the highest percentage of Iberian pigs are currently reared in the intensive system (RIBER, 2019). Therefore, consumers had better opinions of the animal welfare of Iberian pigs, probably because of their beliefs and attitudes toward production systems (Busch et al., 2019). In this case, citizens associate Iberian pigs with an extensive system and commercial white pigs with an intensive system and some works show that consumers consider that outdoor systems provide higher welfare standards (Sinclair et al., 2019; Sørensen & Schrader, 2019). The opinions about the status of the welfare of Iberian pigs depend on the age of the consumers. In this sense, participants under the age of 40 considered the level of animal welfare for Iberian pigs to be lower than those respondents over 40. This can be affected by the fact that, in general, animal welfare is more important for young consumers than older ones (Clark et al., 2016; Cornish et al., 2016).

Consumers consider that Iberian pork and pork products are high quality, tasty and healthy and that these qualities are higher in Iberian pork than in pork from commercial white pigs (average scores of 4.1 and 4.0, respectively). In fact, other works have shown that Spanish consumers perceive Iberian pork and pork products to have excellent sensorial and nutritional qualities (Mesías et al., 2013). In addition, consumers over 60 years old considered Iberian products to be superior ( $P < 0.05$ ) in terms of their quality, taste and health compared to younger consumers. However, no significant differences were found with respect to the age, gender, area and the educational level of the participants about the statement that meat from Iberian pigs is of better quality than that of commercial white pigs.

Generally, Iberian pork and pork products are more expensive than those from white pigs. Regarding the belief that Iberian pork and pork products are too expensive, scores were close to 'agree'. This score was significantly higher in women than men (4.0 vs. 3.7), which is probably related to the fact that women are still primarily responsible for food shopping.

The effect of the degree of consumer knowledge about Iberian pig production on the beliefs toward animal welfare and Iberian production and quality aspects are presented in Table 4. Non-connoisseur consumers of Iberian pig production aspects scored the statement that current animal protection and welfare requirements for Spanish farms

should be increased greater ( $P < 0.05$ ) compared to connoisseurs (Table 4). These results are in line with the consumer concerns about animal welfare, which is related to the level of information or knowledge (Pejman et al., 2019). Although consumers do not have information on livestock production systems, they have a negative opinion of intensive production systems (Clark et al., 2019). No significant differences ( $P > 0.05$ ) between the levels of knowledge of consumers were found regarding whether Iberian pigs have better animal welfare than commercial breeds. As previously mentioned, the non-connoisseurs associate Iberian pigs with extensive systems while the connoisseurs know the different Iberian pig production systems (extensive and intensive systems). Independently of the level of knowledge of the consumer, all of them believe that Iberian pork products are high quality, very tasty and healthy and that these characteristics are higher with Iberian pigs than commercial white pigs. This result confirms the fact that Iberian pork and products are well known as high-quality products (Lopez-Bote, 1998). Iberian pig connoisseurs did not believe that Iberian products were too expensive like non-connoisseurs. It can be hypothesized that the knowledge of the production systems makes the consumers more conscious of the work needed to produce the animals and the products and this probably influences their perception of the price of the product. In fact, Liljestolpe (2011) found that price sensitivity is related to the concerns of consumers regarding some aspects such as food safety issues, animal welfare issues, or intermediate issues.

### *3.3 Importance of pig production and commercialization aspects*

Regarding the importance of pig production and the commercialization aspects of pork and pork products (Table 3), it is possible to see that food labelling and the fact that pigs are reared free and in natural conditions received the highest scores on average (4.06 each). Janssen et al. (2016) in a meta-analysis study reported that to meet consumer preferences it would be advisable to label about the husbandry system, allowing a differentiation for animal-welfare systems. The statements relative to Iberian pigs regarding the Iberian, acorn-fed, PDO, breed and type of feed criteria followed them with an average score of 3.96 each. Thus, all these aspects of pork production and commercialization are therefore important for consumers.

Age significantly affected most of the consumers' importance placed on the aspects of pig production when buying pork (Table 3). The importance of food labelling increased when age increased. The criteria related to Iberian pig production and products such as breed, type of feed (where acorn was highlighted), or PDO also increased in importance as age increased. This is probably due to the fact that older consumers considered Iberian products to be superior in terms of quality, taste and health compared to younger ages.

The living region only significantly influenced ( $P < 0.05$ ) the importance of labelling. SW consumers had a greater score for the importance of labelling when buying pork and pig meat products than NE consumers (4.3 vs. 3.9). The information on a label is an important factor that affects consumers' purchasing decisions (Bandara et al., 2016; Cornish et al., 2020; Sørensen & Schrader, 2019), being more remarkable in Iberian products due to the great variety offered. The higher importance of the labelling among SW consumers could be explained by the fact that in this region, it is easier to find Iberian products and the level of knowledge about Iberian products is higher.

Consequently, food labels are important to identify the characteristics of pork products, mainly Iberian products. In general, consumers are proud of products from their own region and origin is an important parameter of buying preferences (Díaz-Caro et al., 2019; Likoudis et al., 2016; Papanagiotou et al., 2013; Wägeli et al., 2016). The importance of different criteria associated with the labelling of pork and pig meat products (Iberian breed or production system) was not significantly different between regions. However, SW consumers showed a tendency ( $P=0.09$ ) to place greater importance on breed and feeding in Iberian products, probably because of the high knowledge in this region about these products and their characteristics in terms of breed and feeding. This may be because Iberian traditional pig production is based on a pure breed and extensive systems in the *dehesa*. These production characteristics are embedded in SW cultural heritage (Ríos-Núñez & Coq-Huelva, 2015). Therefore, consumers from this region prefer products with these Iberian pig characteristics so that they support local farmers (Papanagiotou et al., 2013). In fact, this is the only significant factor of importance when buying pork that is significantly different between Iberian pig knowledge groups (Table 4). Consumers with good knowledge of Iberian pig production considered the breed and type of feed more important than non-connoisseurs (4.1 vs. 3.9).

#### 3.4 Purchase intentions and willingness to pay

Consumers agree (average score of 3.7) that their choice to purchase pork would be negatively affected if pigs are reared in intensive conditions and sows are in crates (Table 3). Similarly, German consumers considered positive purchase pork that comes from sows that had no movement restrictions (Grunert et al., 2018). Also, Carlsson et al. (2005) reported a higher willingness to pay for meat from animals with outdoor access. Nevertheless, in the present work, consumers neither agree nor disagree (average score of 3.0) regarding castration, tusk removal, or tail docking. In fact, even though the surgical castration of piglets is criticized because of animal welfare issues (Prunier et al., 2006), a low importance placed on castration in consumers' purchasing intention or worries have been found in other works carried out in western (Kallas et al., 2013) and Eastern (Tomasevic et al., 2020) Europe, in accordance with the present results. In fact, in the study of Kallas et al. (2013), European consumers (from The United Kingdom, The Netherlands, Germany, Italy, France and Spain) consider surgical castration less important than other productive aspects (housing conditions) in relation to animal welfare. In opposition to this work, Liljenstolpe (2011) found that Swedish consumers who were classified as being concerned about animal welfare considered no castration to be an important point that positively affects their willingness to pay, in opposition with consumers being more concerned about food safety or being concerned with both. In the same direction, a study focused on castration and its alternative showed that German organic consumers' willingness to pay for meat from castrated pigs without anaesthesia was lower than for other alternatives. In addition, for most of the consumers, the highest discussed the criterion that affects negatively the choice of castration without anaesthesia was animal welfare. This changed substantially when the pain relief is applied to the castration (Heid & Hamm, 2013). Consumers also placed greater importance on other animal welfare aspects such as naturalness or extensive systems, as reported in the study of Sørensen and Schrader (2019). Regarding WTP, the highest scores were obtained by Iberian meat from free-

range animals reared in natural conditions or transported without injury to the slaughterhouse (4.2) and by Iberian meat with PDO certification (4.0). Although consumers agree that they would pay more for organic and GMO-free meat, for Iberian meat from certified farms with higher animal welfare standards and for higher quality food, the scores were slightly lower (3.9 and 3.8, respectively). Certification is an important factor that affects consumer WTP, as demonstrated in Mesías et al. (2005) and Likoudis et al. (2016).

Most of the significant differences in purchase intentions and WTP were related to the gender of the consumer (Table 3). As previously reported, women were more sensitive to issues related to animal welfare (Clark et al., 2017; Font-i-Furnols et al., 2019; Pejman et al., 2019). Their purchase choice would be most negatively affected if the pork and pig meat products came from pigs that were physically castrated or their tails and tusks were cut. Nevertheless, as commented above, this aspect seems to be not as important compared with other factors. In addition, women would pay more for Iberian meat products from free-range animals that were reared in natural conditions or transported without injury to the slaughterhouse than men, indicating again the highest importance placed on animal welfare issues, which is also expressed by women paying more for higher quality food than men. Beardsworth et al. (2002) also found that women more frequently choose foods produced with higher animal welfare than men.

Though some works found that the region may influence purchase intentions and WTP (Clark et al., 2017), no differences were found for WTP related to the region of the consumers in the present study. Only a tendency ( $P < 0.10$ ) can be seen that NE consumers' purchase choices were more negatively influenced by physical management (physical castration, tusks removal, or tails cut) than SW consumers. The primary sector is more important in the SW region than in the NW region (INE, 2019) because it is a rural area. Therefore, SW consumers have more contact with Iberian farmers than NE consumers (urban area), thus generating more positive attitudes towards them (Krystallis et al., 2009). In the same line, SW consumers showed a greater WTP for PDO certified products ( $P = 0.08$ ). The Iberian pig PDO (Dehesa de Extremadura, Los Pedroches, Jabugo and Guijuelo) is found in SW Spain (MAPA, 2019). Consequently, PDO certified Iberian pig products are local products in the SW region. Therefore, SW consumers showed a higher WTP for these local products (Likoudis et al., 2016), considering their local origin and added value (Wägeli & Hamm, 2015). In other studies, SW consumers' preference for local products has been observed for Iberian products (Díaz-Caro et al., 2019; Mesías et al., 2013).

No differences were found related to the effect of consumer age on purchasing intentions and WTP. However, in other works, it was observed that purchase choices were more negatively influenced by physical management (tusks removal or tails docking) or intensive systems for young consumers (Cornish et al., 2020). In addition, young consumers would pay more for Iberian meat products with animal welfare or organic certification (Font-i-Furnols et al., 2019).

Finally, the choice to purchase pig meat products from physically castrated animals and animals subject to other management practices (tusk removal and tails docking) would be more negatively affected for the non-connoisseurs of Iberian products than for consumers with knowledge about their production (Table 4). The perception of

animal welfare may be influenced by the level of knowledge (Pejman et al., 2019). A lack of knowledge about a management practice can produce a more negative reaction of consumers towards this practice. Thus, non-connoisseurs of practices like castration, tusk removal or tail docking can view them as negative because they do not know that these practices are usually performed and there is a reason to do them. The meat of entire male pigs may have a disagreeable odour and flavour known as boar taint mainly due to two compounds (androsterone and skatole) that are accumulated in the fat (Font-i-Furnols et al., 2008; Yunes et al., 2019). In traditional breeds (e.g. Iberian pigs), pigs are slaughtered heavier and older. Consequently, if they were left whole, the meat would have greater boar taint risk (Bonneau et al., 2018) because the pig would have reached maturity and, consequently, have lower sensory quality and consumer acceptability (Font-i-Furnols et al., 2008). In fact, boar taint, facilitating the management of pigs and avoiding unwanted pregnancies in extensive animals are the main reasons for castrating Iberian pigs. Even though general consumers do not know about boar taint and how to avoid it (Kallas et al., 2013), it is possible that connoisseurs know that this is a normal practice in Iberian pigs and, because of that, they do not have a negative opinion about castration because they consider physical castration to be necessary.

### 3.5 Conjoint analysis

The relative importance and utility values of the three factors studied (breed, production system and price) are shown in Table 5. Overall, consumers considered pig breed the most important attribute (42.61%) with a marked preference for Iberian pigs. The preference for Iberian pigs is in accordance with other studies (Díaz-Caro et al., 2019; Mesías et al., 2009) where this breed obtained the highest importance among other factors. These results are in line with the results obtained in the surveys carried out in this study where consumers have a better opinion about different aspects (level of animal welfare, product quality, etc.) of Iberian pigs compared to white pigs that influence purchase choices. The second most important attribute was the production system (39.34%). In this case, consumers showed a preference for extensive systems over intensive systems. We emphasize that similar values were obtained for the breed and production system attributes. The likely image of consumers regarding Iberian pigs is an extensive production (*dehesa*) because this has been used commercially for marketing purposes. Nevertheless, only 35% (RIBER, 2019) of Iberian pigs are extensively fattened (including *cebo de campo* and *montanera*) and only 17% of them are in *montanera* (extensive and acorn feeding in *dehesa*). Consumers probably have a lack of knowledge of the reality of the Iberian productive system and this would indicate that the consumers of Iberian meat products have a distorted image of reality. A meta-analysis (Janssen et al., 2016) showed the preference for outdoor production systems because it influences animal welfare, together with other aspects such as stocking density and floor type. Also, Clark et al., (2019) reported that intensive pig production systems have a high perceived risk of increase in animal stress. The preference for extensive systems has been observed in studies on pig production (Díaz-Caro et al., 2019; Dransfield et al., 2005) and also on other livestock species (Font-i-Furnols et al., 2011; Realini et al., 2013). This preference for extensive systems is in accordance with the previous questions, where the intention to pay more for products produced in natural conditions or pay less for products produced in intensive

systems was observed. The price of meat was the least important attribute for consumers (18.05%) with the lowest price more preferred than the highest price, which is in agreement with other works (Font-i-Furnols et al., 2011; Mesías et al., 2009, 2013; Realini et al., 2013). However, some works show clusters of consumers that prefer an intermediate or high price compared to the lowest one (Font-i-Furnols et al., 2011; Sasaki & Mitsumoto, 2004). Although consumers consider Iberian products to be too expensive in the results obtained in this study, it can be seen that the breed is the most important factor when choosing a pork product and its production system is the second most important factor.

When consumers were segmented by their knowledge of Iberian pig production, both groups showed preferences for Iberian pig meat reared in an extensive system with a low price (Table 5). In particular, connoisseurs gave more importance to price than non-connoisseurs (24% vs. 15%), less importance to the breed (39% vs. 44%) and slightly less importance to the production system (37% vs. 40%). This is probably due to the fact that the number of connoisseurs is higher in the SW region and in this region the income is lower than in the NE region. Nevertheless, when the WTP for extensively produced meat or high-quality meat was evaluated, no significant differences were found between connoisseurs and non-connoisseurs. Furthermore, this group of connoisseurs is characterized by having more consumers from the SW region. In this region of Spain, the living costs and the incomes are lower than in the NE region (INE, 2019) and this might influence the importance of the price for these consumers. However, a study from Lara (2012) shows that amount of Iberian products consumed per capita is higher in SW than the NE region, probably because prices are lower. Also, men are the majority of the connoisseur group, indicating that they probably are more interested in low prices, in accordance with the results obtained before where men would be willing to pay significantly less than women for free-range and higher quality meat. Men also were those that considered the price to be the most important factor in a study carried out in the United Kingdom and Spain on lamb (Font-i-Furnols et al., 2011).

When the analysis was carried out according to region, no important differences between regions were obtained (Table 5). In both of them, the relative importance of the breed was the highest (> 40%), followed by production systems (> 38%) and finally, the price (< 20%). In all the cases, Iberian pigs from an extensive production system with a lower price are preferred.

### 3.6. Limitations of the study

This study has some limitations that might have an influence on the results that have been commented through the text and are summarized in this section.

The first one is a bias in the sample of consumers that participated in the trial, especially in the SW region. In this region, the final sample had an over-representation of young consumers and an under-representation of old consumers. This might have influenced the responses since age has been significant in some of the questions. There are also other biases in the population, as the high number of consumers with high educational level, the high number of public employees and the low percentage of

unemployed consumers. These biases are probably due to the fact that the study was carried out at universities.

Another shortcoming is related to aspects of the questionnaire. In this sense, the questions were provided with the same order to all the consumers and grouped by type of question. This was performed in that way because it allowed to simplify the reading of the questions by the consumers and, consequently, reduce the fatigue in answering the questions. This aspect was important because this work was part of a wider study and consumers participated in other activities.

## 4 Conclusions

In the conditions of the present study, it can be concluded that around 75% of the consumers who participated in this trial did not know which criteria need to be fulfilled by Iberian pig production and which are the characteristics of the different Iberian products. The consumers in this study, even if they were aware or not of the implications of “Iberian pork” and independently on the geographic area studied, consider Iberian products of higher quality, tastier, healthier and produced with higher standards of animal welfare than pork products from white commercial breeds. Consumers also think that Iberian products are too expensive, but this was clearly affected by the degree of knowledge about Iberian production and characteristics, showing the necessity to increase the knowledge to give higher value to the product and understand the price. The labelling and the rearing conditions were considered the most important pork characteristics followed by the breed and rearing conditions. Because of that, the labelling of the products from Iberian pigs that are traditionally produced is of great importance in order to reach a high number of consumers. Probably, it would be advisable that differences in the production systems of Iberian pigs should be clearly provided on the labels than what is currently provided, to avoid misconceptions. Most of the consumers imagined that Iberian pigs are reared extensively in the *dehesa* ecosystem, although two-thirds of Iberian pigs are intensively reared. Information about the husbandry practices, including rearing conditions and feeding system, would allow consumers to take a more informed choice.

The low knowledge about the different types of Iberian pig production among the population supports the opportunity to educate and change some negative beliefs of consumers regarding some production practices and to support pig consumption.

## 5 Acknowledgments

The authors would like to thank Rosario Ramírez-Bernabé from CICYTEX and the IRTA technicians Albert Rossell and Xin Luo for technical assistance. Funding: This work was supported by the National Institute for Agricultural and Food Research and Technology (INIA), grant number RTA2013-00063-C03-02. INIA is also thanked for the scholarship to Javier García-Gudiño.

Title. Understanding preferences and the perception of pork cues in Iberian pig production in Spain

Javier García-Gudiño: Conceptualization, Formal analysis, Investigation, Data Curation, Writing - Original Draft

Isabel Blanco-Penedo: Term, Conceptualization, Investigation, Writing - Review & Editing, Project administration, Funding acquisition

Marina Gispert: Conceptualization, Investigation, Writing - Review & Editing

Albert Brun: Investigation, Data Curation, Writing - Review & Editing

José M. Perea: Investigation, Writing - Review & Editing

Maria Font-i-Furnols: Term, Conceptualization, Formal analysis, Investigation, Writing - Original Draft, Project administration, Funding acquisition

# Conflicts of Interest Statement

Manuscript title: **Understanding preferences and the perception of pork cues in Iberian pig production in Spain**

The authors whose names are listed immediately below certify that they have NO affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript.

Author names:

Javier García-Gudiño

Isabel Blanco-Penedo

Marina Gispert

Albert Brun

José Perea



Maria Font-i-Furnols

The authors whose names are listed immediately below report the following details of affiliation or involvement in an organization or entity with a financial or non-financial interest in the subject matter or materials discussed in this manuscript. Please specify the nature of the conflict on a separate sheet of paper if the space below is inadequate.

## Author names:

**This statement is signed by all the authors to indicate agreement that the above information is true and correct** (a photocopy of this form may be used if there are more than 10 authors):

Author's name (typed)	Author's signature	Date
Javier García-Gudiño		01/05/2020
Isabel Blanco-Penedo		01/05/2020
Marina Gispert 01/05/2020		
Albert Brun 01/05/2020		
José Perea		01/05/2020
Maria Font-i-Furnols		

## 6 References

- Alonso, M. E., González-Montaña, J. R., & Lomillos, J. M. (2020). Consumers' concerns and perceptions of farm animal welfare. *Animals*, *10*(3), 1–13. <https://doi.org/10.3390/ani10030385>
- Alonso, V., Muela, E., Gutiérrez, B., Calanche, J. B., Roncalés, P., & Beltrán, J. A. (2015). The inclusion of duroc breed in maternal line affects pork quality and fatty acid profile. *Meat Science*, *107*, 49–56. <https://doi.org/10.1016/j.meatsci.2015.04.011>
- Bandara, B. E. S., De Silva, D. A. M., Maduwanthi, B. C. H., & Warunasinghe, W. A. A. I. (2016). Impact of Food Labeling Information on Consumer Purchasing Decision: With Special Reference to Faculty of Agricultural Sciences. *Procedia Food Science*, *6*(Icsusl 2015), 309–313. <https://doi.org/10.1016/j.profoo.2016.02.061>
- Beardsworth, A., Bryman, A., Keil, T., Goode, J., Haslam, C., & Lancashire, E. (2002). Women, men and food: The significance of gender for nutritional attitudes and choices. *British Food Journal*, *104*(7), 470–491. <https://doi.org/10.1108/00070700210418767>
- Benito, J., Albarrán, A., & García Casco, J. M. (2006). Extensive Iberian pig production

grazing systems . *Proceedings of the 21st General Meeting of the European Grassland Federation*, 635–645.

- Bonneau, M., Čandek-Potokar, M., Škrlep, M., Font-I-Furnols, M., Aluwé, M., & Fontanesi, L. (2018). Potential sensitivity of pork production situations aiming at high-quality products to the use of entire male pigs as an alternative to surgical castrates. *Animal*, *12*(6), 1287–1295. <https://doi.org/10.1017/S1751731117003044>
- Bonneau, Michel, & Lebret, B. (2010). Production systems and influence on eating quality of pork. *Meat Science*, *84*(2), 293–300. <https://doi.org/10.1016/j.meatsci.2009.03.013>
- Busch, G., Gauly, S., Von Meyer-Höfer, M., & Spiller, A. (2019). Does picture background matter? People's evaluation of pigs in different farm settings. *PLoS ONE*, *14*(2), 1–19. <https://doi.org/10.1371/journal.pone.0211256>
- Čandek-Potokar, M., Fontanesi, L., Lebret, B., Gil, J. M., Oviio, C., Nieto, R., Fernández, A., Pugliese, C., Oliver, M.A., & Bozzi, R. (2019). Introductory Chapter: Concept and Ambition of Project TREASURE. In *European Local Pig Breeds - Diversity and Performance A study of project TREASURE* (pp. 1–7). <https://doi.org/10.5772/intechopen.83749>
- Cardoso, C. S., Von Keyserlingk, M. A. G., & Hötzel, M. J. (2017). Brazilian citizens: Expectations regarding dairy cattle welfare and awareness of contentious practices. *Animals*, *7*(12). <https://doi.org/10.3390/ani7120089>
- Carlsson, F., Frykblom, P., & Lagerkvist, C. J. (2005). Consumer preferences for food product quality attributes from Swedish Agriculture. *Ambio*, *34*(4–5), 366–370. <https://doi.org/10.1579/0044-7447-2004-4.366>
- Clark, B., Panzone, L. A., Stewart, G. B., Kyriazakis, I., Niemi, J. K., Latvala, T., Tranter, R., Philip, J., & Frewer, L. J. (2019). Consumer attitudes towards production diseases in intensive production systems. *PLoS ONE*, *14*(1), 1–24. <https://doi.org/10.1371/journal.pone.0210432>
- Clark, B., Stewart, G. B., Panzone, L. A., Kyriazakis, I., & Frewer, L. J. (2016). A Systematic Review of Public Attitudes, Perceptions and Behaviours Towards Production Diseases Associated with Farm Animal Welfare. *Journal of Agricultural and Environmental Ethics*, *29*(3), 455–478. <https://doi.org/10.1007/s10806-016-9615-x>
- Clark, B., Stewart, G. B., Panzone, L. A., Kyriazakis, I., & Frewer, L. J. (2017). Citizens, consumers and farm animal welfare: A meta-analysis of willingness-to-pay studies. *Food Policy*, *68*, 112–127. <https://doi.org/10.1016/j.foodpol.2017.01.006>
- Cornish, A. R., Briley, D., Wilson, B. J., Raubenheimer, D., Schlosberg, D., & McGreevy, P. D. (2020). The price of good welfare: Does informing consumers about what on-package labels mean for animal welfare influence their purchase intentions? *Appetite*, *148*(January), 104577. <https://doi.org/10.1016/j.appet.2019.104577>
- Cornish, A., Raubenheimer, D., & McGreevy, P. (2016). What we know about the public's level of concern for farm animal welfare in food production in developed countries. *Animals*, *6*(11), 1–15. <https://doi.org/10.3390/ani6110074>
- De Miguel, Á., Hoekstra, A. Y., & García-Calvo, E. (2015). Sustainability of the water footprint of the Spanish pork industry. *Ecological Indicators*, *57*, 465–474.

<https://doi.org/10.1016/j.ecolind.2015.05.023>

- Díaz-Caro, C., García-Torres, S., Elghannam, A., Tejerina, D., Mesias, F. J., & Ortiz, A. (2019). Is production system a relevant attribute in consumers' food preferences? The case of Iberian dry-cured ham in Spain. *Meat Science*, *158*(April), 107908. <https://doi.org/10.1016/j.meatsci.2019.107908>
- Dimara, E., & Skuras, D. (2005). Consumer demand for informative labeling of quality food and drink products: A European union case study. *Journal of Consumer Marketing*, *22*(2), 90–100. <https://doi.org/10.1108/07363760510589253>
- DOOR. (2019). European Commission, Agriculture and Rural Development, Agriculture and Food, DOOR database. Retrieved from <https://ec.europa.eu/agriculture/quality/door>
- Dransfield, E., Ngapo, T. M., Nielsen, N. A., Bredahl, L., Sjöström, P. O., Magnusson, M., Campo, M.M., & Nute, G. R. (2005). Consumer choice and suggested price for pork as influenced by its appearance, taste and information concerning country of origin and organic pig production. *Meat Science*, *69*(1), 51–70. <https://doi.org/10.1016/j.meatsci.2004.06.006>
- Estévez, M., Morcuende, D., & Cava López, R. (2003). Physico-chemical characteristics of M. Longissimus dorsi from three lines of free-range reared Iberian pigs slaughtered at 90 kg live-weight and commercial pigs: A comparative study. *Meat Science*, *64*(4), 499–506. [https://doi.org/10.1016/S0309-1740\(02\)00228-0](https://doi.org/10.1016/S0309-1740(02)00228-0)
- European Commission. (2016). *Special Eurobarometer 442 - Attitudes of Europeans towards Animal Welfare*. <https://doi.org/10.2875/884639>
- Feldmann, C., & Hamm, U. (2015). Consumers' perceptions and preferences for local food: A review. *Food Quality and Preference*, *40*(PA), 152–164. <https://doi.org/10.1016/j.foodqual.2014.09.014>
- Font-i-Furnols, M., & Guerrero, L. (2014). Consumer preference, behavior and perception about meat and meat products: An overview. *Meat Science*, *98*(3), 361–371. <https://doi.org/10.1016/j.meatsci.2014.06.025>
- Font-I-Furnols, M., Skarlep, M., & Aluwé, M. (2019). Attitudes and beliefs of consumers towards pig welfare and pork quality. *IOP Conference Series: Earth and Environmental Science*, *333*(1). <https://doi.org/10.1088/1755-1315/333/1/012002>
- Font i Furnols, M., Gispert, M., Guerrero, L., Velarde, A., Tibau, J., Soler, J., Hortós, M., García-Regueiro, J.A., Pérez, J., Suárez, P., & Oliver, M. A. (2008). Consumers' sensory acceptability of pork from immunocastrated male pigs. *Meat Science*, *80*(4), 1013–1018. <https://doi.org/10.1016/j.meatsci.2008.04.018>
- Font i Furnols, M., Realini, C., Montossi, F., Sañudo, C., Campo, M. M., Oliver, M. A., Nute, G.R., & Guerrero, L. (2011). Consumer's purchasing intention for lamb meat affected by country of origin, feeding system and meat price: A conjoint study in Spain, France and United Kingdom. *Food Quality and Preference*, *22*(5), 443–451. <https://doi.org/10.1016/j.foodqual.2011.02.007>
- Gil, J. M., & Sánchez, M. (1998). Consumer Preferences for Wine Attributes in Different Retail Stores: A Conjoint Approach. *International Journal of Wine Marketing*, *10*(1), 25–38. <https://doi.org/10.1108/eb008675>
- Grunert, K. G., Sonntag, W. I., Glanz-Chanos, V., & Forum, S. (2018). Consumer

- interest in environmental impact, safety, health and animal welfare aspects of modern pig production: Results of a cross-national choice experiment. *Meat Science*, 137(September 2017), 123–129. <https://doi.org/10.1016/j.meatsci.2017.11.022>
- Grunert, Klaus G., Bredahl, L., & Brunsø, K. (2004). Consumer perception of meat quality and implications for product development in the meat sector - A review. *Meat Science*, 66(2), 259–272. [https://doi.org/10.1016/S0309-1740\(03\)00130-X](https://doi.org/10.1016/S0309-1740(03)00130-X)
- Heid, A., & Hamm, U. (2013). Animal welfare versus food quality: Factors influencing organic consumers' preferences for alternatives to piglet castration without anaesthesia. *Meat Science*, 95(2), 203–211. <https://doi.org/10.1016/j.meatsci.2013.04.052>
- INE. (2016). National Statistics Institute.
- INE. (2019). National Statistics Institute.
- Janssen, M., Rödiger, M., & Hamm, U. (2016). Labels for Animal Husbandry Systems Meet Consumer Preferences: Results from a Meta-analysis of Consumer Studies. *Journal of Agricultural and Environmental Ethics*, 29(5), 1071–1100. <https://doi.org/10.1007/s10806-016-9647-2>
- Kallas, Z., Gil, J. M., Panella-Riera, N., Blanch, M., Font-i-Furnols, M., Chevillon, P., De Roest, K., Tacken, G., & Oliver, M. A. (2013). Effect of tasting and information on consumer opinion about pig castration. *Meat Science*, 95(2), 242–249. <https://doi.org/10.1016/j.meatsci.2013.05.011>
- Kendall, H. A., Lobao, L. M., & Sharp, J. S. (2006). Public concern with animal well-being: Place, social structural location, and individual experience. *Rural Sociology*, 71(3), 399–428. <https://doi.org/10.1526/003601106778070617>
- Krystallis, A., de Barcellos, M. D., Küryler, J. O., Verbeke, W., & Grunert, K. G. (2009). Attitudes of European citizens towards pig production systems. *Livestock Science*, 126(1–3), 46–56. <https://doi.org/10.1016/j.livsci.2009.05.016>
- Lagerkvist, C. J., Carlsson, C., & Viske, D. (2006). Swedish consumer preferences for animal welfare and biotech: A choice experiment. *AgBioForum*, 9(1), 51–58.
- Lara, P., & De Pedro, E. (2012). El consumo de jamón Ibérico en España. *Solo Cerdo Ibérico*, 28, 79–103.
- Lee, M. A., Jung, Y., Jo, C., Park, J. Y., & Nam, K. C. (2017). Analysis of consumers' preferences and price sensitivity to native chickens. *Korean Journal for Food Science of Animal Resources*, 37(3), 469–476. <https://doi.org/10.5851/kosfa.2017.37.3.469>
- Likoudis, Z., Sdrali, D., Costarelli, V., & Apostolopoulos, C. (2016). Consumers' intention to buy protected designation of origin and protected geographical indication foodstuffs: The case of Greece. *International Journal of Consumer Studies*, 40(3), 283–289. <https://doi.org/10.1111/ijcs.12253>
- Liljenstolpe, C. (2011). Demand for Value-Added Pork in Sweden: A Latent Class Model Approach. *Agribusiness*, 27(2), 129–146. <https://doi.org/10.1002/agr.20262>
- Lopez-Bote, C. J. (1998). Sustained utilization of the Iberian pig breed. *Meat Science*, 49(SUPPL. 1). [https://doi.org/10.1016/S0309-1740\(98\)00072-2](https://doi.org/10.1016/S0309-1740(98)00072-2)

- MAPA. (2019). Spanish Ministry of Agriculture, Fishery and Food.
- McEachern, M. G., & Seaman, C. (2005). Consumer perceptions of meat production: Enhancing the competitiveness of British agriculture by understanding communication with the consumer. *British Food Journal*, *107*(8), 572–593. <https://doi.org/10.1108/00070700510610986>
- Meinert, L., Christiansen, S. C., Kristensen, L., Bjerregaard, C., & Aaslyng, M. D. (2008). Eating quality of pork from pure breeds and DLY studied by focus group research and meat quality analyses. *Meat Science*, *80*(2), 304–314. <https://doi.org/10.1016/j.meatsci.2007.12.021>
- Mesías, F. J., Gaspar, P., Escribano, M., & Pulido, F. (2010). The role of protected designation of origin in consumer preference for iberian dry-cured ham in Spain. *Italian Journal of Food Science*, *22*(4), 367–376.
- Mesías, Francisco J., Escribano, M., De Ledesma, A. R., & Pulido, F. (2005). Consumers' preferences for beef in the Spanish region of Extremadura: A study using conjoint analysis. *Journal of the Science of Food and Agriculture*, *85*(14), 2487–2494. <https://doi.org/10.1002/jsfa.2283>
- Mesías, Francisco J., Gaspar, P., Pulido, Á. F., Escribano, M., & Pulido, F. (2009). Consumers' preferences for Iberian dry-cured ham and the influence of mast feeding: An application of conjoint analysis in Spain. *Meat Science*, *83*(4), 684–690. <https://doi.org/10.1016/j.meatsci.2009.08.004>
- Mesías, Francisco J., Pulido, F., Escribano, M., Gaspar, P., Pulido, Á. F., Escribano, A., & Rodríguez-Ledesma, A. (2013). Evaluation of new packaging formats for dry-cured meat products using conjoint analysis: An application to dry-cured iberian ham. *Journal of Sensory Studies*, *28*(3), 238–247. <https://doi.org/10.1111/joss.12040>
- Nieto, R., García-Casco, J., Lara, I., Palma-Granados, P., Izquierdo, M., Hernandez, F., Dieguez, E., Duarte, L., & Batorek-Lukač, N. (2019). Ibérico (Iberian) Pig. In *European Local Pig Breeds - Diversity and Performance A study of project TREASURE* (pp. 1–25). <https://doi.org/10.5772/intechopen.83749>
- O'Mahony, M. (1986). *Sensory evaluation of food: statistical methods and procedures* (Marcel Dekker). New York, N.Y.
- Papanagiotou, P., Tzinitra-Kalogianni, I., & Melfou, K. (2013). Consumers' expected quality and intention to purchase high quality pork meat. *Meat Science*, *93*(3), 449–454. <https://doi.org/10.1016/j.meatsci.2012.11.024>
- Pejman, N., Kallas, Z., Dalmau, A., & Velarde, A. (2019). Should Animal Welfare Regulations Be More Restrictive? A Case Study in Eight European Union Countries. *Animals*, *9*(195).
- Plastow, G. S., Carrión, D., Gil, M., García-Regueiro, J. A., Font i Furnols, M., Gispert, M., Oliver, M.A., Velarde, A., Guàrdia, M.D., Hortós, M., Rius, M.A., Sárraga, C., Díaz, I., Valero, A., Sosnicki, A., Klont, R., Dornan, S., Wilkinson, J.M., Evans, G., Sargent, C., Davey, G., Connolly, D., Houeix, B., Maltin, C.M., Hayes, H.E., Anandavijayan, V., Foury, A., Geverink, N., Cairns, M., Tilley, R.E., Mormède, P., & Blott, S. C. (2005). Quality pork genes and meat production. *Meat Science*, *70*(3 SPEC. ISS.), 409–421. <https://doi.org/10.1016/j.meatsci.2004.06.025>
- Prunier, A., Bonneau, M., von Borell, E. H., Cinotti, S., Gunn, M., Fredriksen, B.,

- Giersing, M., Mortin, D.B., Tuytens, F.A.M., & Velarde, A. (2006). A review of the welfare consequences of surgical castration in piglets and the evaluation of non-surgical methods. *Animal Welfare*, 15(3), 277–289.
- Real Decreto 4/2014, de 10 de enero, por el que se aprueba la norma de calidad para la carne, el jamón, la paleta y la caña de lomo ibérico (p. <https://www.boe.es/buscar/doc.php?id=BOE-A-2014-31>). (n.d.).
- Realini, C. E., Font i Furnols, M., Sañudo, C., Montossi, F., Oliver, M. A., & Guerrero, L. (2013). Spanish, French and British consumers' acceptability of Uruguayan beef, and consumers' beef choice associated with country of origin, finishing diet and meat price. *Meat Science*, 95(1), 14–21. <https://doi.org/10.1016/j.meatsci.2013.04.004>
- Registro informativo de organismos independientes de control del ibérico. (2019). RIBER.
- Ríos-Núñez, S. M., & Coq-Huelva, D. (2015). The Transformation of the Spanish Livestock System in the Second and Third Food Regimes. *Journal of Agrarian Change*, 15(4), 519–540. <https://doi.org/10.1111/jac.12088>
- Sasaki, K., & Mitsumoto, M. (2004). Questionnaire-based study on consumer requirements for beef quality in Japan. *Animal Science Journal*, 75(4), 369–376. <https://doi.org/10.1111/j.1740-0929.2004.00199.x>
- Schnettler, B., Ruiz, D., Sepúlveda, O., & Sepúlveda, N. (2008). Importance of the country of origin in food consumption in a developing country. *Food Quality and Preference*, 19(4), 372–382. <https://doi.org/10.1016/j.foodqual.2007.11.005>
- Scholderer, J., Nielsen, N. A., Bredahl, L., Claudi-magnussen, C., & Lindahl, G. (2004). Organic pork: consumer quality perceptions. *Project Paper, MAPP proje(2–4)*, 5–25.
- Sinclair, M., Yan, W., & Phillips, C. J. C. (2019). Attitudes of pig and poultry industry stakeholders in Guangdong Province, China, to animal welfare and farming systems. *Animals*, 9(11). <https://doi.org/10.3390/ani9110860>
- Sørensen, J. T., & Schroder, L. (2019). Labelling as a tool for improving animal welfare-The pig case. *Agriculture (Switzerland)*, 9(6), 1–13. <https://doi.org/10.3390/agriculture9060123>
- Spanish Ministry of Finance. (2019). Spanish Ministry of Finance.
- Stolz, H., Stolze, M., Janssen, M., & Hamm, U. (2011). Preferences and determinants for organic, conventional and conventional-plus products - The case of occasional organic consumers. *Food Quality and Preference*, 22(8), 772–779. <https://doi.org/10.1016/j.foodqual.2011.06.011>
- Straadt, I. K., Aaslyng, M. D., & Bertram, H. C. (2013). Sensory and consumer evaluation of pork loins from crossbreeds between Danish Landrace, Yorkshire, Duroc, Iberian and Mangalitza. *Meat Science*, 95(1), 27–35. <https://doi.org/10.1016/j.meatsci.2013.04.026>
- Te Velde, H., Aarts, N., & Van Woerkum, C. (2002). Dealing with ambivalence: Farmers' and consumers' perceptions of animal welfare in livestock breeding. *Journal of Agricultural and Environmental Ethics*, 15(2), 203–219. <https://doi.org/10.1023/A:1015012403331>

- Tejerina, D., García-Torres, S., Cabeza De Vaca, M., Vázquez, F. M., & Cava, R. (2012). Effect of production system on physical-chemical, antioxidant and fatty acids composition of Longissimus dorsi and Serratus ventralis muscles from Iberian pig. *Food Chemistry*, *133*(2), 293–299. <https://doi.org/10.1016/j.foodchem.2012.01.025>
- Tomasevic, I., Bahelka, I., Čandek-Potokar, M., Čitek, J., Djekić, I., Djurkin Kušec, I., Getya, A., Guerrero, L., Iordăchescu, G., Ivanova, S., Nakov, D., Solowiej, B.G., Szabó, C., Tudoreanu, L., Weiler, U., & Font-i-Furnols, M. (2020). Attitudes and beliefs of Eastern European consumers towards piglet castration and meat from castrated pigs. *Meat Science*, *160*(March 2019), 107965. <https://doi.org/10.1016/j.meatsci.2019.107965>
- Tuytens, F.A.M., Vanhonacker, F., Langendries, K., Aluwé, M., Millet, S., Bekaert, K., & Verbeke, W. (2011). Effect of information provisioning on attitude toward surgical castration of male piglets and alternative strategies for avoiding boar taint. *Research in Veterinary Science*, *91*, 327-332. <https://doi.org/10.1016/j.rvsc.2011.01.005>
- Vanhonacker, F., Verbeke, W., & van Poucke, E. (2007). Segmentation based on consumers' perceived importance and attitude toward farm animal welfare. *International Journal of Sociology*, *15*(3).
- Ventanas, S., Ventanas, J., Ruiz, J., & Estévez, M. (2005). Iberian pigs for the development of high-quality cured products. *Recent Res. Devel. Agricultural & Food Chem*, *6*(January), 1–27.
- Verlegh, P. W. J., & Van Ittersum, K. (2001). The origin of the spices: The impact of geographic product origin on consumer decision making. In L. J. Frewer, E. Risvik, & H. Schifferstein (Eds.), *Food, people and society. A European perspective of consumers' food choices* (pp. 267–279). Berlin: Springer-Verlag.
- Vietoris, V., Kozelová, D., Mella, I., Chreneková, M., Potclan, J. E., Fikselová, M., Kopkás, P., & Horská, E. (2016). Analysis of Consumer Preferences at Organic Food Purchase in Romania. *Polish Journal of Food and Nutrition Sciences*, *66*(2), 139–146. <https://doi.org/10.1515/pjfn-2015-0028>
- Wägeli, S., & Hamm, U. (2015). Consumers' perception and expectations of local organic food supply chains. *Organic Agriculture*, *6*(3), 215–224. <https://doi.org/10.1007/s13165-015-0130-6>
- Wägeli, S., Janssen, M., & Hamm, U. (2016). Organic consumers' preferences and willingness-to-pay for locally produced animal products. *International Journal of Consumer Studies*, *40*(3), 357–367. <https://doi.org/10.1111/ijcs.12262>
- Yunes, M. C., Teixeira, D. L., Von Keyserlingk, M. A. G., & Hotzel, M. J. (2019). Is gene editing an acceptable alternative to castration in pigs? *PLoS ONE*, *14*(6), 1–18.
- Zagata, L. (2012). Consumers' beliefs and behavioural intentions towards organic food. Evidence from the Czech Republic. *Appetite*, *59*(1), 81–89. <https://doi.org/10.1016/j.appet.2012.03.023>

Table 1: Consumers' characteristics by area and knowledge about Iberian production (%)<sup>+</sup>.

Region	Knowledge
--------	-----------

	NE*	SW*	No	Yes
n	201	202	294	109
Region				
NE*			59.52	23.85
SW*			40.48	76.15
Age group				
< 25	8.50	29.35	17.81	22.02
25-40	29.00	25.37	26.37	29.36
40-60	42.50	38.81	41.44	38.53
> 60	20.00	6.47	14.38	10.09
Gender				
Male	47.76	50.99	42.86	66.97
Female	52.24	49.01	57.14	33.03
Educational level				
Basic studies	29.50	17.41	27.05	13.76
University	33.50	61.19	40.41	66.06
Vocational education	37.00	21.39	32.53	20.18
Employment situation				
Student	9.95	34.65	20.41	27.52
Self-employed	6.47	3.47	4.42	6.42
Public employee	5.47	43.17	20.41	34.86
Retired	15.42	3.47	10.54	6.42
Employee	55.22	13.86	39.12	22.02
Unemployed	7.46	1.49	5.10	2.75

\* Abbreviations: NE: Northeast, SW: Southwest

\* Spanish distribution (INE, 2016): Age group (<25: 10.38%; 25-40: 27.52%; 40-60: 42.38%; >60: 20.72%); Gender (Male: 49.07%; Female: 50.93%); Educational level (Basic studies: 41.65%; University: 35.75%; Vocational education: 22.60%)

Table 2: First and second factors (PC1 and PC2) of the Principal Component Analysis (PCA) by group (beliefs, importance and purchasing intentions).

<i>Beliefs</i>	PC A*	PC 1	PC 2
I think that the current requirements for animal protection and welfare should be improved on Spanish farms.		0.36	0.24
I think that Iberian pig ...		0.53	0.34
are reared to achieve higher standards of welfare.		0.33	-
are reared for better welfare than commercial white pigs.		0.3	0.3
I think that Iberian pork and meat products ...		0.6	0.4
are of a high quality.	a	0.8	0.6
are very tasty.	a	0.7	0.3
are healthy.	a	0.1	0.8
have higher quality than those from commercial white pigs.	b	0.6	0.0
are tastier than those from commercial white pigs.	b	0.7	-



		3	0.2
			9
		0.6	-
		2	0.5
are healthier than those from commercial white pigs.	b		9
		0.4	0.3
are too expensive.		3	8
<hr/>			
<i>Importance of pork characteristics</i>			
<hr/>			
When I buy pork and pig meat products,....			
		0.6	0.3
food labels are important for me.		4	9
		0.7	0.4
acorn-fed category is important for me.	c	2	3
		0.6	0.3
the Iberian origin criteria is important for me.	c	9	9
		0.6	0.2
the PDO certification is important for me.	c	6	1
		0.7	-
		4	0.4
it is important for me that pigs are reared free.	d		8
		0.7	-
		8	0.4
it is important for me that pigs are reared in natural conditions.	d		8
		0.6	-
		2	0.1
the breed is important for me (if they are Iberian pigs).	e		1
		0.7	-
		8	0.2
the type of feed is important for me (if they are Iberian pigs).	e		0
<hr/>			
<i>Purchase intentions and willingness to pay</i>			
<hr/>			
My purchase choice would be negatively affected if I would know that ...			
		0.6	-
		4	0.3
pigs are reared in intensive conditions.	f		1
		0.6	-
		5	0.4
sows are kept in crates.	f		8
		0.6	-
		3	0.6
pig tusks are removed.	g		1
		0.6	-
		8	0.5
pig tail docking is still practiced.	g		7
		0.6	-
		5	0.5
pigs are physically castrated.	g		2
I would pay more for Iberian pork and pig meat products...			
		0.6	0.3
with an animal welfare certificate.	h	5	2
		0.6	0.2
with an organic certificate.	h	8	6

		0.5	0.3
with a GMO-free certificate.	h	9	0
		0.4	0.5
with a PDO certification.		3	4
		0.7	0.4
from free-range pigs.	i	0	0
		0.7	0.4
from pigs reared in natural conditions.	i	1	3
		0.6	0.2
from pigs transported without injury to the slaughterhouse.	i	8	8
		0.2	0.1
I would pay more for higher quality food.		8	8

---

\*Items with the same letter in the PCA column were considered together for the analysis.

Journal Pre-proof

	mean	Region		Age group				Gender			P value		
global	NE*	SW*	< 25	25- 40	40- 60	> 60	M*	F*	RMSE*	Region	Age	Gender	
<i>Beliefs</i>													
I think that the current requirements for animal protection and welfare on Spanish farms should be increased.	4.14	4.3	4.0	4.2	4.3	4.1	4.1	4.0	4.3	1.01	<b>0.008</b>	0.683	<b>0.005</b>
I think that Iberian pigs are reared... in high welfare standards.	3.67	3.5	3.7	3.1 <sup>b</sup>	3.4 <sup>b</sup>	3.7 <sup>a</sup>	4.1 <sup>a</sup>	3.6	3.6	0.90	0.306	<b>&lt;0.001</b>	0.978
in a better welfare than commercial pigs.	3.78	3.8	3.7	3.4	3.6	3.8	4.1	3.8	3.7	1.05	0.539	0.119	0.760
I think that Iberian pork and meat products... are of a high quality, very tasty and healthy.	4.14	4.1	4.2	3.9 <sup>b</sup>	3.9 <sup>b</sup>	4.1 <sup>b</sup>	4.5 <sup>a</sup>	4.1	4.1	0.70	0.191	<b>0.002</b>	0.757
have higher quality, tastier and healthier than pork and meat products from commercial pigs.	4.02	4.0	4.0	3.8	3.9	4.1	4.2	4.0	4.0	0.85	0.981	0.233	0.852
are too expensive.	3.81	3.9	3.8	3.8	3.8	3.8	4.0	3.7	4.0	0.95	0.232	0.652	<b>0.010</b>
<i>Importance of pork characteristics</i>													
When I buy pork and pig meat products, it is important for me... the food labels.	4.06	3.9	4.3	3.8 <sup>b</sup>	4.1 <sup>ab</sup>	4.2 <sup>a</sup>	4.5 <sup>a</sup>	4.1	4.1	0.98	<b>0.003</b>	<b>0.013</b>	0.878
the Iberian breed, fed-acorn and PDO criteria.	3.96	3.9	4.1	3.7 <sup>b</sup>	3.9 <sup>b</sup>	4.1 <sup>ab</sup>	4.4 <sup>a</sup>	4.0	4.0	0.77	0.159	<b>0.007</b>	0.303
that the pigs have been reared in natural conditions and free.	4.06	4.2	4.2	4.3	4.0	4.2	4.3	4.1	4.3	0.92	0.988	0.359	0.204
the breed and the type of feed if it is from Iberian products.	3.96	4.0	4.2	3.7 <sup>b</sup>	3.8 <sup>b</sup>	4.2 <sup>ab</sup>	4.5 <sup>a</sup>	4.1	4.0	0.87	0.087	<b>0.001</b>	0.088
<i>Purchase intentions and willingness to pay</i>													
My purchase choice would be negatively affected if I would know that... pigs are reared in intensive conditions and sows are kept in crates.	3.67	3.7	3.7	3.9	3.8	3.6	3.4	3.6	3.7	1.10	0.790	0.395	0.251
pigs are physically castrated, their tusks are removed or tail docking is practiced.	3.01	3.2	2.9	3.2	3.2	3.0	2.8	2.8	3.3	1.24	0.070	0.515	<b>&lt;0.001</b>
I would pay more for Iberian pork and pig meat products...													

with an animal welfare, an organic or a GMO free certificates.	3.85	4.0	3.9	4.1	4.0	4.0	3.8	3.9	4.0	0.90	0.452	0.754	0.078
with a PDO certification. from pigs reared in natural conditions, in free-range or transported without injury to the slaughterhouse.	4.04	4.0	4.3	4.2	4.0	4.2	4.2	4.2	4.1	0.95	0.078	0.529	0.468
I would pay more for higher quality food.	3.81	3.8	3.9	3.9	3.9	3.8	3.7	3.7	3.9	1.01	0.385	0.703	0.028

Table 3: Consumers' beliefs, importance of pork characteristics when purchasing and willingness to pay by consumers' demographic characteristics.

\* Abbreviations: NE: northeast; SW: southwest; M: male; W: female; RMSE: root mean square error. P-values for educational level and employment situation were >0.05 for all the items. Table 4: Consumers' beliefs, importance of pork characteristics when purchasing and willingness to pay by knowledge of consumers about Iberian production.

	Knowledge		RMSE*	P-value
	No	Yes		
<i>Beliefs</i>				
I think that the current requirements for animal protection and welfare on Spanish farms should be increased.	4.3	3.7	1.01	<0.001
I think that Iberian pigs are reared... in high welfare standards.	3.7	3.5	0.93	0.012
in a better welfare than commercial pigs.	3.8	3.6	1.07	0.083
I think that Iberian pork and meat products... are of a high quality, very tasty and healthy.	4.2	4.0	0.71	0.037
have higher quality, tastier and healthier than pork and meat products from commercial pigs.	4.1	3.9	0.85	0.156
are too expensive.	3.9	3.5	0.95	<0.001
<i>Importance of pork characteristics</i>				
When I buy pork and pig meat products, it is important for me... the food labels.	4.0	4.2	0.99	0.176
the Iberian, acorn and PDO criteria.	4.0	3.9	0.79	0.619
that the pigs have been reared in natural conditions and freely.	4.1	3.9	0.94	0.149
the breed and the type of feed if it is from Iberian products.	3.9	4.1	0.89	0.027
<i>Purchase intentions and willingness to pay</i>				
My purchase choice would be negatively affected if I would know that... pigs are reared in intensive conditions and sows are kept in crates.	3.7	3.5	1.10	0.157
pigs are physically castrated, their tusks are removed or their tail docking is performed.	3.2	2.6	1.27	<0.001
I would pay more for Iberian pork and pig meat products... with an animal welfare, an organic or a GMO-free certificates.	3.9	3.8	0.91	0.238
with a PDO certification.	4.0	4.1	0.95	0.222
from pigs reared in natural conditions, in free-range or	4.2	4.1	0.79	0.154

transported without injury to the slaughterhouse.

I would pay more for higher quality food. 3.8 3.9 1.02 0.245

\* Abbreviations: RMSE: root mean square error.


Table 5: Relative importance and utility values of each attribute for consumers and for each group.

	Knowledge			Region	
	Global	No	Yes	NE*	SW*
<i>n</i>	403	294	109	201	201
Intercept	4.5	4.5	4.5	4.5	4.5
<i>Breed</i>					
White pig	-1.18	-1.16	-1.25	-1.10	-1.27
Iberian pig	1.18	1.16	1.25	1.10	1.27
Relative importance (%)	42.61	44.12	38.89	44.86	40.93
<i>Production System</i>					
Extensive	1.09	1.00	1.19	0.94	1.24
Intensive	-1.09	-1.00	-1.19	-0.94	-1.24
Relative importance (%)	39.34	40.47	37.08	38.49	39.91
<i>Price</i>					
7€/kg	0.50	0.40	0.77	0.41	0.60
12€/kg	-0.50	-0.40	-0.77	-0.41	-0.60
Relative importance (%)	18.05	15.41	24.03	16.65	19.17
RMSE*	1.55	1.62	1.29	1.73	1.32
R <sup>2</sup> *	0.54	0.50	0.68	0.43	0.67

\*Abbreviations: NE: northeast; SW: southwest; RMSE: root mean square error; R<sup>2</sup>: coefficient of determination.

Figure 1.- Pork label presented in the conjoint analysis.

Highlights



**PORK**

easing their demands about animal welfare.

**Breed: White or Iberian pig**  
consumers have no knowledge of Iberian pig production system.


generally positive opinion about the Iberian pig.

**Production system:**  
igs, extensive system and a low price are preferred by consumers.

**extensive or intensive**

**Price: 7 or 12 €/kg**

Code: XXX



7 751234 123456