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Authors contribution according to CRediT (Contributor Roles Taxonomy).

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The more you know: the equivocal effects of prior knowledge on preferences for hunted vs. farmed wild boar meat

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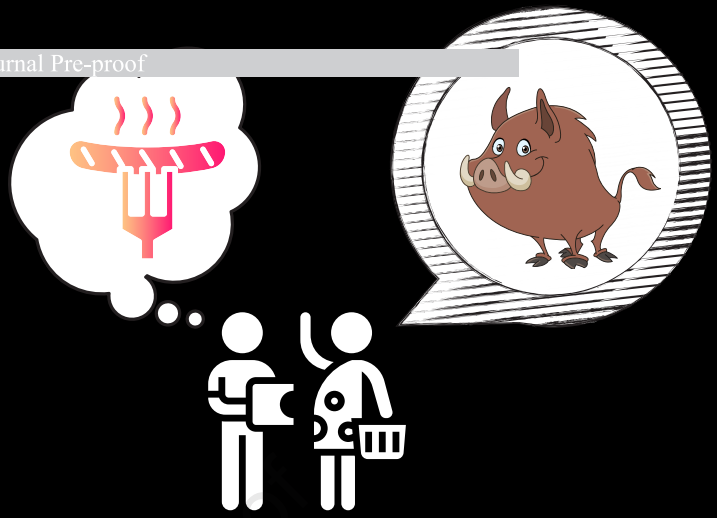
Authors declare they have no competing financial, professional or personal interests that might have influenced the performance or presentation of the work described in this manuscript.

PRODUCTION METHOD KNOWLEDGE



Much of the so-called ‘wild’ or ‘game’ meat bought these days is actually farmed (not hunted), and current legislation does not require marketers to reveal the production method. What would consumers make of this distinction if they knew?

OBJECTIVE KNOWLEDGE

SUBJECTIVE KNOWLEDGE

GAME MEAT CHOICE

FARMED MEAT

HUNTED MEAT

The more you know: the equivocal effects of prior knowledge on preferences for hunted vs. farmed wild boar meat

Abstract:

Much of the so-called 'wild' or 'game' meat bought these days is actually farmed (not hunted), and current legislation does not require marketers to reveal the production method. What would consumers make of this distinction if they knew? We explore the roles of objective and subjective prior knowledge in determining consumer preferences for wild boar (*Sus scrofa*) sausage produced using meat from hunting, farming or an unspecified production method. A discrete choice experiment that includes two tests and corresponding self-evaluations reveals that farmed meat is the most preferred type, closely followed by hunted meat, while meat from an unspecified production method is clearly the least preferred. Objective knowledge about hunting is positively related to preferences for hunted meat, while the opposite is true for the effect of prior knowledge about farming on preferences for farmed meat. Finally, subjective knowledge is not a reliable predictor of preferences for either hunted or farmed meat.

Keywords:

Hunted wild game meat; Farmed wild game meat; Objective knowledge; Subjective knowledge; Choice experiments; Food choice behaviours

1. Introduction

How does prior knowledge influence food choices? According to the current literature, the relationship between consumers' knowledge and consumers' purchase behaviours is direct, even though the direction of the effect is not clear (Brucks, 1985; Flynn & Goldsmith, 1999; Pieniak et al., 2010a; Aertsens et al., 2011). Thus, 'the more you know' about a certain product, the more you (dis)like it. In regard to food, and in particular meat products, the link between prior knowledge and purchase behaviour is not at all straightforward, since consumption of meat products is also related to knowledge about environmental and/or ethical issues. Furthermore, these interrelations involve relevant individual characteristics such as moral values (De Backer & Hudders, 2015; Hartmann & Siegrist, 2020) and sometimes prejudices, beliefs and/or cognitive biases (Magnusson et al., 2001; Lea & Worsley, 2002; Spence, 2010; Anonymous, 2013; Lee et al., 2013; Anderson & Barret, 2016; Demartini et al., 2018a; Richetin et al., 2019), thus making understanding the mechanisms behind individuals' choices a key challenge for policy-makers and marketers.

An important element in disentangling the links between consumers' prior knowledge and purchase behaviour of meat and other food products is the distinction between objective and subjective knowledge (Cordell, 1997). Objective knowledge refers to how much an individual knows about a topic (measured via specifically designed tests), while subjective knowledge is the individual's perception of how much s/he knows about a product (measured via self-assessment; see Brucks, 1985; Cordell, 1997). Distinguishing between these two components is imperative, as they tend to be unrelated. Indeed, people with limited objective knowledge appear to overestimate their knowledge, while most expert subjects underestimate their competencies (Kruger & Dunning, 1999). Even the relative importance of the two knowledge types is not clear. Thus, some scholars find that subjective knowledge plays a fundamental role in how well consumers understand information about the characteristics of foods, which consequently drives their final choices (Radecki & Jaccard, 1995; House et al, 2004; Lusk et al., 2004; Pieniak et al., 2010a). Others, however, have demonstrated that objective knowledge might dominate subjective knowledge in shaping consumers' purchase of food (Mesías Díaz et al., 2012; Zhang & Liu 2015).

Nowhere would this be more problematic than in the context of wild game meat consumption, as this type of meat can be produced in two ways, hunting or farming, and each of these activities comes with their own preconceptions. For instance, in developed countries, studies on both hunting (Demartini et al., 2019) and farming (Hartmann & Siegrist, 2020) confirmed that both activities raise some ethical, health and environmental concerns among consumers. Unhelpfully, consumers tend to show little knowledge about either hunted (Marescotti et al., 2019) or farmed animals (de Andrade et al., 2016), and a recent study even found that consumers are wilfully ignorant about these topics (Bell et al., 2017).

To shed additional light on this conundrum, we specifically chose an application context that resembles a field experiment by keeping the species constant and thus comparing hunted wild game meat and farmed wild game meat from the same species. To keep the product categories as constant as possible, we focused on comparisons of a common product of porcine origin in the studied cultural context, i.e., sausages from either farmed or hunted wild boar (*Sus scrofa*) in Italy. This case study seems particularly well-suited to Italy

because, even if wild boar meat is consumed much less frequently than conventional meats and cold cuts, it is a product traditionally consumed in Italy (Giacomelli & Gibbert, 2018) and is often used as a substitute for farmed pork meat (e.g., in sausages or hams) (Ramanzin et al., 2010; Gaviglio et al., 2018; Marescotti et al., 2021). On the other hand, it is worth emphasizing that wild species must always be carefully chosen in studies focused on consumers' perceptions of wild game meat. In fact, the term 'wild game meat' possesses different meanings depending on the cultural environment and hunting traditions or farming methods of each country. For instance, wild species that are considered edible for Americans (Burger, 2000; Burger & Gochfeld, 2002) might not be considered edible (or even huntable) in other contexts (Bodnar et al., 2014; Demartini et al., 2018b; Tomasevic et al., 2018).

Nonetheless, large wild ungulates (e.g., red deer, roe deer, chamois and wild boar) have recently been discussed as a sustainable substitute for farmed meat (Hoffman & Bigalke, 1999; Hoffman & Wiklund, 2006). First, properly hunted wild ungulate meat presents good sensory and safety characteristics[1] (Wiklund et al., 2003; Valencak et al., 2015; Viganò et al., 2019) and possesses nutritional properties that are even better than those of intensively farmed meats (Bureš et al., 2015; Viganò et al., 2019). Second, as emphasized by Demartini et al. (2018b), hunted game meat should be considered more ethically justifiable than farmed meat because wild ungulates have roamed free until the moment of harvest; in fact, a recent study by Hartmann and Siegrist (2020) proved that German consumers strongly prefer hunting to intensive farming. Third, properly managed hunting activities can respond to ecological issues related to wild animal overpopulation at no cost to local communities (Giacomelli et al., 2018) and provide meat with an ecological footprint four times smaller than that of beef (Fiala, 2020). Finally, hunted meat seems socially and economically viable because it is typically sold locally and thus represents an interesting supplementary source of income in mountain areas, as discussed in Gaviglio et al. (2017 and 2018, who focus on the case study of the short supply chain for hunted game meat in Val d'Ossola North Piedmont, Italy).

On the other hand, some contributions discussing the negative characteristics of wild game meat can be found in the literature. For instance, in a sample of respondents representative of the Northern Italian resident population, Demartini et al. (2018b) found that consumers show highly positive attitudes towards the product but have a negative perception of hunters. Furthermore, it must be emphasized that some consumers are averse to the consumption of hunted game meat, especially consumers with limited prior knowledge or intrinsic dispositions against hunting and high levels of concern about animal welfare and wildlife conservation issues (Marescotti et al., 2019; Marescotti et al., 2020). Similar attitudes held towards farmed

[1] Although game meat can evoke an unpleasant "wild taste and flavour" for some consumers, there is no scientific evidence that this is due to the characteristics of the wild animals per se. As discussed in Ramanzin et al. (2010), in fact, bad hunting practices are the most likely explanation for the occurrence of undesirable sensorial defects in wild ungulate meat. Among the most relevant problems, the authors emphasize that if the animals are culled during the rutting season, some reproductive hormones and behaviours might result in an unpleasant taste in the meat, especially in male subjects (Ramanzin et al., 2010). Other studies have shown that wild animals are sensitive to pre-mortem stress, which causes higher pH than expected and can even lead to dark, firm and dry (DFD) meat (Wiklund et al., 1996; Viganò et al., 2019).

meat. Some are enthusiastically carnivorous, oblivious to production methods (Monteiro et al., 2017; and sometimes even wilfully so: see Bell et al., 2017), while others are much more attentive to the way the animals have been raised, distinguishing, for instance, between conventional, organic or intensive farming (Zanoli et al., 2013; García-Torres et al., 2016; Risius & Hamm, 2017).

Overall, then, while some researchers have analysed the links between knowledge and food choices, very few of them have systematically considered subjective and objective knowledge, and to the best of our knowledge, no study has been undertaken in the context of carefully controlled consumption of two differently produced wild boar products in a hypothetical (though, for the cultural context, eminently plausible) purchase scenario, as we do here. Thus, our study aims to estimate (1) consumer preferences for hunting and farming as different types of wild boar meat production and (2) the effect of (a) objective and (b) subjective knowledge about hunting and farming on consumers' preferences for meat derived from hunting and farming, respectively.

The results from the present paper can be useful for public and private stakeholders in at least two ways. First, we propose the first assessment of consumers' preferences for game meat from hunting activity (hunted wild animals) versus farming (farmed wild animals). Second, we study the value of a hypothetical labelling system for wild game meat in Italy (and, potentially, Europe). Overall, the study clearly contributes to the existing literature on the role of knowledge and its different components in consumers' preferences for food.

The remainder of the text is organized as follows. In Section 2, we present a review of the literature on the role of objective and subjective knowledge on consumers' food choices. Section 3 describes the material and methods used in the survey, including the data collection and questionnaire structure (Section 3.1), the choice experiment (Section 3.2) and the econometric approach used to estimate consumers' preferences (Section 3.3). The empirical results are provided in Section 4, while Section 5 summarizes the research and discusses important implications.

2. The impact of objective and subjective knowledge on consumers' food choices

A large body of published papers has focused on how different characteristics of food imply cognitive responses with important downstream implications for the perception and choice of food (Linder et al., 2010). Particularly relevant for our purposes here is the role of prior knowledge on purchase behaviour related to meat and the distinction between objective and subjective knowledge (Cordell, 1997). Despite the large body of literature concerning issues related to the components and measurement of knowledge, the links between prior knowledge, food consumption and, in particular, consumption of (hunted) meat are still unclear. Table 1 summarizes previous studies that analyse the impact of consumer knowledge on food consumption by food product, method, country, the dependent variable investigated, the key findings, the components of knowledge investigated and their measurement.

With reference to the types of consumer knowledge investigated, the studies can be grouped into the following three categories: i) studies that have measured only consumers' objective knowledge; ii) studies

that have measured only consumers' subjective knowledge; and iii) studies that have considered both components. Collectively, the results from these studies suggest that the impact of knowledge on consumer behaviour differs based on the food product and between countries and regions; subjective and objective knowledge are often used interchangeably as equivalent measures, which results in contradictory findings about the impact of objective and subjective knowledge on food consumption. To illustrate, Hoban (1998), Gaskell et al. (1999), Mesías Díaz et al. (2012), Van Loo et al. (2013) and Wu et al. (2019) measured objective knowledge. Hoban (1998) and Gaskell et al. (1999), focusing on genetically modified foods, found that higher levels of knowledge did not explain more positive attitudes towards these products. In contrast, with regard to organic food products, Mesías Díaz et al. (2012) investigated levels of knowledge about and the consumption of organic tomatoes and their influence on consumers' willingness to pay (WTP) using a contingent valuation survey in a Spanish context. The results from this study reveal the existence of a relationship between consumers' levels of knowledge about and consumption of organic foods and their willingness to pay a premium for these products. In line with this, Van Loo et al. (2013), following a structural equation modelling (SEM) approach, found that there is a positive association between knowledge about, attitudes towards and the consumption of organic yogurt. However, objective knowledge has a relatively weak relationship with attitudes towards the product. In addition, the authors found that the association between objective knowledge and the consumption of organic produce is fully mediated by attitudes. In China, Wu et al. (2019), applying a binary logit regression, found that consumer knowledge affects purchasing behaviour for organic rice depending on the consumers' region of origin. This suggests that the effect of knowledge on preferences might be mediated by country-specific characteristics, including Chinese consumers' region of origin.

Only a few studies have investigated the effects of subjective knowledge on consumers' preferences (Boccaletti & Moro, 2000; Li et al., 2003; Lusk et al., 2004). For instance, Boccaletti and Moro (2000), using the contingent valuation method, found that higher levels of subjective knowledge increase willingness to accept and willingness to pay for genetically modified foods. Similarly, Li et al. (2003) found that Chinese consumers' subjective knowledge is significantly related to their acceptance of GMO soybean oil. Lusk et al. (2004), using an incentive-compatible auction mechanism, found that subjective knowledge significantly affects respondents' bid levels. As pointed out by House et al. (2004), the results from Lusk et al. (2004) suggest that 'participants with higher initial levels of subjective knowledge were likely to change their bids less as a result of the new information they were provided with, implying they relied more heavily on their subjective knowledge'.

Finally, other studies have investigated the impact of consumer knowledge on their food choice behaviour by considering both subjective and objective knowledge. Most of these studies have reported that subjective knowledge is a stronger motivator of behaviour than objective knowledge. For example, House et al. (2004) investigated the impact of subjective and objective knowledge on the acceptance of genetically modified foods. The results showed that while consumers' subjective knowledge is positively associated with their willingness to accept GMO foods, objective knowledge is not significantly related to their acceptance of

such foods. Furthermore, Pieniak et al. (2010a), using SEM, studied the association between consumers' subjective knowledge of, objective knowledge of, attitudes towards and behaviours towards the consumption of organic vegetables. The results indicated that subjective knowledge is an important factor in explaining choice behaviour, since it appears to be significantly and directly associated with consumption. Objective knowledge, on the other hand, is only indirectly associated with consumption through increased subjective knowledge and more positive general attitudes. Moreover, in line with previous studies on subjective and objective knowledge (Brucks, 1985; Radecki & Jaccard, 1995; Carlson et al., 2009), Pieniak et al. (2010a) confirmed that the correspondence between these two types of knowledge is very low. That is, what people think they know does not strongly align with what they objectively know. Similar findings have been reported by Dodd et al. (2005), Pieniak et al. (2010b), Choi and Kim (2011), Aertsens et al. (2011), Gambaro et al. (2013), Altintzoglou and Heide (2016) and Piha et al. (2018). In direct contrast, Zhang and Liu (2015), reported that Chinese consumers' objective knowledge rather than subjective knowledge plays an important role in the formation of consumer attitudes. Of the studies mentioned above, none of them have considered meat as the product of interest, a significant theoretical gap we venture to address here. Moreover, despite the heterogeneity in the methodologies adopted, a significant methodological gap is that the discrete choice experiment (DCE) approach has not yet been used in the consumer food choice literature when analysing the impact of objective and subjective knowledge.

177 **Table 1. Summary of previous studies analysing the impact of knowledge on the consumption of food**

Author	Year	Journal	Product	Method	Country	Dependent Variable(s)	Key findings: relation between type of knowledge and the dependent variable(s)	Subjective knowledge		Objective knowledge	
								Included (Y/N)	Measurement	Included (Y/N)	Measurement
Hoban	1998	AgBioForum 1(1)	GM foods	Analythical review and analysis of previous studies	Europe (15 states), USA, Japan	Attitudes and acceptance	Higher levels of objective knowledge about biotechnology applied in agricultural sector did not explain more positive attitudes. Providing factual information increases consumer acceptance depending on country.	N		Y	NA
Gaskell et al.	1999	Science 285(5426): 384-387	GM foods	Cross tabulation	Europe (17 states) vs. USA	Attitudes and perceptions	Objective knowledge about biotechologies and GM foods does not explain the more positive attitudes of people in the United States compared to Europe	N		Y	7 items, True/False
Boccaletti & Moro	2000	AgBioForum 3(4): 259-267	GM foods	Contingent Valuation	Italy	Consumers' WTP	Subjective knowledge about biotechnology and and GM foods has an important role in purchasing decisions. Higher levels of knowledge increase the willingness to accept GM and the increasing the willingness to pay.	Y	1 item Likert scale: 1 (high or little) to 0 (no knowledge)	N	
Li et al.	2003	AgBioForum, 5(4): 145-152	GMO soybean oil	Contingent Valuation	China	Attitudes	Subjective knowledge about biotechnology significantly increase willingness to accept GM foods.	Y	1 item Likert scale: 1 (none) to 4 (good)	N	
House et al.	2004	AgBioForum 7(3): 113-123	GM foods	Cross tabulation, Probit model	US, England, France	Consumers' WTA	Higher levels of subjective knowledge about GM foods significantly increase willingness to accept GM foods. Objective knowledge about GM foods is not significantly related to willingness to accept.	Y	1 item Likert scale: 1 (not at all knowledgeable) to 9 (extremely knowledgeable)	Y	4 items, True/False
Lusk et al.	2004	European Review of Agricultural Economics 31(2): 179-204	GM foods	Experimental Auctions	US, England, France	Consumers' WTA	Subjective knowledge about GM foods significantly affect the respondents' bid levels.	Y	1 item Likert scale: 1 (not at all knowledgeable) to 9 (extremely knowledgeable)	N	
Dodd et al.	2005	Journal of Hospitality & Tourism Research 29(1): 3-19	Wine	Structural Equation Modelling	USA (Texas)	Usage experience	Usage experience is related positively to objective and subjective knowledge about wine. The relationship between objective knowledge and usage experience is not as strong as the relationship between experience and subjective knowledge.	Y	4 items, Likert scale: 1 (strongly disagree) to 7 (strongly agree)	Y	10 items, Multiple-choice answers to choose from

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Author	Year	Journal	Product	Method	Country	Dependent Variable(s)	Key findings: type of knowledge and its impact on the	Subjective knowledge		Objective knowledge	
								Included	Measurement	Included	Measurement

							dependent variable(s)	(Y/N)		(Y/N)	
Pieniak et al.	2010a	Food Quality and Preferences 21: 581-588	Organic vegetables	Structural Equation Modelling	Belgium	Consumption	Subjective knowledge about organic vegetables is significantly, relatively strongly and directly associated with organic vegetables consumption. The association between objective knowledge about organic agriculture and foods and organic vegetables consumption it's fully mediated by general attitude and by subjective knowledge.	Y	3 items, Likert scale: 1 (totally disagree) to 7 (totally agree)	Y	4 items, True/False
Pieniak et al.	2010b	Journal of Human Nutrition and Dietetics 23: 480-488	Fish	Structural Equation Modelling and multi-group models	Belgium, Netherlands, Denmark, Poland, Spain	Consumption frequency	Subjective knowledge about fish has a stronger direct effect on consumption frequency compared to objective knowledge about healthy characteristics of fish.	Y	1 item, Likert scale: 1 (totally disagree) to 7 (totally agree)	Y	4 items, True/False
Aertsens et al.	2011	British Food Journal, 113(11): 1353-1378	Organic vegetables	TPB (Multiple regression models, probit model, analysis of variance)	Belgium	Attitudes; Motivations; Consumption	Higher level of objective and subjective knowledge about organic vegetables are positively correlated with a more positive attitudes towards organic food. Only the subjective knowledge about organic vegetables significantly and positively influence the likelyhood of actually consuming organic vegetables.	Y	3 items, Likert scale: 1 (totally disagree) to 7 (totally agree)	Y	4 items, True/False; certainty of the answer on a likert scale from 1 (uncertain) to 5 (certain)
Choi & Kim	2011	Culinary science and hospitality research 17(4): 153-168	Organic food	Structural Equation Modelling	Korea	Purchase intentions	Subjective knowledge about organic foods is significantly associated with the purchasing behaviour of organic food. Objective knowledge about organic foods, in contrast, is only indirectly associated with purchasing organic food, through increased subjective knowledge and risk perception towards purchasing organic food.	Y	4 items, Likert scale	Y	5 items, True/False
Mesías Díaz et al.	2012	British Food Journal, 114(3): 318-334	Organic tomatoes	Contingent Valuation	Spain	Consumers' WTP	Consumers' levels of knowledge about organic foods and consumption of organic foods positively affect their willingness to pay a premium for organic tomatoes.	N		Y	9 items, True/False
Gambaro et al.	2013	Food and Nutrition Science 4: 445-453	Olive oil	Decision Trees	Uruguay	Consumption frequency	Consumer subjective and objective knowledge about olive oil nutritional properties affect positively the frequency of consumption. Among all the factors that have an impact on the consumption frequency, subjective knowledge has the highest explanatory capacity.	Y	3 items, Likert scale: 1 (I completely disagree) to 7 (I could not agree more)	Y	6 items, True/False and I don't know

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Author	Year	Journal	Product	Method	Country	Dependent Variable(s)	Key findings: type of knowledge and its impact on the dependent variable(s)	Subjective knowledge		Objective knowledge	
								Included	Measurement	Included	Measurement

								(Y/N)		(Y/N)	
Van Loo et al.	2013	Journal of Dairy Science 96: 2118-6262	Organic yogurt	Structural Equation Modelling	Belgium	Consumption	There is a positive association between knowledge about organic food labels, attitudes, and the frequency of purchasing and consuming organic yogurt. Objective knowledge has a relatively weak relationship with attitude towards organic yogurt. The association between objective knowledge and organic yogurt consumption is fully mediated by attitude.	N		Y	4 items, True/False
Zhang & Liu	2015	International Journal of Food Science and Technology 50: 1198-1205	GM foods	Structural Equation Modelling	China	Attitudes	Consumers' objective knowledge rather than subjective knowledge about biotechnology and GM foods plays an important role in the formation of consumer's attitudes to GM foods.	Y	5 Items (Flynn & Goldsmith, 1999), Likert scale: 1 (totally disagree) to 5 (totally agree)	Y	5 Items (House et al., 2004) + 2 Items (Verdurme & Viaene, 2003) True/False
Altintzoglou & Heide	2016	Journal of Aquatic Food Product Technology 25(6): 885-894	Fresh fish fillets	Factor analysis, Cross tabulation	Norwey	Purchasing behaviour	Higher levels of knowledge about fish quality have a positive effect on the importance of almost all the factors that influence buying choice for fish fillets.	Y	3 items, Likert scale: 1 (totally disagree) to 7 (totally agree)	Y	4 Items (Pieniak et al., 2010), True/False
Piha et al.	2018	Food Quality and Preferences 70: 1-10	Insect food	Structural Equation Modelling and multi-group models	Finland, Sweden, Germany, Czech Republic	Willingness To Buy	Knowledge about insect food only indirectly affect consumers' willingness to buy insect food products. Its effect is mediated by general attitudes, differing significantly between Northern and Central Europe.	Y	3 items, Likert scale: 1 (completely disagree) to 7 (completely agree)	Y	11 items, True/False and I don't know
Wu et al.	2019	Journal of Food Products Marketing 25(5): 549-565	Organic rice	Binary logit regression	China	Purchasing behaviour	Consumers' objective knowledge about organic rice and organic labelling influence purchasing behavior for organic rice. Regional differences affect the purchasing behaviour.	N		Y	3 items, True/False

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3. Material and methods

3.1 Data collection and questionnaire structure

The data analysed in this study are part of a more extensive research project on consumers' attitudes towards, preferences for and knowledge about hunted and farmed wild boar meat (*Sus scrofa*). The data were originally collected through an online survey sent to a sample of Italian consumers using the Qualtrics XM™ survey platform. The sample was recruited by the Qualtrics Panels service during July 2019, stratifying by age and gender in order to be representative of the Italian population (Table 2). Consumers who were less than 18 years old and persons who indicated that they did not eat meat in the three months prior to the research were excluded. Ultimately, 510 participants completed the questionnaire with a mean completion time of 18'28'' (median time= 12'45''). Before starting, participants read basic information on marketing and consumer research techniques and the General Data Protection Regulation (GDPR - Reg. EU 2016/679). Moreover, respondents read a brief description of the research and a detailed description of the European labelling scheme for the wild boar meat production process. Specifically, consumers read an informative sheet explaining that wild boar meat might come from hunting or farming, but no specification on labels is required by EU laws.

The survey instrument consisted of a questionnaire containing closed-ended questions organized into four sections. Section one contained the hypothetical discrete choice experiment , section two included questions aimed at detecting consumers' attitudes towards hunted and farmed wild boar meat (the results of this part of the questionnaire are not discussed below), and the section three questions were aimed at assessing consumers' objective and subjective knowledge about hunting and farming. Finally, section four consisted of questions related to sociodemographic characteristics, familiarity with hunting as well as the consumption habits of the sample.

Table 2. Representativeness of the survey sample compared to the Italian population

	Survey sample						**Italian population (*1,000)[1]**					
	Male		**Female**		**Total**		**Male**		**Female**		**Total**	
18-25 years	7	3%	7	3%	14	3%	2,480	10%	2,265	9%	4,745	9%
26-35 years	25	10%	41	15%	66	13%	3,341	14%	3,242	12%	6,583	13%
36-45 years	40	16%	46	17%	86	17%	4,132	17%	4,140	16%	8,272	16%
46-55 years	41	17%	55	21%	96	19%	4,776	20%	4,898	19%	9,674	19%
56-65 years	47	19%	49	18%	96	19%	3,853	16%	4,122	16%	7,975	16%
66-75 years	52	21%	48	18%	100	20%	3,067	13%	3,461	13%	6,528	13%
over 75 years	33	13%	19	7%	52	10%	2,553	11%	3,914	15%	6,467	13%
	245		**265**		**510**		**24,203**		**26,040**		**50,244**	

[1]Data referred to the Italian resident population at 01.01.2019 from Istat.it

3.2 Objective and subjective knowledge assessment

Six true/false and multiple-choice questions were used to measure consumers' objective knowledge about hunting and farming. Such questions were developed on the basis of the previous literature and the authors' own expertise as both active hunters and farmers. The final score per respondent is the sum of 1 point per correct response; thus, we ultimately had two variables that measure 'objective knowledge of hunting' (*KnowHunt-Obj*) and 'objective knowledge of farming' (*KnowFarm-Obj*), ranging from a minimum of 0 to a maximum of 6. Subjective knowledge about hunting (*KnowHunt-Subj)* and farming (*KnowFarm-Subj*) was measured by asking each respondent to self-evaluate their performance on the two tests by using a 10-point bipolar scale ranging from 1=*Not at all knowledgeable* to 10=*Extremely knowledgeable*.

3.3 Discrete choice experiments

Although the approach used in the present paper has never been applied to explore the relationship between knowledge and preferences in the food domain, in recent years, the discrete choice experiment (DCE) methodology has become one of the most widely used methodologies among the stated preference methods for the analysis of consumers' preferences for food (Brown, 2003; Van Loo et al., 2011; Mauracher et al., 2013; Tempesta & Vecchiato, 2013; Marian et al., 2014; Demartini et al., 2018b; Torquati et al., 2018; Torquati et al., 2019; Marescotti et al., 2020).

The DCE methodology usually consists of presenting respondents with a hypothetical market in which the respondents (consumers) are asked to choose their preferred option between a set of products/services (choice options) (Hensher et al., 2005; Hauber et al., 2016; Ben-Akiva et al., 2019). Each choice option represents an analysed product. These products are differentiated/characterized by a set of attributes or key characteristics, and each characteristic can assume different levels. For example, one attribute can be the price of the good, and its levels are the different amounts of money (€1, €2, etc.) that are necessary to buy each good. While the price attribute is numeric, product attributes might also be qualitative, such as country of origin or production method, and the levels in this case could be ''organic' or ''conventional'. In this respect, each choice set presents a certain number of choice options that share the same attributes but with different attribute levels. Respondents are presented several choice sets (usually from 3 to 9), and each choice set includes different choice options (usually a fixed number, e.g., 3 or 4).

By observing the choices made by the respondents, it is then possible to indirectly derive how each attribute level contributes to the respondents' utility: it is not possible to measure utility directly, but utility can be measured indirectly by observing the choices made by respondents under the assumption that consumers make their choices rationally in order to maximize their utility (Luce, 1959; Thurston, 1927). This indirect measurement of utility is then used to derive the importance of each attribute in determining the probability a consumer will choose a given product. The latter step is consistent with Lancastrian consumer theory (Lancaster, 1966), which postulates that the utility of a good or service is given by the sum of the utilities of its characteristics.

Thus, the present study applies a DCE to study consumer preferences for hunted wild game meat and to collect information on the relative importance of each attribute to respondents and the probability of choosing the product depending on its attribute levels. Finally, a DCE permits us to estimate respondents' willingness to pay (WTP) for the attributes analysed, as explained in equation 1:

$$WTP_i = -\frac{\beta_i}{\beta_{price}} \qquad \text{(Eq. 1)}$$

where β_i is the estimated parameter for the non-monetary *i*-th attribute if β_i is a continuous attribute (or attribute level if β_i is a qualitative attribute) and β_{price}, the estimated coefficient of the monetary attribute.

3.4 Experimental design and model specifications

The product of interest for the study is a wild boar sausage (WBS) weighing 300 g. The product was selected for two reasons. First, sausages represent one of the most common and traditional preparations of wild game meat in Italy. Second, wild boar (*Sus scrofa*) is an easily domesticable wild species, which helped us create a plausible scenario for the DCE.

In fact, among the three attributes included in the experimental design, the first is the production method, which was introduced at three different levels, namely, hunting, farming and 'unspecified''. The first two levels (hunting or farming) represent the way wild game meat can be produced for the market, while the third level represents the 'required' European labelling for hunted game meat at the time of the research. In fact, processors are not currently required to declare if the meat they use in their products comes from hunting or farming, and thus, the production method remains 'unspecified'. The second attribute is the origin of the product, presented as local (Italy), Italian or Austrian. The local and Italian labels were chosen because wild game meat products are considered traditional foods in Italy and are often consumed at local fairs or in restaurants (Gaviglio et al., 2017; Demartini et al, 2018b). Austria was selected as a plausible foreign country that exports wild game meat to Italy (as well as many other countries), and as such, Austria is an important producer of this type of product (UNECE, 2018). Finally, the last attribute considered is the price of the product expressed as €6.00, €7.50 and €9.00 for a 300 g sausage. Figure 1 summarizes the attributes and the attribute levels include in the experimental design.

We opted for a labelling design, in which the production method was listed on the product label. Therefore, in each choice set, the first-choice option was a sausage made with hunted wild boar meat, and the second option was a sausage made with farmed wild boar meat. The third option was a sausage made with wild boar meat under an unspecified production method, thus resembling the contemporary purchase scenario in Italy (where no specification about the method by which the wild game meat is produced is required). For completeness and realism, we included the option 'none of these' in the design, letting the respondent choose to not buy any of the proposed products.

The final experimental design was obtained with Ngene Software (Choice Metrics, 2018) using a D_p-efficient generation procedure (Johnson et al., 2013) and was therefore optimized using priors. The design used in the DCE consisted of 12 choice sets with four choice options each (including the 'none of these' option). To avoid 'fatigue' effects, the design was divided into two blocks; therefore, each respondent was presented with 6 choice sets. The order in which the choice sets were presented to respondents was randomized: respondents in each of the two blocks responded to the same choice sets but in different orders. An example of the choice sets used in the DCE is presented in Figure 2.

Figure 1. The attributes and attribute levels considered in the experimental design

ATTRIBUTES	Production method	Origin	Price (300g)
LEVELS	Hunted	Local (Italy)	6.00€
	Farmed	Italy	7.50€
	Unspecified	Austria	9.00€

Figure 2. One of the choice tasks presented to respondents during the DCE translated from Italian

The DCE data were analysed with NLogit 6 software (Econometric Software Inc., 2016). A random parameters model (RPL) was applied during data analysis to take into account preference heterogeneity (Train, 2009). Multinomial logit models (MNL) (McFadden, 1974), which do not account for heterogeneity, were estimated for completeness, and are presented in Appendix A. Four models were estimated to answer our research questions. First, we analysed our data without accounting for the effects of knowledge (either objective or subjective). Then, we estimated a model including an interaction term between the production method and objective knowledge. The third model considered subjective knowledge, including an interaction

term between the production method and subjective knowledge. Finally, the fourth model simultaneously considered objective and subjective knowledge.

In all models, the random parameters were specified as normal, and the estimation was performed using 1,000 Halton draws. Categorical variables were dummy coded, while the degree of knowledge (either subjective or objective) was considered to be continuous. Finally, the utility function used was linear and additive in all models, starting from the following specification of the utility function for model 1 (Eq. 2):

(Eq. 2)

$$U(X_i) = \beta_{NS} \times NS + \beta_{Hunted} \times HUNTED + \beta_{Farmed} \times FARMED + \beta_{Loc} \times LOCAL + \beta_{Ita} \times ITALY + \beta_{PRICE} \times PRICE$$

Where:

- *NS* is a dummy variable assuming the value 1 if the sausage production method was not specified
- *HUNTED* is a dummy variable assuming the value 1 if the sausage was produced from hunted wild boar
- *FARMED* is a dummy variable assuming the value 1 if the sausage was produced from farmed wild boar
- *ITALY* and *LOCAL* are dummy variables that refer to the origin of the product, either Italy or a local place in Italy
- *PRICE* is a continuous measure of the price attribute

In the remaining three models, we used equation 2, but we added interaction terms to consider the interaction of objective and subjective knowledge with the hunting and farming production labels. The terms were obtained by multiplying the *HUNTED* dummy with the respondent's degree of objective and subjective knowledge about hunting or the *FARMED* dummy with the respondent's degree of objective knowledge about farmed meat.

4. Results

4.1 Sample characteristics, familiarity with hunting, and conventional and wild game meat consumption habits

Table 3 shows the sociodemographic characteristics and familiarity with hunting of the sample. Half of the sample lives in flat land areas, and most of the respondents held a high school degree, had a monthly household net income lower than €4.000, lived in households with at least three members and were responsible for daily meal purchases. Only a small number of observations had children in the household. Concerning familiarity with hunting, of the sample, less than 3% hunt and less than 10% had relatives who hunt.

Table 4 illustrates the respondents' consumption habits regarding red and white fresh meat and cured red meat products, while in Table 4, the frequency of wild game meat consumption among the sample is summarized. The consumption of conventional meat is high; in fact, a quarter of the sample reported consuming fresh red meat two or three times per week, and almost half of respondents reported consuming fresh white meat and cured red meat at least two or three times per week.

As expected, the consumption of different types of wild game meat appears to be lower than the consumption of conventional meat (Table 4). Only one-third of the sample consumed wild boar meat at least 'sometimes', and the reported consumption of wild game meat decreased strongly after including other species, with red deer being consumed more frequently than roe deer or chamois. Nevertheless, the data on meat consumption in Italy seem to be in line with previous research on the Italian wild game meat supply chain (Ramanzin et al., 2010; Gaviglio et al., 2017; Gaviglio et al. 2018), consolidating the representation of the potential of this market.

Table 3. Socio-demographic characteristics of the sample and familiarity with hunting

	n.	*%*		*n.*	*%*
Education			**Household income (€ per month)**		
First and secondary school	52	10.2	< 1,000	57	11.2
High school	283	55.5	1,000-2,000	216	42.4
Bachelor degree	58	11.4	2,001-4,000	190	37.3
Master Degree or higher	117	22.9	4,001-6,000	31	6.1
Residence Area			> 6,000	16	3.1
Coastal	134	26.3	**Household size (number)**		
Inland flat	255	50.0	1	63	12.4
Inland hilly/mountainous	121	23.7	2	158	31.0
Respondent practices hunting			3	139	27.3
No	498	97.6	4	150	29.4
Yes	12	2.4	5+	40	7.8
Responsible for daily meal purchase			**Children in the household 0–12 years**		
No	33	6.5	No	422	82.7
Yes	477	93.5	Yes	88	17.3
Respondent has relatives that practice hunting			**Children in the household 13–18 years**		
No	469	92.0	No	439	86.1
Yes	41	8.0	Yes	71	13.9

342 **Table 4. Conventional meat and meat products and wild game meat consumption habits of the sample**

	Conventional meat							Wild game meat							
	Fresh red meat		**Cured red meat**		**Fresh white meat**			**Wild boar**		**Red deer**		**Roe deer**		**Chamois**	
	Beef and/or pork		***Beef and/or pork***		***Poultry and/or rabbit***			***Sus scrofa***		***Cervus elaphus***		***Capreolus capreolus***		***Rupicapra rupicapra***	
	n.	*%*	*n.*	*%*	*n.*	*%*		*n.*	*%*	*n.*	*%*	*n.*	*%*	*n.*	*%*
No more than 3 times per year	21	4.12	7	1.38	11	2.15	Never	137	26.86	366	71.76	397	77.84	459	90.00
Once per month	54	10.59	42	8.24	21	4.12	Rarely	191	37.45	104	20.39	82	16.08	40	7.84
Once every two weeks	92	18.04	74	14.51	43	8.43	Sometimes	156	30.59	34	6.67	24	4.71	8	1.57
Once per week	207	40.59	176	34.51	191	37.45	Often	22	4.31	3	0.59	5	0.98	2	0.39
At least two or three times per week	136	26.67	211	41.37	244	47.84	Very often	4	0.78	3	0.59	2	0.39	1	0.20

Number of participants in the survey= 510

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4.2 Objective and subjective knowledge of hunting and farming

The results regarding objective knowledge about hunting and farming are summarized in Table 5 and Table 6. On average, the sample correctly answered less than half of the questions presented (*KnowHunt-Obj mean*= 2.8; *KnowFarm-Obj mean*= 2.6). With reference to hunting, the most common knowledge is that wolves cannot be hunted in Italy, whereas more than half of the sample was not able to identify a roe deer. Concerning farming, the most common knowledge was the part of the pig used to make San Daniele DOP ham (*hind legs*). On the other hand, the majority of the respondents failed to correct the false statement '*As soon as they are born, intensively farmed piglets are removed from the sow and artificially fed*'.

The distribution of the responses regarding consumers' subjective knowledge is presented in Figure 3. The majority of the sample used scores from 7 to 10 to evaluate the accuracy of their responses (56.7% for hunting and 57.8% for farming). These results, compared with the objective knowledge mean scores, demonstrate that, on average, consumers failed to correctly assess their performance on the test. The discrepancy between subjective and objective knowledge is evident when comparing the mean scores and the scale points. Specifically, the mean objective test scores were 2.82 and 2.68 for hunting and farming knowledge, respectively, which means that on average, the sample scored fewer than half the points possible (3) on the two tests. On the other hand, the mean scores from the self-evaluations were 6.92 and 6.88 for hunting and farming, respectively, which means that on average, the sample assessed their performance on the tests as being above the halfway point (5) for both tests. In other words, respondents overestimated their actual knowledge about hunting and farming, and the objective and subjective components of knowledge were uncorrelated in the sample, in line with the findings of Kruger and Dunning (1999).

Table 5. Percentage of correct answers on the objective knowledge questions focused on hunting activity

	Correct response	**% Correct response**
Indicates whether the following statements are true or false:		
- The Italian populations of large wild ungulates are growing rapidly	True	43.3
- The meat of large wild ungulates has a lower protein content than beef	False	42.2
Which of the following wild species can be hunted in Italy?		
- Red deer	True	42.8
- Steinbock	False	46.3
- Wolf	False	73.3
Which species does the animal in the photograph belong to? [*Chamois, Roe deer, Steinbock, Red deer*]	Roe deer	34.3
Mean/median score[1] *= 2.82/3.00*		

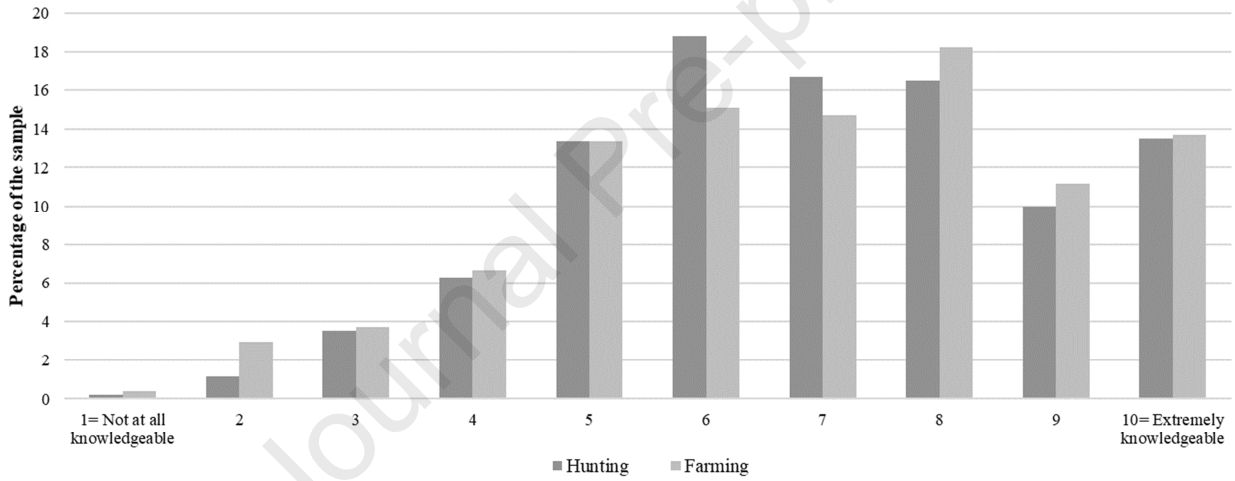
[1]Respondent gets one point per correct answer - Score ranges from a minimum of 0 to a maximum of 6.

Table 6. Percentage of correct answers on the objective knowledge questions focused on livestock farming

	Correct response	% Correct response
Indicates whether the following statements are true or false:		
- Intensively farmed pigs live in single and narrow cages	False	28.0
- Intensively farmed pigs have their tails cut off	True	20.4
- Intensively farmed pigs have their ears cut off	False	32.0
- As soon as they are born, intensively farmed piglets are removed from the sow and artificially fed	False	14.9
Which of the following parts of the pig is used to make San Daniele DOP ham? [*Shoulder, Thigh, Loin, Jowl*]	Thigh	88.0
Which of the following cured meat products is not made with pork? [*Bresaola, Varzi salami, Coppa, Speck*]	Bresaola	78.4
Mean/median score[1] *= 2.64/3.00*		

[1]Respondent gets one point per correct answer - Score ranges from a minimum of 0 to a maximum of 6.

Figure 3. Consumers' subjective knowledge related to hunting activities and livestock farming



4.3 Choice experiment results

4.3.1. DCE estimates

The DCE estimates are presented in Table 7. All models have good explicative capacity, but the log-likelihood shows that taking the interactions between knowledge about hunting and farming and preferences for hunted or farmed wild boar sausages into consideration slightly improves the model performance. In all models, the price coefficient is negative, as expected from economic theory, signifying that the higher the price is, the lower the respondents' utility. Figure 4 presents the kernel density functions for the 4 attribute levels obtained from the RPL base model (Table 7). These are the probability density functions for the estimated DCE random parameter coefficients (for each respondent) and are normally used to provide an intuitive visual representation of the distribution of their values in the sample considered. In fact, while we report the mean values of the estimated coefficients in Table 7, in Figure 4, it is possible to visually understand how these coefficients are heterogeneous around their mean. Considering Table 7, it is interesting to observe how consumers' preferences over the production method and geographical origin attribute levels

are quite heterogeneous according to the estimates from the four models, testifying that our results are stable despite the different utility function formulations.

According to the model results (RPL base model without knowledge), both farmed and hunted meat products are preferred to unspecified products. However, among the two alternatives, respondents exhibit higher utility from a farmed product than from a hunted one. Nationally produced wild boar sausages (either generically Italian or local) are preferred to foreign products (from Austria in our case study). It is interesting to observe how Italian products are only slightly preferred to local ones: this result is probably because 'local' and 'national' origins overlap in consumers' perceptions of wild boar meat.

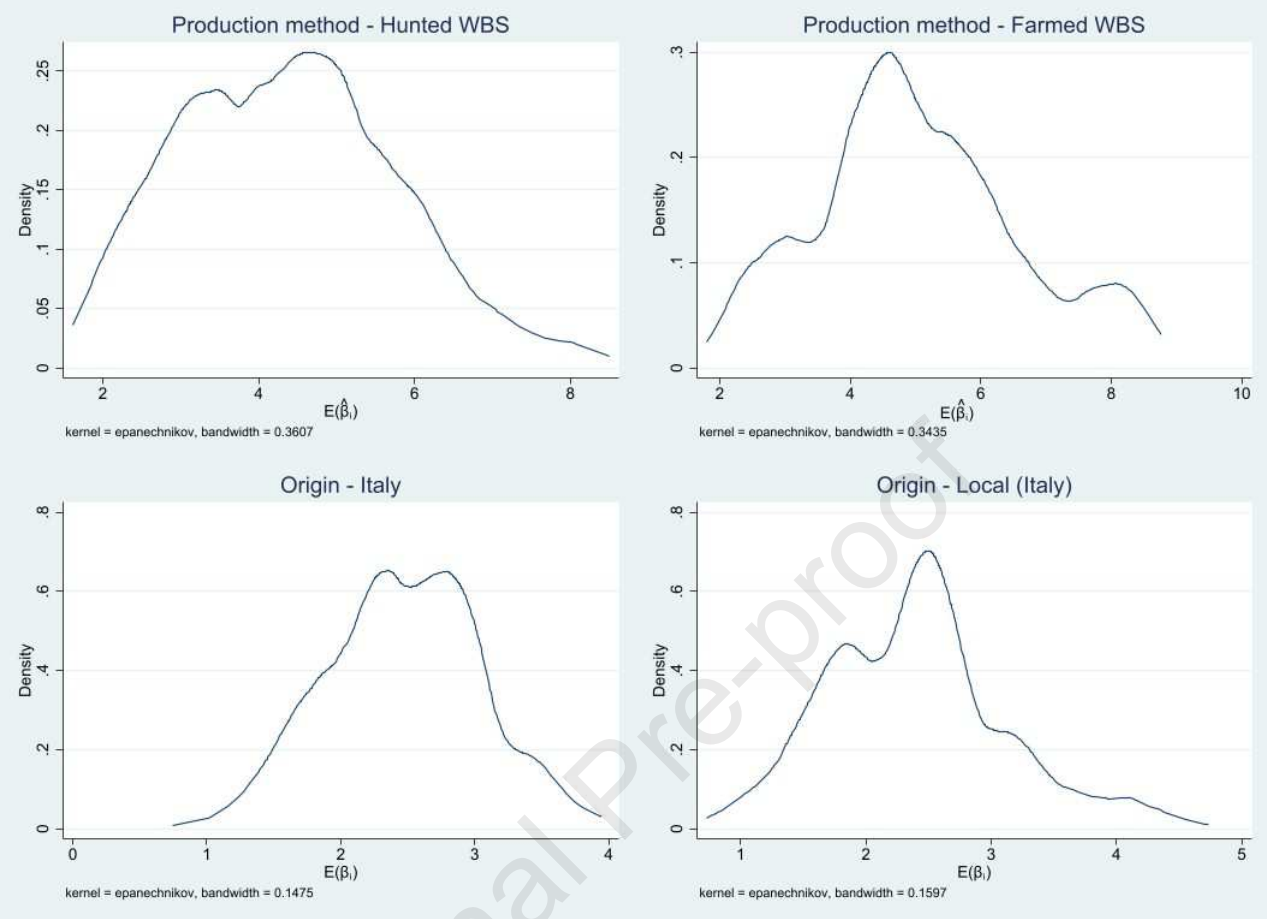
The effect of objective knowledge of hunting on preferences for hunted meat is statistically significant in both the RPL-obj and RPL-obj-subj models, while the effect of objective knowledge of farming on preferences for farmed meat is statistically significant only in the RPL-obj model. In the RPL-obj model, the two interaction terms have different signs: while the coefficient for the effect of objective knowledge of hunting has a positive sign, the coefficient for the effect of objective knowledge of farmed meat has a negative sign. This implies — *ceteris paribus* — the higher the respondents' objective knowledge about hunting, the higher their utility from a hunted WBS, and the higher their knowledge about farmed meat, the lower their utility from a farmed WBS. Another interesting result is that this tendency is quite stable among respondents, given that the models indicate an absence of heterogeneity for the interaction terms *Hunted* × *KnowHunt-Obj* and *Farmed* × *KnowFarm-Obj*. Finally, according to our model estimates, subjective knowledge does not seem to affect consumer preferences. In fact, it is not statistically significant when introduced into our models either alone (RPL-subj model) or in conjunction with objective knowledge (RPL-obj-subj model).

409 **Table 7. DCE models results**

	RPL-base		RPL-obj		RPL-subj		RPL-obj-subj	
Unspecified	2.975	***	2.987	***	3.093	***	3.120	***
	(0.204)		(0.206)		(0.209)		(0.207)	
Farmed	4.956	***	5.478	***	5.194	***	5.614	***
	(0.242)		(0.346)		(0.404)		(0.425)	
Hunted	4.323	***	3.854	***	4.494	***	4.042	***
	(0.232)		(0.301)		(0.427)		(0.424)	
Italy	2.457	***	2.462	***	2.468	***	2.473	***
	(0.112)		(0.112)		(0.113)		(0.112)	
Local (Italy)	2.368	***	2.374	***	2.405	***	2.407	***
	(0.119)		(0.119)		(0.121)		(0.119)	
Hunted × KnowHunt-Obj			0.175	**			0.144	**
			(0.070)				(0.070)	
Farmed × KnowFarm-Obj			-0.194	**			-0.130	
			(0.088)				(0.090)	
Hunted × KnowHunt-Subj					-0.008		0.011	
					(0.053)		(0.055)	
Farmed × KnowFarm-Subj					-0.002		-0.014	
					(0.048)		(0.048)	
Price (Euro)	-0.772	***	-0.774	***	-0.791	***	-0.792	***
	(0.032)		(0.032)		(0.033)		(0.032)	
Standard deviation of random parameters distribution[§]								
Farmed	1.961	***	1.961	***	1.738	***	1.871	***
	(0.117)		(0.119)		(0.127)		(0.129)	
Hunted	1.781	***	1.774	***	1.58	***	1.327	***
	(0.123)		(0.124)		(0.209)		(0.201)	
Italy	0.979	***	0.981	***	1.05	***	1.027	***
	(0.114)		(0.114)		(0.119)		(0.106)	
Local (Italy)	1.194	***	1.208	***	1.213	***	1.176	***
	(0.128)		(0.127)		(0.118)		(0.112)	
Hunted × KnowHunt-Obj			0.010				0.124	
			(0.090)				(0.075)	
Farmed × KnowFarm-Obj			0.037				0.039	
			(0.082)				(0.208)	
Hunted × KnowHunt-Subj					0.148	***	0.167	***
					(0.033)		(0.029)	
Farmed × KnowFarm-Subj					0.129	***	0.076	***
					(0.026)		(0.030)	
N Obs.	3,060		3,060		3,060		3,060	
N Subj.	510		510		510		510	
Log-likelihood	-3,028.63		-3,022.98		-3,019.06		-3006.54	
McFadden pseudo-R^2	0.29		0.29		0.29		0.29	
AIC/N	1.99		1.99		1.98		1.98	
AIC	6,077		6,074		6,066.10		6,049.10	

410 Standard error in parenthesis. § Random parameters were assumed normally distributed.
411 Significance: * = p < 0.1; ** = p < 0.05; *** = p < 0.001

Figure 4. Kernel densities of random parameters distributions from RPL-base model results



By means of equation 1, we estimated the WTP for the different WBS attributes (Table 8). We first comment on the estimated WTP without taking knowledge into account (RPL-based model). Consumers are willing to pay €3.85 for a 300 g WBS if no information is provided about the production method. The premium price for a farmed WBS with respect to an unspecified WBS is €2.57 (we calculate the WTP for the farmed WBS and subtract the WTP for the unspecified WBS: 6.42 – 3.85= €2.57), while the premium price for a hunted WBS with respect to an unspecified WBS is €1.75 (5.60 – 3.85). The latter values are quite interesting because they provide the premium price for labelling a product as 'farmed' or 'hunted'. It is interesting to observe that the premium price for a farmed product relative to a hunted one is €0.82. Finally, consumers are willing to pay approximately €3 more for a nationally produced product than for a foreign product.

Considering the RPL base model, on average, consumers exhibit higher utility from farming than from hunting as the method of provision for wild boar meat. However, objective knowledge of hunting has a positive impact on WTP for a hunted WBS (RPL-obj model). Specifically, for each point scored on the test of objective knowledge of hunting, consumers are on average willing to pay €0.23 more for a hunted WBS. For example, a consumer with an objective knowledge level of 5 for hunting is willing to pay €1.15 (5 × €0.23) more than the baseline price for a hunted WBS. Conversely, objective knowledge about farmed meat has a negative impact on WTP for farmed WBS (RPL-obj model): the marginal decrease in WTP for farmed

WBS is on average equal to €0.25. Therefore, a consumer with an objective knowledge level of 5 for farming is willing to pay €1.25 less for a farmed WBS (5 × -€0.25).

Table 8. WTP estimates

Attribute level	WTP (€/300g)			
	RPL-base	RPL-obj	RPL-subj	RPL-obg-subj
Unspecified	3.85	3.86	3.91	3.94
Farmed	6.42	7.08	6.57	7.09
Hunted	5.60	4.98	5.68	5.10
Italy	3.18	3.18	3.12	3.12
Local (Italy)	3.07	3.07	3.04	3.04
Hunted × KnowHunt-Obj		0.23		0.18
Farmed × KnowFarm-Obj		-0.25		*n.s.*
Hunted × KnowHunt-Subj			*n.s.*	
Farmed × KnowFarm-Subj			*n.s.*	

Note: only significant coefficients in Table 7 are reported here
n.s: not significant (p > 0.100)

4.3.2. Simulations of market shares for differently produced wild boar sausages at different levels of objective knowledge

To further understand the effect of objective knowledge on purchase behaviour and quantify its effect on market demand for wild boar sausages, we simulated the changes in market shares for the different purchase options given different levels of knowledge using the results from the RPL model reported in Table 7 (RPL-obj-subj model). Such a simulation helps predict the potential effect of a campaign aimed at increasing the objective knowledge of consumers about hunting and farming on the market share of hunted WBS. As shown in Figure 5, increasing the average respondents' knowledge from 0 (no knowledge) to 6 (perfect knowledge) would increase the market share of hunted WBS by approximately 16.9 percentage points, from 22.1% to 39.0%. According to this simulation, the increase in the market share of hunted wild boar meat is due first to a change in consumer preferences for farmed meat; in fact, an increase of 6 points in consumer knowledge of hunting and farming decreases the market share of farmed WBS by approximately 18.1 percentage points, from 49.2% to 31.1%. The second most important group of consumers who are affected by an increase in knowledge about hunting are those who would not buy WBS; in fact, the simulation shows that 1.1% of this type of respondent would prefer hunted WBS to the 'no-buy' option. Finally, consumers who prefer an 'unspecified' method of production seem mostly unaffected by changes in knowledge of hunting. In this respect, investing in the provision of proper knowledge about hunting and farming to consumers could generate important gains in terms of the market share of hunted products among specific segments of consumers.

Table 9 presents a simulation that takes the sample mean knowledge about hunting and farming as its base scenario and compares the market share in that scenario to the market share that could be obtained by increasing knowledge about hunting and farming to 6 points (using our scale as the metric). In this case, the

increase in the market share of hunted meat is approximately 9.5 percentage points, while the farmed market segment loses 9.75 percentage points.

Figure 5. Simulation of market share changes depending on the level of objective knowledge about hunting and farming (using RPL-obj model estimates)

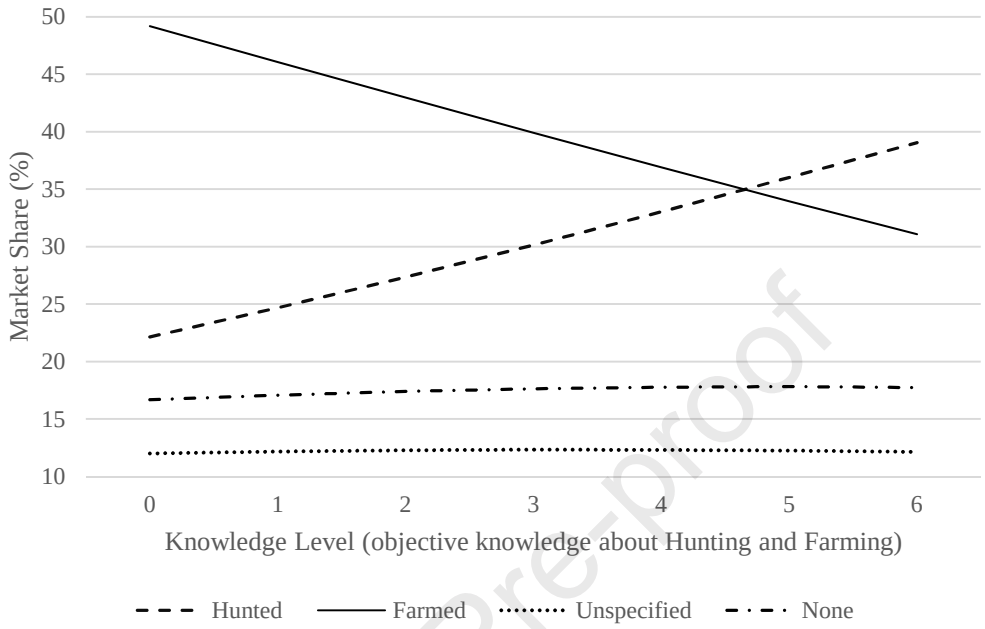


Table 9. Simulation of market share changes: sample mean objective knowledge (Base) vs maximum objective knowledge about hunting and farming (Scenario) (using RPL-obj-subj model estimates)

Choice	Base*		Scenario**		Change in market share Δ (Scenario – Base)	
	% Share	Number	%Share	Number	Δ %	Δ Number
Hunted	29.53	904	39.04	1195	9.51	291
Farmed	40.84	1,250	31.09	951	-9.75	-299
Unspecified	12.22	374	12.13	371	-0.09	-3
None	17.41	533	17.75	543	0.34	10
Total		3,061		3,061		0

* Base: *sample mean objective knowledge*
** Scenario: *maximum objective knowledge about hunting and farming (6 points)*

5. Discussion and conclusions

In the present research, we conducted a survey at the national level on a sample of Italian consumers that are representative by age and gender. Specifically, we used an online discrete choice experiment to estimate consumer preferences for hunted and farmed wild boar meat and the effect of objective and subjective knowledge about hunting and farming on consumer preferences for hunted and farmed meat, respectively. On average, consumers slightly preferred farmed meat to hunted meat and revealed that reporting the production method for the wild boar sausage is strongly preferred to an 'unspecified' label. Most

interestingly, we find that objective knowledge has a mixed effect on consumer preferences. Specifically, the more consumers (objectively) know about hunting, the more they like hunted meat; in contrast, the more they know about farming, the less they like farmed meat. Finally, consumers' subjective evaluations of their knowledge seem to be unrelated to their preferences for the product considered.

These results seem relevant in four ways. First, the empirical results suggest that Italian consumers would strongly prefer wild game meat and specifically would prefer to have an indication of the production method used over having no specification. Second, reminding consumers that wild game meat might be derived from hunting does not produce negative perceptions. Third, the more consumers know about farming, the more they dislike farmed meat. Finally, informing and educating consumers about hunting and wildlife in general might have a positive effect on consumers' attitudes and eventually result in a shift in consumer preferences from farmed meat towards hunted meat.

The present results are in line with recent studies on this topic, where wild game meat is presented as an interesting product *per se* or in comparison to conventional meats. For example, Demartini et al. (2018b) conducted a survey on consumer preferences for beef and red deer *carpaccio* (thinly sliced raw meat drizzled with olive oil) and found that consumers generally prefer beef. Similarly, in the present research, respondents slightly preferred farmed over hunted wild boar meat, which suggests that more conventional alternatives (beef and farmed wild boar) dominate wild game meat. However, in both studies, the authors identify the high marketing potential for hunted wild game meat using the individual characteristics of respondents to segment the sample. Our results are also in line with those from the study of Marescotti et al. (2020), which confirmed that consumers generally prefer conventional meat but found that 20% of the interviewed consumers would prefer a package of labelled hunted red deer *bresaola* over bovine *bresaola* (a traditional air-cured Italian cold cut). Finally, it is worth comparing the present research with the survey conducted by Hartmann and Siegrist (2020), which found that hunting is perceived as much more morally justifiable than intensive farming, which is in fact perceived as cruel.

In this sense, our results present interesting hints for both private and public stakeholders involved in the wild game meat supply chain. In fact, the DCE estimates clearly show the economic value of a traceability labelling system for minor meats derived from wild animals. Thus, an indication of the production method could be privately used by wild game meat processors to improve communication about the characteristics of their products. On the other hand, European policy makers should consider this opportunity to support a voluntary labelling programme to reduce the information asymmetries that are now present in the wild game meat market.

With regard to knowledge, one theoretical finding is also worth mentioning: as far as we know no previous studies on food choice have focused on the effect of both objective and subjective knowledge on consumer preferences with the systematic approach used in the present contribution. In this sense, our results are in line with the seminal demonstration of Kruger and Dunning (2009), which showed that people normally fail to evaluate their skill and, thus, objective and subjective knowledge are not directly related. In fact, our data

show that the two objective components significantly interact with the target labels, while neither of the subjective components are able to explain consumers' preferences for hunted or farmed meat.

Regarding subjective knowledge, it should be noted that previous studies have found a link between subjective knowledge and consumer attitudes and preferences for food (Boccaletti & Moro, 2000; Li et al., 2003; Lusk et al., 2004). We might argue that the divergence of our results from those of other studies can be explained by the specific nature of the foods considered in those studies and the measurement of subjective knowledge. In fact, those studies all considered GMO foods, and the measure of subjective knowledge in those cases might have overlapped with individual prejudices regarding the considered food, finally resulting in correlations with final choices. To exclude this possible issue, in the present paper, we used the formal definition of subjective knowledge used by Kruger and Dunning (1999), which required each respondent to self-evaluate her/his own performance on the tests of objective knowledge. Thus, in our case, we excluded the chance that the measure of subjective knowledge was biased by any prejudice on the topic.

While our results clarify some relevant aspects of wild game meat consumption, many other questions are still open and worth considering for future research. For instance, some papers have emphasized that wild game meat consumption is related to consumers' age and gender (Burger, 2000; Burger & Gochfeld, 2002; Tolusic et al., 2005; Bodnar et al., 2014; Ljung et al., 2015; Marescotti et al., 2019), familiarity with hunting (Ljung et al., 2012; Marescotti et al., 2019) and/or prejudices (Demartini et al., 2018b; Marescotti et al., 2019). Wild game acceptance is also surely linked to personal background and specifically to psychographic variables. We focused on knowledge; however, a consumer who is an expert about wildlife and farming might not consider certain wild animal species to be food for cultural reasons. It is widely known that different wild animal species are eaten in different countries. For example, Americans consume racoons and squirrels (Burger et al., 2000), while most Italian consumers would probably refuse to eat those species, suggesting that our results might not be replicable in other contexts and that more analysis is required in this field.

Finally, some technical limitations of the research must be acknowledged. While the empirical findings seem to be in line with what we expected based on the literature, it must also be emphasized that the interaction terms for objective knowledge and hunting and farming are significant at the 0.05 level, which means that the mediating role of knowledge in determining preferences could be small, which implies that further research is needed for confirmation. Furthermore, even if our measure of subjective knowledge were to be considered adequate, other measurements could be even better. For these reasons, we suggest further investigating this issue by changing products and research contexts to test for the reproducibility of the effects found and to deepen the analysis by considering different possible components of subjective knowledge in order, for example, to separate the consumer's overestimations of her/his skills from prejudices.

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Appendix A

Table A1. DCE models MNL estimates

	MNL-base	MNL-obj	MNL-subj	MNL-obj-subj
Not-spec	1.607***	1.614***	1.609***	1.615***
	(0.143)	(0.143)	(0.143)	(0.143)
Farmed	3.214***	3.411***	3.404***	3.512***
	(0.144)	(0.173)	(0.203)	(0.214)
Hunted	2.855***	2.587***	2.738***	2.595***
	(0.141)	(0.164)	(0.214)	(0.219)
Italy	1.671***	1.676***	1.672***	1.676***
	(0.070)	(0.070)	(0.070)	(0.070)
Local (Italy)	1.632***	1.636***	1.633***	1.636***
	(0.073)	(0.073)	(0.073)	(0.073)
Price (Euro)	−0.473***	−0.475***	−0.473***	−0.475***
	(0.019)	(0.019)	(0.019)	(0.019)
Hunted × KnowHunt-Obj		0.097**		0.094**
		(0.030)		(0.031)
Farmed × KnowFarm-Obj		−0.071*		−0.064°
		(0.035)		(0.036)
Hunted × KnowHunt-Subj			0.017	−0.000
			(0.023)	(0.024)
Farmed × KnowFarm-Subj			−0.027	−0.017
			(0.021)	(0.021)
N	3060	3060	3060	3060
N Subj.	510	510	510	510
Log-likelihood	−3378.616	−3370.167	−3376.881	−3369.785
BIC	6805.389	6804.544	6817.971	6819.831
AIC	6769.232	6756.334	6769.761	6759.570

Standard error in parenthesis.
Significance: ° = p < 0.1; * = p < 0.05; ** = p < 0.01; *** = p < 0.001

Highlights:

1. Declaring the method of production of wild game meat is not compulsory in Italy;
2. A web survey is used to evaluate consumer preferences for labelled wild game meat;
3. Consumers slightly prefer farmed over hunted wild game meat;
4. The objective knowledge of hunting increases the preferences for hunted game meat;
5. The objective knowledge of farming decreases the preferences for farmed game meat;

The present paper presents at least three implications for the gastronomy field. Firstly, it focuses on wild boar meat, a niche market product in Italy, particularly interesting for restaurants especially in the mountainous areas, where Italian tourists usually eat wild game meat (WGM). Furthermore, WGM in general possesses a still unexpressed marketing potential in terms of nutritional, environmental, and social characteristics compared to conventional meats.

Secondly, this is the first research that systematically analyzes consumer preferences towards the production method of wild boar meat. In fact, although the origin of the product is a primary driver of consumers' choices, European regulations allow the WGM to enter the market without the indication of their country of origin and method of production (i.e. if the animals were farmed or hunted). Nonetheless, our research demonstrates that consumers are willing to pay a premium price for this type of information, confirming that a clear labelling of origin for WGM would be appreciated. In this sense, our results offer new hints for professionals in the field of gastronomy to understand the real value of this product and propose new strategies for its promotion.

Finally, the evidences of the role of objective knowledge in shaping individuals' preferences showed the importance of explaining the characteristics of food to consumers to promote their intrinsic values. This emphasizes, with specific reference to the field of gastronomy, the role of emerging marketing techniques such as storytelling to enhance customers' experience with meals they are eating and places they are visiting.

Declaration of interests

☒ The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.