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1 Understanding consumers' perceptions towards Iberian pig 2 production and animal welfare

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14 Abstract

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

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

28 1 Introduction

29 In the past few years, consumers' awareness of the different ways in which food is
30 produced has increased (Pejman et al., 2019). An increasing preference and demand
31 for organic and high welfare animal-based food products have been reported in
32 different studies (Alonso et al., 2020; Kallas et al., 2013; Vietoris et al., 2016). Because
33 of this, consumers are demanding more information on food labels (Pejman et al.,
34 2019). In particular, Spain is one of the EU countries with higher demand for
35 information about food production aspects according to Eurobarometer (2016). At the
36 time of purchase, consumers receive different types of information that can affect their
37 choice among the great variety of products available. This information is used by
38 consumers to infer the quality of the product because although the quality of some

39 foods, like meat, cannot be directly evaluated before purchase, quality expectations, to
40 some extent, are created by the available internal and external cues (Grunert et al.,
41 2004). The information that consumers may consider most important in the choice of a
42 product depends on personal and situational characteristics and on the product itself
43 (Dimara & Skuras, 2005; Liljenstolpe, 2011; Verlegh & Van Ittersum, 2001).

44 As a general rule, consumers have low knowledge of livestock production systems
45 (Cardoso et al., 2017; Clark et al., 2019). In this sense, differences between consumers
46 from urban and rural areas can be found (McEachern & Seaman, 2005). Rural
47 consumers are more likely to have contact with livestock and have a more positive
48 attitude towards livestock practices (Krystallis et al., 2009) or simply belong to the
49 livestock community, thereby influencing their opinions as consumers (Te Velde et al.,
50 2002). Furthermore, information about the production system is not always available,
51 although some labels (i.e. Protected Designations of Origin (PDO) and organic) are
52 related to specific production systems. In this sense, production systems influence
53 purchasing decisions, with a preference for outdoors (access to outdoor areas for only
54 part of their lives) or extensive (farming husbandry where the pigs can run around
55 outside on pasture/grasslands and roam freely on a large area) livestock systems
56 (Díaz-Caro et al., 2019; Dransfield et al., 2005; Krystallis et al., 2009; Mesías et al.,
57 2005), probably because consumers expect higher quality in this type of product
58 (Scholderer et al., 2004), although this is not always demonstrated (Bonneau & Lebret,
59 2010).

60 The breed or genetics can also influence the quality of meat and meat products
61 (Alonso et al., 2015; Plastow et al., 2005) and its sensory acceptability to consumers
62 (Meinert et al., 2008; Straadt et al., 2013). Breed might also influence the purchase of
63 meat products (Lee et al., 2017). Despite that, information about the breed is not
64 always available. However, in some cases meat products from some PDO like, for
65 instance, Dehesa de Extremadura, Los Pedroches (DOOR, 2019) the breed can be
66 known. In addition, meat from some specific breeds is also labelled. In Spain, for
67 example, meat from certain breeds like Iberian and Duroc is related to higher quality
68 and it is possible to find it labelled. Consequently, breeds can be one of the factors that
69 can affect consumers' purchasing decisions. In fact, previous studies (Díaz-Caro et al.,
70 2019; Mesías et al., 2009) indicate that Spanish consumers have a preference for local
71 breed products.

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

83 Although the intensification of animal production in most farms is increasingly common
84 (Clark et al., 2019), traditional production can still be found in some countries, mainly
85 related to autochthonous breeds (Čandek-Potokar et al., 2019). For instance, Spain is

86 the fourth largest pig producing country worldwide, the 2nd largest in Europe (MAPA,
87 2019). Spain has developed an export-oriented pork industry that is heavily
88 concentrated. The intensive production system is predominant but coexists with a
89 traditional pig farm model system. The major component is the Iberian traditional pig
90 production that differs considerably from the conventional system. This local breed has
91 been traditionally bred in the SW of the Iberian Peninsula (De Miguel et al., 2015),
92 where it is perfectly adapted to the pasture ecosystem (Benito et al., 2006). This local
93 production is managed extensively if natural resources are available, mainly during the
94 finishing period where pigs are exclusively fed acorns and grass (Lopez-Bote, 1998).
95 This breed is characterized by the high-quality of its cured products, with Iberian acorn-
96 fed ham being the largest component (Mesías et al., 2009). Therefore, local Iberian pig
97 production offers an added value in their products that cannot be found in commercial
98 white pig products (Lopez-Bote, 1998).
99 Iberian pig production has achieved great success in recent times. The economic
100 development of the country and the globalization of the markets has led to an increase
101 in the demand for traditional and high-quality Iberian pig products (Estévez et al., 2003;
102 Lopez-Bote, 1998; Ventanas et al., 2005). However, the scarcity of existing hectares of
103 *dehesa* and an orientation towards more economically profitable intensive production
104 systems by Iberian pig farmers limit the number of pigs that are produced exclusively
105 with natural resources (Mesías et al., 2009). Because of that, the increase in Iberian
106 pig production has resulted in the use of crossbreeds between Iberian and Duroc and
107 in the more intensive production, expanding even outside the traditional regional
108 framework of this breed (Nieto et al., 2019) and reaching 10% of the total number of
109 Spanish pigs (MAPA, 2019). This has generated the possibility of finding different
110 categories of Iberian pork products with different qualities and production systems in
111 the market (Tejerina et al., 2012).

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

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

130 **2 Material and Methods**

131 *2.1 Data collection*

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

149 *2.2 Questionnaire design*

150 The design of the questionnaire was based on the existing literature on consumer
151 preferences and perceptions (Feldmann & Hamm, 2015; Lagerkvist et al., 2006; Stolz,
152 et al., 2011; Wägeli et al., 2016; Zagata, 2012) and the questions were adapted to the
153 context of Iberian pig production. Even though the Iberian pork is less present in
154 supermarkets in the NE region than in the SW region, it is possible to find it. Although
155 this difference, additional information was not previously given to the consumers before
156 answering the questionnaire. This allows us to evaluate the opinion of the consumers
157 in a real situation without the effect of the information on their response (Tomasevic et
158 al., 2020), because it has been proved that information can influence consumer's
159 answer (Tuytens et al., 2011). The questionnaire was structured in three parts. The
160 first part assessed the consumers' knowledge about Iberian pig production using three
161 questions about the management criteria for Iberian pigs and three more about the
162 categories of Iberian pig products. These questions have a true or false answer and
163 can be used to classify consumers according to their real knowledge on this subject.
164 Secondly, the questionnaire covers 10 items related to beliefs, 8 items about the
165 importance of pork characteristics when purchasing products and 13 items about
166 purchase intentions and WTP (see Appendix 1). These questions were answered on a
167 5-point scale ranging from 1: 'I strongly disagree' to 5: 'I strongly agree'. Finally, the
168 socio-demographic characteristics of consumers (gender, age, education level, and
169 employment situation) were recorded.

170 *2.3 Conjoint analysis*

171 Conjoint analysis was conducted to determine the relative importance of three
172 attributes in the purchase of pork in Spain: breed, production system and price of pork.
173 These attributes were selected because they refer to very relevant aspects in Iberian
174 pig production and pork consumption and it was aimed to see its contribution to the
175 consumers' purchasing decisions. Breed had two levels, white pig and Iberian pig.

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

189 *2.4 Data analysis*

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

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

199 For each of the questions, the Generalized Linear Model (GLM) procedure was
200 applied. The model included as fixed effects region, age group, gender, education level
201 and employment situation. Differences between least-square means were obtained at
202 $P < 0.05$ level by means of Tukey test. A non-parametric Kruskal-Wallis test was
203 performed previously with the NPAR1WAY procedure, but since there were no relevant
204 differences between both statistical analyses, the parametric analysis of variance was
205 considered (O'Mahony, 1986) since it allows us to have more information.

206 Following, consumers were divided into two groups according to their knowledge about
207 Iberian production and products, which was evaluated in six questions. Three
208 questions about the term "Iberian pig", to determine if it defines this type of pig as a
209 pure breed, raised in free-range and fed acorn. According to Spanish national
210 legislation (Real Decreto 4/2014) the three answers were false. And three questions
211 about how the different types of Iberian products are defined by their management:
212 "bellota" as fed by acorn in the fattening period, "cebo de campo" as fed by compound
213 feed in free-range and "cebo" as fed by compound feed in intensive conditions.
214 According to the Spanish national legislation (Real Decreto 4/2014) all of them are true.
215 Consumers were considered to have knowledge (connoisseurs) about Iberian
216 production if they answered two or three questions about Iberian criteria correctly and
217 two or three questions about Iberian pig management also correctly. Else, they were
218 considered non-connoisseurs about Iberian characteristics. An analysis of variance
219 was performed for beliefs, importance of pork characteristics at purchase and WTP

220 questions considering the classification of consumers by knowledge about Iberian as a
221 fixed effect.

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

231 **3 Results and Discussion**

232 *3.1 Consumers' characteristics*

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

245 Consumers' characteristics based on Iberian pig knowledge (Table 1) show that the
246 percentage of people surveyed who know the characteristics of Iberian pig production
247 was very low (27.05%). Clark et al. (2019) also show that, in general, consumers have
248 a low level of knowledge about animal production systems. In particular, knowledge
249 about Iberian pig production was higher in the SW than the NE region (41.1% vs.
250 12.9%, respectively). This is probably due to the fact that Iberian pig production is
251 rooted in the SW of Spain. Most of the consumers that stated that they have knowledge
252 about Iberian pig production were men (67.0%). In addition, the knowledge of Iberian
253 pig production increases with the education level. The age group and employment
254 situation were not remarkable in this aspect since they did not make a difference.

255 *3.2 Beliefs about Iberian production and pork products*

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

259 The majority of consumers that responded to this survey answered that the animal
260 welfare and protection requirements for Spanish farms should increase (average score
261 of 4.1). This finding is in line with the answers obtained from Spanish citizens in the last

262 Eurobarometer (2016). In particular, this demand was significantly emphasized
263 ($P<0.05$) by women and NE consumers. Several works have shown that women are
264 more concerned about animal welfare than men (Kendall et al., 2006; Pejman et al.,
265 2019; Vanhonacker et al., 2007). Some previous works show that the importance of
266 animal welfare decreases with age (Clark et al., 2017; Cornish et al., 2016), but this
267 was not observed in the present work.

268 The opinions on the degree of animal welfare for Iberian pigs were generally positive. It
269 supported a better view of the Iberian pig than the commercial white pig. In fact, the
270 score of the consumers regarding the statement “Iberian pigs are reared in better
271 welfare standards than commercial pigs” is 3.78, which is in between ‘neither agree nor
272 disagree’ and ‘agree’. Consumer preferences are influenced by marketing aspects
273 (Font-i-Furnols & Guerrero, 2014) and citizens relate Iberian pigs with an extensive
274 system that is environmentally friendly and fed natural resources, although the highest
275 percentage of Iberian pigs are currently reared in the intensive system (RIBER, 2019).
276 Therefore, consumers had better opinions of the animal welfare of Iberian pigs,
277 probably because of their beliefs and attitudes toward production systems (Busch et
278 al., 2019). In this case, citizens associate Iberian pigs with an extensive system and
279 commercial white pigs with an intensive system and some works show that consumers
280 consider that outdoor systems provide higher welfare standards (Sinclair et al., 2019;
281 Sørensen & Schrader, 2019). The opinions about the status of the welfare of Iberian
282 pigs depend on the age of the consumers. In this sense, participants under the age of
283 40 considered the level of animal welfare for Iberian pigs to be lower than those
284 respondents over 40. This can be affected by the fact that, in general, animal welfare is
285 more important for young consumers than older ones (Clark et al., 2016; Cornish et al.,
286 2016).

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

297 Generally, Iberian pork and pork products are more expensive than those from white
298 pigs. Regarding the belief that Iberian pork and pork products are too expensive,
299 scores were close to ‘agree’. This score was significantly higher in women than men
300 (4.0 vs. 3.7), which is probably related to the fact that women are still primarily
301 responsible for food shopping.

302 The effect of the degree of consumer knowledge about Iberian pig production on the
303 beliefs toward animal welfare and Iberian production and quality aspects are presented
304 in Table 4. Non-connoisseur consumers of Iberian pig production aspects scored the
305 statement that current animal protection and welfare requirements for Spanish farms
306 should be increased greater ($P<0.05$) compared to connoisseurs (Table 4). These
307 results are in line with the consumer concerns about animal welfare, which is related to
308 the level of information or knowledge (Pejman et al., 2019). Although consumers do not

309 have information on livestock production systems, they have a negative opinion of
310 intensive production systems (Clark et al., 2019). No significant differences ($P>0.05$)
311 between the levels of knowledge of consumers were found regarding whether Iberian
312 pigs have better animal welfare than commercial breeds. As previously mentioned, the
313 non-connoisseurs associate Iberian pigs with extensive systems while the
314 connoisseurs know the different Iberian pig production systems (extensive and
315 intensive systems). Independently of the level of knowledge of the consumer, all of
316 them believe that Iberian pork products are high quality, very tasty and healthy and that
317 these characteristics are higher with Iberian pigs than commercial white pigs. This
318 result confirms the fact that Iberian pork and products are well known as high-quality
319 products (Lopez-Bote, 1998). Iberian pig connoisseurs did not believe that Iberian
320 products were too expensive like non-connoisseurs. It can be hypothesized that the
321 knowledge of the production systems makes the consumers more conscious of the
322 work needed to produce the animals and the products and this probably influences
323 their perception of the price of the product. In fact, Liljenstolpe (2011) found that price
324 sensitivity is related to the concerns of consumers regarding some aspects such as
325 food safety issues, animal welfare issues, or intermediate issues.

326

327 *3.3 Importance of pig production and commercialization aspects*

328 Regarding the importance of pig production and the commercialization aspects of pork
329 and pork products (Table 3), it is possible to see that food labelling and the fact that
330 pigs are reared free and in natural conditions received the highest scores on average
331 (4.06 each). Janssen et al. (2016) in a meta-analysis study reported that to meet
332 consumer preferences it would be advisable to label about the husbandry system,
333 allowing a differentiation for animal-welfare systems. The statements relative to Iberian
334 pigs regarding the Iberian, acorn-fed, PDO, breed and type of feed criteria followed
335 them with an average score of 3.96 each. Thus, all these aspects of pork production
336 and commercialization are therefore important for consumers.

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

344 The living region only significantly influenced ($P<0.05$) the importance of labelling. SW
345 consumers had a greater score for the importance of labelling when buying pork and
346 pig meat products than NE consumers (4.3 vs. 3.9). The information on a label is an
347 important factor that affects consumers' purchasing decisions (Bandara et al., 2016;
348 Cornish et al., 2020; Sørensen & Schrader, 2019), being more remarkable in Iberian
349 products due to the great variety offered. The higher importance of the labelling among
350 SW consumers could be explained by the fact that in this region, it is easier to find
351 Iberian products and the level of knowledge about Iberian products is higher.
352 Consequently, food labels are important to identify the characteristics of pork products,
353 mainly Iberian products. In general, consumers are proud of products from their own
354 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 than 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

401 meat from certified farms with higher animal welfare standards and for higher quality
402 food, the scores were slightly lower (3.9 and 3.8, respectively). Certification is an
403 important factor that affects consumer WTP, as demonstrated in Mesías et al. (2005)
404 and Likoudis et al. (2016).

405 Most of the significant differences in purchase intentions and WTP were related to the
406 gender of the consumer (Table 3). As previously reported, women were more sensitive
407 to issues related to animal welfare (Clark et al., 2017; Font-i-Furnols et al., 2019;
408 Pejman et al., 2019). Their purchase choice would be most negatively affected if the
409 pork and pig meat products came from pigs that were physically castrated or their tails
410 and tusks were cut. Nevertheless, as commented above, this aspect seems to be not
411 as important compared with other factors. In addition, women would pay more for
412 Iberian meat products from free-range animals that were reared in natural conditions or
413 transported without injury to the slaughterhouse than men, indicating again the highest
414 importance placed on animal welfare issues, which is also expressed by women paying
415 more for higher quality food than men. Beardsworth et al. (2002) also found that
416 women more frequently choose foods produced with higher animal welfare than men.
417

418 Though some works found that the region may influence purchase intentions and WTP
419 (Clark et al., 2017), no differences were found for WTP related to the region of the
420 consumers in the present study. Only a tendency ($P < 0.10$) can be seen that NE
421 consumers' purchase choices were more negatively influenced by physical
422 management (physical castration, tusks removal, or tails cut) than SW consumers. The
423 primary sector is more important in the SW region than in the NW region (INE, 2019)
424 because it is a rural area. Therefore, SW consumers have more contact with Iberian
425 farmers than NE consumers (urban area), thus generating more positive attitudes
426 towards them (Krystallis et al., 2009). In the same line, SW consumers showed a
427 greater WTP for PDO certified products ($P = 0.08$). The Iberian pig PDO (Dehesa de
428 Extremadura, Los Pedroches, Jabugo and Guijuelo) is found in SW Spain (MAPA,
429 2019). Consequently, PDO certified Iberian pig products are local products in the SW
430 region. Therefore, SW consumers showed a higher WTP for these local products
431 (Likoudis et al., 2016), considering their local origin and added value (Wägeli & Hamm,
432 2015). In other studies, SW consumers' preference for local products has been
433 observed for Iberian products (Díaz-Caro et al., 2019; Mesías et al., 2013).
434

435 No differences were found related to the effect of consumer age on purchasing
436 intentions and WTP. However, in other works, it was observed that purchase choices
437 were more negatively influenced by physical management (tusks removal or tails
438 docking) or intensive systems for young consumers (Cornish et al., 2020). In addition,
439 young consumers would pay more for Iberian meat products with animal welfare or
440 organic certification (Font-i-Furnols et al., 2019).
441

442 Finally, the choice to purchase pig meat products from physically castrated animals
443 and animals subject to other management practices (tusk removal and tails docking)
444 would be more negatively affected for the non-connoisseurs of Iberian products than
445 for consumers with knowledge about their production (Table 4). The perception of
446 animal welfare may be influenced by the level of knowledge (Pejman et al., 2019). A
447 lack of knowledge about a management practice can produce a more negative reaction
448 of consumers towards this practice. Thus, non-connoisseurs of practices like

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

464

465 3.5 Conjoint analysis

466 The relative importance and utility values of the three factors studied (breed, production
467 system and price) are shown in Table 5. Overall, consumers considered pig breed the
468 most important attribute (42.61%) with a marked preference for Iberian pigs. The
469 preference for Iberian pigs is in accordance with other studies (Díaz-Caro et al., 2019;
470 Mesías et al., 2009) where this breed obtained the highest importance among other
471 factors. These results are in line with the results obtained in the surveys carried out in
472 this study where consumers have a better opinion about different aspects (level of
473 animal welfare, product quality, etc.) of Iberian pigs compared to white pigs that
474 influence purchase choices. The second most important attribute was the production
475 system (39.34%). In this case, consumers showed a preference for extensive systems
476 over intensive systems. We emphasize that similar values were obtained for the breed
477 and production system attributes. The likely image of consumers regarding Iberian pigs
478 is an extensive production (*dehesa*) because this has been used commercially for
479 marketing purposes. Nevertheless, only 35% (RIBER, 2019) of Iberian pigs are
480 extensively fattened (including *cebo de campo* and *montanera*) and only 17% of them
481 are in *montanera* (extensive and acorn feeding in *dehesa*). Consumers probably have
482 a lack of knowledge of the reality of the Iberian productive system and this would
483 indicate that the consumers of Iberian meat products have a distorted image of reality.
484 A meta-analysis (Janssen et al., 2016) showed the preference for outdoor production
485 systems because it influences animal welfare, together with other aspects such as
486 stocking density and floor type. Also, Clark et al., (2019) reported that intensive pig
487 production systems have a high perceived risk of increase in animal stress. The
488 preference for extensive systems has been observed in studies on pig production
489 (Díaz-Caro et al., 2019; Dransfield et al., 2005) and also on other livestock species
490 (Font-i-Furnols et al., 2011; Realini et al., 2013). This preference for extensive systems
491 is in accordance with the previous questions, where the intention to pay more for
492 products produced in natural conditions or pay less for products produced in intensive
493 systems was observed. The price of meat was the least important attribute for
494 consumers (18.05%) with the lowest price more preferred than the highest price, which
495 is in agreement with other works (Font-i-Furnols et al., 2011; Mesías et al., 2009, 2013;

496 Realini et al., 2013). However, some works show clusters of consumers that prefer an
497 intermediate or high price compared to the lowest one (Font-i-Furnols et al., 2011;
498 Sasaki & Mitsumoto, 2004). Although consumers consider Iberian products to be too
499 expensive in the results obtained in this study, it can be seen that the breed is the most
500 important factor when choosing a pork product and its production system is the second
501 most important factor.

502 When consumers were segmented by their knowledge of Iberian pig production, both
503 groups showed preferences for Iberian pig meat reared in an extensive system with a
504 low price (Table 5). In particular, connoisseurs gave more importance to price than
505 non-connoisseurs (24% vs. 15%), less importance to the breed (39% vs. 44%) and
506 slightly less importance to the production system (37% vs. 40%). This is probably due
507 to the fact that the number of connoisseurs is higher in the SW region and in this region
508 the income is lower than in the NE region. Nevertheless, when the WTP for extensively
509 produced meat or high-quality meat was evaluated, no significant differences were
510 found between connoisseurs and non-connoisseurs. Furthermore, this group of
511 connoisseurs is characterized by having more consumers from the SW region. In this
512 region of Spain, the living costs and the incomes are lower than in the NE region (INE,
513 2019) and this might influence the importance of the price for these consumers.
514 However, a study from Lara (2012) show that amount of Iberian products consumed
515 per capita is higher in SW than the NE region, probably because prices are lower. Also,
516 men are the majority of the connoisseur group, indicating that they probably are more
517 interested in low prices, in accordance with the results obtained before where men
518 would be willing to pay significantly less than women for free-range and higher quality
519 meat. Men also were those that considered the price to be the most important factor in
520 a study carried out in the United Kingdom and Spain on lamb (Font-i-Furnols et al.,
521 2011).

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

527 *3.6. Limitations of the study*

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

530 The first one is a bias in the sample of consumers that participated in the trial,
531 especially in the SW region. In this region, the final sample had an over-representation
532 of young consumers and an under-representation of old consumers. This might have
533 influenced the responses since age has been significant in some of the questions.
534 There are also other biases in the population, as the high number of consumers with
535 high educational level, the high number of public employees and the low percentage of
536 unemployed consumers. These biases are probably due to the fact that the study was
537 carried out at universities.

538 Another shortcoming is related to aspects of the questionnaire. In this sense, the
539 questions were provided with the same order to all the consumers and grouped by type

540 of question. This was performed in that way because it allowed to simplify the reading
541 of the questions by the consumers and, consequently, reduce the fatigue in answering
542 the questions. This aspect was important because this work was part of a wider study
543 and consumers participated in other activities.

544 **4 Conclusions**

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

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

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854

855 Table 1: Consumers' characteristics by area and knowledge about Iberian production (%)*.

	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	43.07	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

856 * Abbreviations: NE: Northeast, SW: Southwest

857 * Spanish distribution (INE, 2016): Age group (<25: 9.38%; 25-40: 27.52%; 40-60: 42.38%; >60: 20.72%); Gender (Male:

858 49.07%; Female: 50.93%); Educational level (Basic studies: 41.65%; University: 35.75%; Vocational education: 22.60%)

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

<i>Beliefs</i>	PCA*	PC 1	PC2
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 pigs ...			
are reared to achieve higher standards of welfare.		0.53	0.34
are reared for better welfare than commercial white pigs.		0.63	-0.30
I think that Iberian pork and meat products ...			
are of a high quality.	a	0.68	0.46
are very tasty.	a	0.71	0.38
are healthy.	a	0.64	0.04
have higher quality than those from commercial white pigs.	b	0.75	-0.37
are tastier than those from commercial white pigs.	b	0.73	-0.29
are healthier than those from commercial white pigs.	b	0.62	-0.59
are too expensive.		0.43	0.38
<i>Importance of pork characteristics</i>			
When I buy pork and pig meat products,....			
food labels are important for me.		0.64	0.39
acorn-fed category is important for me.	c	0.72	0.43
the Iberian origin criteria is important for me.	c	0.69	0.39
the PDO certification is important for me.	c	0.66	0.21
it is important for me that pigs are reared free.	d	0.74	-0.48
it is important for me that pigs are reared in natural conditions.	d	0.78	-0.48
the breed is important for me (if they are Iberian pigs).	e	0.62	-0.11
the type of feed is important for me (if they are Iberian pigs).	e	0.78	-0.20
<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.	f	0.64	-0.31
sows are kept in crates.	f	0.65	-0.48
pig tusks are removed.	g	0.63	-0.61
pig tail docking is still practiced.	g	0.68	-0.57
pigs are physically castrated.	g	0.65	-0.52
I would pay more for Iberian pork and pig meat products...			
with an animal welfare certificate.	h	0.65	0.32
with an organic certificate.	h	0.68	0.26
with a GMO-free certificate.	h	0.59	0.30
with a PDO certification.		0.43	0.54
from free-range pigs.	i	0.70	0.40
from pigs reared in natural conditions.	i	0.71	0.43
from pigs transported without injury to the slaughterhouse.	i	0.68	0.28
I would pay more for higher quality food.		0.28	0.18

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

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

	Mean global	Region		Age group				Gender		RMSE*	P-value		
		NE*	SW*	< 25	25-40	40-60	> 60	M*	F*		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	0.008	0.683	0.005
I think that Iberian pigs are reared...													
in high welfare standards.	3.67	3.5	3.7	3.1 ^b	3.4 ^b	3.7 ^a	4.1 ^a	3.6	3.6	0.90	0.306	<0.001	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 ^b	3.9 ^b	4.1 ^b	4.5 ^a	4.1	4.1	0.70	0.191	0.002	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	0.010
<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	3.5 ^b	4.1 ^{ab}	4.2 ^a	4.5 ^a	4.1	4.1	0.98	0.003	0.013	0.878
the Iberian breed, fed-acorn and PDO criteria.	3.96	3.9	4.1	3.7 ^b	3.9 ^b	4.1 ^{ab}	4.4 ^a	4.0	4.0	0.77	0.159	0.007	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 ^b	3.8 ^b	4.2 ^{ab}	4.5 ^a	4.1	4.0	0.87	0.087	0.001	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	<0.001
I would pay more for Iberian pork and pig meat products...													
with an animal welfare, an organic or a GMO free certificates.	3.85	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.	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
from pigs reared in natural conditions, in free-range or transported without injury to the slaughterhouse.	4.17	4.2	4.3	4.2	4.2	4.3	4.4	4.2	4.4	0.78	0.390	0.818	0.011
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

* 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.

867 Table 4: Consumers' beliefs, importance of pork characteristics when purchasing and willingness
 868 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 transported without injury to the slaughterhouse.	4.2	4.1	0.79	0.154
I would pay more for higher quality food.	3.8	3.9	1.02	0.245

869 * Abbreviations: RMSE: root mean square error.

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

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	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	1.06	1.19	0.94	1.24
Intensive	-1.09	-1.06	-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
<i>R</i> ² *	0.54	0.50	0.68	0.43	0.67

883 *Abbreviations: NE: northeast; SW: southwest; RMSE: root mean square error; *R*²: coefficient of determination.

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PORK

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889



Breed: White or Iberian pig

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**Production system:
extensive or intensive**

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Price: 7 or 12 €/kg

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894

Code: XXX



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Conservation between 0°C and 5°C

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

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