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Consumer preferences for red deer meat: a discrete choice analysis considering attitudes towards wild game meat and hunting

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ABSTRACT

This study aims to analyse consumer preferences for red deer meat (RDM) (*Cervus elaphus*) by conducting a case study in northern Italy. This analysis considers how the attitudes of consumers towards wild game meat and hunting might influence such preferences. This goal is achieved by combining the results of a *k*-means clustering analysis of the attitudes collected by means of two valuation scales with a discrete choice experiment (CE). According to our results, a positive attitude towards wild game meat has an effect on the willingness to pay (WTP) for RDM that is more than 3 times greater than being in favour of hunting. An analysis of the heterogeneity of consumer preferences allowed us to identify the presence of an important niche market for RDM served as carpaccio. Examining only the mean estimates for carpaccio without considering heterogeneity would lead to neglecting 18% of the sample with a positive willingness to pay for this attribute level.

1. Introduction

The meat of hunted large wild ungulates has traditionally been consumed in Italy and many European countries. Indeed, regional dishes containing red deer (*Cervus elaphus*), roe deer (*Capreolus capreolus*), chamois (*Rupicapra rupicapra*) and wild boar (*Sus scrofa*) can be found in most restaurants and local fairs in the Alps, Apennines, Central Europe and Mediterranean. As highlighted by Hoffman and Wiklund (2006), wild game meat responds to well-informed modern consumers' concerns related to the sustainability of meat production and consumption.

The existing literature shows that these products present interesting characteristics when compared to conventional meat in terms of environmental (Hoffman & Bigalke, 1999), nutritional (Bureš, Bartoň, Kotrba, & Hakl, 2015), and social issues. Considering the sustainability of the production, hunting or cropping of large wild ungulates in nature has been compared to organic meat production in terms of the environmental impact (Hoffman & Bigalke, 1999). The nutritional characteristics of large wild ungulates meat have also been analysed (Bureš et al., 2015), indicating that its consumption is healthier than that of red meat, which is traditionally considered its direct substitute. The meat of large wild ungulates has high-quality protein and low-fat contents, presenting an optimal fatty-acid composition. Furthermore, as heating treatment could alter the poly-unsaturated fatty acids composition of food, Valencak, Gamsjäger, Ohrnberger, Culbert, and Ruf (2015) analysed five types of large wild ungulates obtained by hunting activity and proved that they maintained their nutrients after cooking. Finally, a recent study by Tomasevic et al. (2018) investigated consumers' perception of different types of wild game meat in ten European countries (excluding Italy), confirming that it is perceived as healthy and as more organic than other types of meat products.

On the other hand, some safety and quality issues of hunted wild game meat must be considered. Specifically, the two most important safety issues are the possible chemical (Paulsen, Bauer, Vodnasnky, Winkelmayer, & Smulders, 2011) and microbiological contamination (Atanassova, Apelt, Reich, & Klein, 2008; Avagnina et al., 2012; Gill, 2007). All of the most common large wild ungulates have been investigated in terms of toxic metals residuals. For example, Lehel et al. (2016) found that the consumption of Hungarian meat of roe deer could expose consumers to very low concentrations of lead and mercury, while no risk have been calculated for cadmium and arsenic. A second study also underscored that the threat for venison consumers is strictly related to the pollution of the areas in which the animals reside (Durkalec et al., 2015). Considering the microbiological safety issue,

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wild game meat consumption could present some risks related to *Toxoplasma spp.* (Formenti et al., 2015; Formenti et al., 2016), *hepatitis E virus* (HEV) (Martelli et al., 2017), *Cryptosporidium* spp. and *Giardia duodenalis* (De Liberato et al., 2015; Duff, 2017; Li et al., 2017). According to many studies (Atanassova et al., 2008; Avagnina et al., 2012; Gill, 2007; Hoffman & Wiklund, 2006; Paulsen et al., 2011; Sales & Kotrba, 2013; Winkelmayer & Paulsen, 2008), these risks can be reduced to reasonable limits by good hunting practices. In fact, the way in which wild animals are hunted and the practices used by hunters to dress the carcasses determine the first sources of microbial corruption. The same reasoning applies when considering meat quality. Indeed, good hunting practices guarantee the decreased of the pH of the meat, preserving the optimal sensory characteristics of the product (Pollard, Stevenson-Barry, & Littlejohn, 1999; Viganò et al., 2017; Viganò, Cottini, & Fili, 2017; Wiklund, Manley, & Littlejohn, 2004). Finally, the microbiological risks linked to wild game meat consumption can increase during the meat preparation phase. For instance, the risks from *Toxoplasma gondii* can be removed by heating the meat to 67 °C (Dubey, Kotula, Sharar, Andrews, & Lindsay, 1990) or freezing it at −12 °C for 48 hours (Kotula et al., 1991). Conversely, HEV is removed by heating at 71 °C for 20 minutes, but it is resitant for 30 days at −20 °C (Cook & van der Poel, 2015).

Building on these considerations, it is important to emphasise that only wild large ungulates meat deriving from animals that live in unpolluted areas and are hunted and prepared according to good and strict practices should be considered a good substitute for other types of meat. However, despite its beneficial nutritional properties and advantages in terms of sustainability, game meat consumption has received far less attention from scholars than traditional meat. Studies have evaluated the economic relevance of the livestock sector and public concerns regarding the sustainability of meat production (Font-i-Furnols & Guerrero, 2014; Henchion, McCarthy, Resconi, & Troy, 2014) and, particularly over the past few years, the adverse outcomes of the (possible) overconsumption of red meat (Larsson & Orsini, 2013; Pan et al., 2012). Wild game meat might be not attractive for researchers because it accounts for a very small fraction of the meat market – in Italy, it is estimated to represent only 0.1% of the apparent consumption of meat (Ramanzin et al., 2010) – and/or because its environmental and biological characteristics are much more relevant for a public audience than its potential commercial audiences. As a consequence, while a plethora of studies have been published on consumer willingness to pay (WTP) for different types of meat (Gracia & Maza, 2015; Hamlin, 2016; Lusk & Tonsor, 2016; Papanagiotou, Tzimitra-Kalogianni, & Melfou, 2013), no relevant research has estimated the WTP for wild game meat. However, there are at least four reasons why there is a need to analyse consumers' preferences for the meat of large wild ungulates and to understand consumers' attitudes towards hunting as a method of meat provision:

(1) the purchase of hunted game could represent a source of supplementary income for people living in marginal areas (Hoffman & Bigalke, 1999; Hoffman, Muller, Schutte, Calitz, & Crafford, 2005);
(2) the meat of large wild ungulates presents excellent nutritional characteristics in terms of protein and fat contents (Triumf et al., 2012);
(3) in Europe, the populations of large wild ungulates have increased over the last two decades, generating a concrete availability of the product and some conflict with human activities (Barrios-Garcia & Ballari, 2012; Bruinderink & Hazebroek, 1996); and
(4) although hunting represents a cost-effective solution to the overpopulation of wild animals, it faces a problem in terms of social acceptance (Geisser & Reyer, 2004).

Building on these premises, the present research has three objectives. First, we seek to contribute to the small body of literature devoted to wild game meat consumption by using a case study to analyse consumer preferences for red deer meat (RDM) in northern Italy. Second, we analyse how the attitudes of consumers towards wild game meat and hunting might influence such preferences. Third, we seek to understand whether consumer preferences are heterogeneous, and if so, whether such heterogeneity indicates new strategies that could be used for product valorisation and hidden niche markets.

To the best of our knowledge, we conduct the first exploration of consumers' preferences through a discrete choice experiment (CE), controlling for the roles of attitudes towards wild game meat and hunting. In fact, even if there is previous evidence that attitudes and the consumption of wild game meat are correlated (Ljung, Riley, & Ericsson, 2015; Ljung, Riley, Heberlein, & Ericsson, 2012; Tidball et al., 2014), our study evaluates and describes these relationships in terms of consumer choices. One original aspect of our approach is that we simultaneously consider consumer choices (derived from the CE data) and consumer attitudes towards wild game meat and hunting. Furthermore, our CE is structured to analyse possible niche markets for different RDM presentations.

Therefore, the results could be relevant for scholars because of the novelty of the approach and the information collected from respondents. Second, policy makers could benefit from the research when designing public interventions for wildlife management, with particular reference to promotion of the local food supply chain. Finally, this research clearly offers useful marketing suggestions for people directly involved in the supply chain for wild game meat.

2. Material and methods

This study combines in the same questionnaire the CE and a series of questions related to respondents' attitudes towards wild game meat and hunting (Fig. 1). The CE helps us to understand consumer preferences and to determine the monetary value placed by consumers on the various attributes considered. Moreover, two specific attitudinal scales were created to measure the impacts of attitudes on preferences. Specifically, *k*-means clustering was separately applied on the items of the two scales, allowing us to classify the respondents as either positively or negatively disposed to eating wild game meat and/or hunting. The results of the clustering were considered in the CE model as interaction terms to check the relevance of the attitudes towards wild game meat and hunting to explain consumer preferences, along with the other attributes included in the CE.

To determine whether the attitudinal scales were reliable, we calculated the Cronbach's alpha of each scale. The scales were also evaluated for validity using principal component analysis. Both analyses showed reasonably good performance, confirming that the items captured the selected attitudes; for brevity, the results of the reliability and validity analysis are presented in supplementary materials.

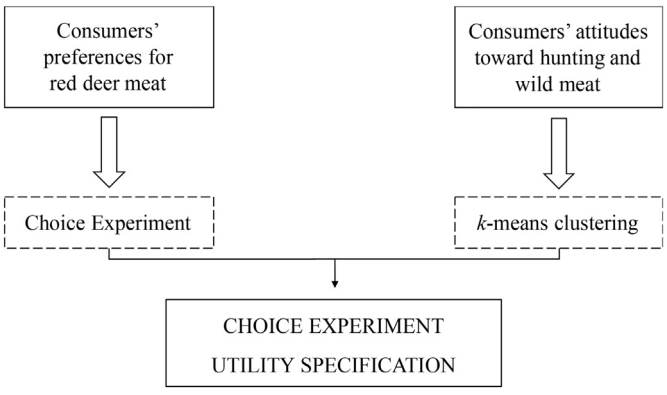

Fig. 1. Framework of the analysis.

Express how much you agree with the following statements:

I think that wild game meat [from red deer, roe deer, chamois and wild boar]:

Completely disagree ☹					Completely agree ☺	I don't know
1	2	3	4	5	6	

1. It is safe to eat
2. It possesses good nutritional properties
3. It tastes good
4. Its price is fair compared to product quality
5. It comes from a natural production process that does not involve advanced technologies
6. It is easy to find
7. It is easy to cook
8. It is appealing
9. Its production method respects the environment
10. It is a source of income in mountainous areas
11. It is traditional
12. It has mainly an Italian origin

Fig. 2. Scale used to evaluate attitudes towards large wild ungulates meat.

2.1. Attitudinal scales

2.1.1. Scale used to measure attitudes towards large wild ungulates meat

The scale used to measure consumers' attitudes towards large wild ungulates meat is composed of twelve items and is derived from an adaptation of the Food Values scale, which is used to infer the importance that people attach to different characteristics of food in purchasing decisions (Lusk & Briggeman, 2009). The scale used in the survey is described in Fig. 2. Consumers' attitudes were estimated by asking the degree to which they agreed with some statements describing the product using the dimensions of the Food Values. The measures were collected using a 6-point Likert scale, along with an "I don't know" option. Although the original scale included 11 items, we used 12 items and modified another one to determine the perceived convenience of large wild ungulate meat. Respondents were asked to evaluate whether the product is easy to find and to cook instead of asking whether they thought it is "convenient" (the ease with which food is cooked and/or consumed), as proposed by Lusk and Briggeman (2009). The other values considered included safety, nutritional properties, taste, price, naturalness, appearance, environmental impact, fairness, tradition and origin. Notably, all of the items are interpreted in the same direction; the higher that the score that is attributed is, the better that the product is perceived with respect to the item considered.

2.1.2. Scale used to measure attitudes towards hunting

A new scale was created to specifically evaluate consumers' attitudes towards hunting. Fig. 3 shows that the scale includes seven items that are evaluated with the same rules used in the scale for wild game meat. The items used are derived from both the scientific literature (Ljung et al., 2012; Ljung et al., 2015) and the researchers' personal evaluations of what might determine the positive or negative feelings of individuals towards hunting. First, negative attitudes can be caused by perceptions of its environmental impact; thus, two items control for this issue. The first refers to "the respect of the environment", while the second refers to the specific role of hunting in "reducing the problems related to the overpopulation of wild animals". Second, consumers might be concerned about hunting regulations. Three specific items are used to measure this construct; in fact, consumers were asked whether they think that hunting is "well regulated", "conducted in compliance with the laws" and "practised by people that respect regulations". Finally, we asked whether the participants perceived hunting as "traditional" and as a "food production activity that provides food that is suitable for human consumption". We added this question because, although hunting is a traditional method used to procure food, hunters do not need to be food professionals, which could generate a lack of trust between consumers and producers (Gaviglio, Marescotti, & Demartini, 2018). The "I don't know" option was also used on this scale, and the same considerations as discussed in the previous paragraph were included for the case of wild game meat evaluations.

Express how much you agree with the following statements:

I think that hunting:

Completely disagree ☹					Completely agree ☺	I don't know
1	2	3	4	5	6	

1. It is traditional
2. It is well regulated
3. It is conducted in compliance with the laws
4. It is practiced in a manner that respects the environment
5. It reduces problems related to the overpopulation of wild animals in our rural and mountainous areas
6. It can be considered a food production activity that provides food that is suitable for human consumption
7. It is practiced by people who respect the regulations

Fig. 3. Scale used to evaluate attitudes towards hunting.

Table 1
Sample demographic characteristics.

Variable	N	%
Gender		
Male	368	51.0
Female	353	49.0
Age		
20–35	247	34.3
36–45	239	33.1
Older than 45	235	33.6
Area of residence		
Flat areas	366	50.8
Internal mountains	322	44.7
Internal hills	31	4.3
Sea/lake hills	2	0.3
Education		
Elementary school	28	3.9
Middle school	136	18.9
High school	346	48.0
Bachelor's	117	16.2
Master's degree or PhD	94	13.0
Number of children ≤ 18 years old		
0	577	80.0
1	108	15.0
2	32	4.4
≥ 3	3	0.4

2.2. Questionnaire and data

Data were collected from winter 2015 to fall 2016 in northeast Italy via self-completed questionnaires distributed at traditional large retail chains according to some pre-defined requirements. The final sample included 721 completed questionnaires. In accordance with the research aims, vegans and vegetarians were excluded from the survey, as they are not meat consumers. The sample was stratified by age and gender, and a quota sampling method was applied (Levy & Lemeshow, 2013). Furthermore, to collect data from people living both in flat and mountainous areas, half of the data were collected in Milan and Monza (flat areas in Italy) and half in the towns located in the Ossola Valley (Piedmont, Italy, which is a mountainous area). Furthermore, young people, aged between 20 and 45 years old were preferred a priori for the sample to allow us to collect the preferences of "future consumers", while people younger than 18 years old were excluded because in general, they are not responsible for grocery shopping. The participants mostly reside in flat areas and areas with internal mountains (Male = 51%; 20–35 yrs. = 34%, 36–45 = 33%), as described in Table 1. One third of the sample possesses at least a bachelor's degree, and 80% of the respondents do not live with children that are younger than 18 years old. Most of the participants are not hunters (96%) nor do they have a relative who hunts (91%). Notably, the educational level of the sample is greater than the regional average, which is quite common in questionnaire-based surveys, due to self-selection and non-response bias (Hudson, Seah, Hite, & Haab, 2004). The authors acknowledge that this fact might be a limitation of the study and might have introduced some bias to the average estimates of the models in terms of comparisons with the regional population (Bethlehem, 2010). However, it should be remembered that the interviewed sample refers to a specific market segment that differs from the regional population statistics, given that it does not include vegans and vegetarians, and young consumers are preferred a priori; thus, it is difficult to have proper statistics for the reference population.

2.3. Statistical method

2.3.1. The choice experiment: selection of attributes and experimental design

Choice experiments (Hauber et al., 2016; David A. Hensher, Rose, & Greene, 2005; Lancsar, Fiebig, & Hole, 2017; Train, 2009) are used to estimate consumers' preferences for products/services and their attributes. One of the great advantages of CE is that, by asking respondents to choose among alternative versions of a product, it simultaneously allows for inferring the preference for the product and how much the characteristics of the product contribute to determining such preferences. In fact, one of CEs' theoretical pillars derives from Lancastrian consumer theory (Lancaster, 1966), which proposes that utilities for goods can be decomposed into separable utilities for their characteristics or attributes. Utility is derived from the properties/characteristics that goods possess, rather than the goods per se. Therefore, utility becomes a function of commodity characteristics. In CE, the goods valued are decomposed into their key attributes. The researcher associates an array of values (attribute levels) with each attribute, and these values can be qualitative or quantitative, depending on the nature of the attribute considered (in our case, for example, the attribute price is quantitative, while the "origin of the meat" is qualitative). The researcher proceeds to the experimental design, varying the attribute levels to build different choice sets (Fig. 4). Each choice set is composed of a fixed set of "choice options" or "choice profiles".

Participants in CEs are asked to indicate the preferred option among two or more alternatives ("choice options"). According to Lancastrian consumer theory, these alternatives consist of hypothetical or real products characterised by a set of attributes and their respective levels. Choices are repeated to collect more information from each subject and to obtain a more consistent estimation of his/her preferences. In the present research, we designed a CE survey using a self-compiled questionnaire with meat dishes as the product of interest.

Because consumers might be not familiar with an evaluation of RDM, we were careful to reproduce a plausible context of purchasing. Thus, the consumers were asked to choose the preferred dish from a restaurant menu, on which RDM was among the available dishes, along with beef, which is a common dish at restaurants. Asking the consumers to state their preferred option allowed us to determine the trade-off between the two types of meat. The selected attributes for the CE are meat type, type of preparation, origin and price. The attributes and levels are reported in Table 2. The meat types included red deer and beef because we wanted to test the market appeal of venison as a substitute for red meat. The preparation of meats has been considered a strong driver of consumers' choices (Radder, 2002); therefore, we used

If A and B are two dishes on a restaurant's menu, which one would you choose?

Red Deer Meat - Option [A]	Beef - Option [B]
Red deer meat Stew [180 g per portion – Origin of the meat: **Italian Alpine Valley**] Price: 9.00€	Beef carpaccio [90 g per portion – Origin of the meat: **Italy**] Price: 10.50€
○ I would choose A	○ I would choose B
○ I would not choose either of the two options	

Fig. 4. A representative choice set used in the choice experiment, translated from Italian.

Table 2
Product attributes and levels of the choice experiment.

Attributes	Description	Levels
Meat	Type of meat	Deer Beef
Cooking	Type of preparation	Stew – 180 g per portion Carpaccio – 90 g per portion
Origin	Origin of the product	Austria Italy Italian alpine valley
Price	Price per portion	€ 9.00 € 10.50 € 11.50 € 13.00

stew and carpaccio.

Stew was chosen because it represents one of the most traditional preparations used for the meat of wild ungulates (Gaviglio, Demartini, & Marescotti, 2017; Hoffman, Crafford, Muller, & Schutte, 2003), while carpaccio (namely, sliced fresh raw meat) is representative of a gourmet recipe that could be used in restaurants to increase RDM consumption and restaurateurs' profits. In fact, one of the objectives of the study was estimating the presence and dimension of a niche market for gourmet recipes and determining whether there is an opportunity for additional profitability by including a new item on menus. It might be worth noting that this new item enters the menu at low cost for restaurateurs and high cost for consumers. In fact, the type of meat used for this type of dish is the same used for stew preparation, while the portion served is normally half or less than that in the stew.

Two commonly recognised drivers of consumers' preferences and attitudes towards foods are country-of-origin (Lim, Hu, Maynard, & Goddard, 2014; Loureiro & Umberger, 2007; Lusk et al., 2006; Mauracher, Tempesta & Vecchiato, 2013; Tempesta & Vecchiato, 2013) and local labelling (Chang et al., 2016; Hu, Batte, Woods, & Ernst, 2012; Torquati, Tempesta, Vecchiato & Venanzi, 2018). Therefore, we introduced three options for the origin attribute – Austria, Italy and the Italian alpine valley – to determine the potential benefit of using different origin framings for RDM. Finally, we considered the price per portion. The price levels were defined based on direct interviews with four experts from the alpine area, where the survey was conducted (Val D'Ossola, Piedmont – Italy) and can be considered representative of real market prices in the study area. To reduce all of the possible combinations of the full factorial design, we used a labelled, orthogonal and balanced fractional factorial design that included 96 choice options (or choice profiles). The choice tasks were divided into 48 choice sets that each include two choice options and a no-buy option (Dhar & Simonson, 2003). The design was separated into 12 blocks; therefore, each respondent was asked four times to state his/her preferences among the two proposed alternatives and the no-buy option. One of the 48 choice sets used is presented in Fig. 4. Our experimental design was labelled; therefore, option A in the choice task was always RDM, while option B was always beef.

Considering that consumers stated their preferences in a hypothetical context, their choices might have been affected by hypothetical bias (Carlsson, Frykblom, & Lagerkvist, 2005; Hensher, 2010; Murphy, Allen, Stevens, & Weatherhead, 2005). To mitigate the gap between real and hypothetical contexts, the choice tasks were preceded by a cheap talk. This strategy has been proved to reduce hypothetical bias and produce better estimates for consumers' preferences (Tonsor & Shupp, 2011).

2.3.2. Specification of CE models

The analysis of the information collected with the CE was organised in two steps, as described in Fig. 5. Multinomial logit (MNL) and random parameter logit (RPL) models were computed at each step using the RPL estimation to check for the presence of heterogeneous preferences among the sample. In the first step, two models were tested that did not consider the interaction of preferences with individual attitudes (MNL1 and RPL1 models). In the second step, the attitudinal measures towards wild game meat and hunting were included in the basic models, controlling for the effects of the covariates on individuals' preferences (MNL2 and RPL2 models).

Both the RPL1 and RPL2 models assume that the random variables are normally distributed. In both models, all of the variables were dummy coded (with the exception of price, which is a continuous variable) and considered random, with the exception of price, based on the assumption that all of respondents share the same utility of money. MNL1 and RPL1 models share the following specification of utility:

$$U(X_i) = \beta_{deer} \cdot RDM + \beta_{beef} \cdot Beef + \beta_{carp} \cdot Carp + \beta_{ita} \cdot Ita + \beta_{alps} \cdot Alps + \beta_{price} \cdot Price \quad (1)$$

where:

- *RDM* is an alternative specific constant (ASC) for the RDM choice option;
- *Beef* is an ASC for the beef choice option;
- *Carp* is a dummy assuming the value of 1 for the carpaccio presentation of the dish;
- *Ita* is a dummy assuming the value of 1 if the meat origin is Italy;
- *Alps* is a dummy assuming the value of 1 if the meat origin is the Italian Alps; and,
- *Price* is a continuous variable for the price attribute.

$$U(X_i) = \beta_{deer} \cdot RDM + \beta_{beef} \cdot Beef + \beta_{RDMDWEnth} \cdot RDMWEnt + \beta_{RDMDHEnt} \cdot RDMHEnt + \beta_{RDMCarp} \cdot RDMCarp + \beta_{RDMIta} \cdot RDMIta + \beta_{RDMAlps} \cdot RDMAlps + \beta_{bCarp} \cdot BCarp + \beta_{bIta} \cdot BIta + \beta_{bAlps} \cdot BAlps + \beta_{price} \cdot Price \quad (2)$$

In the second utility specification (2), we introduced several interaction variables. Two interaction variables were obtained from the *k*-mean clustering analysis (see paragraph 3.2) aiming to describe the relationships between attitudes towards wild game meat and hunting as well as consumers' preferences. These two variables are as follows:

- *RDMWEnt* interacts the RDM ASC with those classified as positively disposed towards wild game meat; and
- *RDMHEnt* interacts the RDM ASC with those classified as positively disposed towards the practice of hunting.

More specifically, the interaction variables were introduced to check for the presence of niche markets among people positively disposed towards eating wild game meat and to isolate the effects of people opposed to hunting. We include the latter because the RDM proposed in the CE is obtained through hunting.

The remaining interaction variables are all dummies that represent the interactions of *Carp*, *Ita* and *Alps* with the two ASCs, RDM and *Beef*. For instance, *RDMCarp* refers to RDM presented as carpaccio, while *BCarp* refers to beef presented as carpaccio. These interaction variables were introduced because we wanted to test whether the perception of the attributes varied depending on whether they were associated with RDM or beef. In fact, the single attribute levels might assume a different meaning for the participants depending on whether they were associated with RDM or beef. Consider the attribute level Origin-Alps: perceptions about this variable might change if it is associated with RDM (namely, *RDMAlps*, RDM from the Italian Alps) rather than from beef (*BAlps*, beef from Italian Alps). It is possible that it is more important that RDM originates from the Alps than beef.

To calculate the WTP for each of the products' attributes, we applied the following formula:

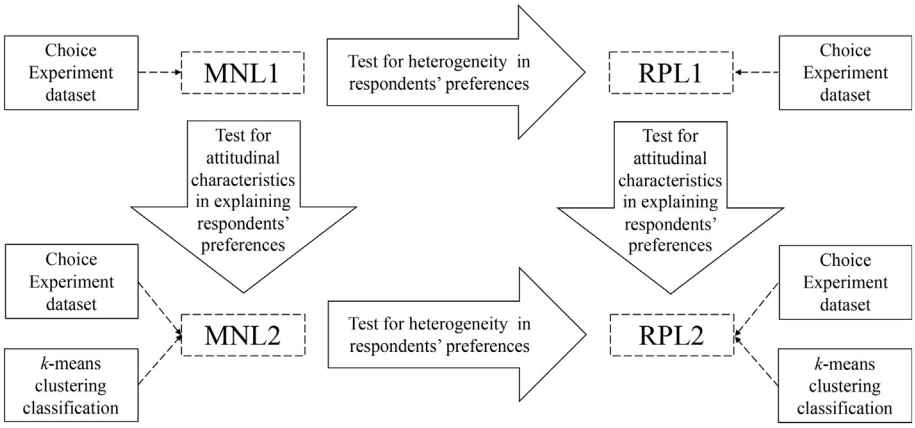

Fig. 5. CE data analysis workflow.

$$WTP_i = -\frac{\beta_i}{\beta_{price}} \quad (3)$$

where i is the *i-th* attribute, β_i is the estimated coefficient for the *i-th* attribute, and β_{price} is the estimated coefficient for the *price* attribute.

3. Results

3.1. Consumption habits and consumers' attitudes towards game meat and hunting

The consumption habits of respondents are summarised in Table 3. Of the participants, 71% indicated that they consumed a portion of wild game meat at least once in the last year, 75% consumed at least one type of meat 2–3 times per week, and 44% consumed red meat at least 2–3 times per week. The information about the consumers' attitudes towards wild game meat and hunting are reported in Table 4. The characteristics considered in the scale contribute differently to creating consumers' attitudes. According to the mean points for each characteristic on a scale ranging from 1 to 6, in order of importance, the participants thought that wild game meat tastes good (4.70), possesses good nutritional properties (4.61), is traditional (4.58) and is safe to eat (4.51). In contrast, consumers stated that it is not easy to cook (3.48), nor is it easy to find (3.39).

Regarding the attitudes for hunting, the participants considered it to be traditional (4.04) and a suitable activity for producing food (3.77), as well as addressing the overpopulation of wild animals in marginal areas (3.75). Conversely, hunters have a bad reputation in terms of consumers' perceptions of their behaviours regarding regulations (3.18). Notably, even if consumers reported having positive attitudes, the rate of "I don't know" responses shows that consumers have strong beliefs for some items, while they are not able to express their opinions about others. According to our results, almost one-quarter of the sample could not state whether the price paid for the meat of wild ungulates is fair, which is a much higher rate than their responses regarding its quality or whether it comes from Italy. Eighteen percent of the respondents did not know whether hunting activity is well regulated or whether hunters respect the national laws.

Table 3
Sample consumption habits.

Variable	N	%
Have you consumed wild game meat in the last year?		
No	212	0.29
Yes	509	0.71
How often do you eat any type of meat?		
1 time per month	19	0.03
1 time every two weeks	41	0.06
1 time per week	134	0.19
2–3 times per week	269	0.37
3–4 times per week	164	0.23
More than 5 times per week	110	0.15
How many times do you eat red meat per month?		
1 time per month	54	0.07
1 time every two weeks	101	0.14
1 time per week	257	0.36
2–3 times per week	199	0.28
3–4 times per week	77	0.11
More than 5 times per week	33	0.05

3.2. Classification of respondents as either positively or negatively disposed towards the product and/or production method

The attitudinal responses were used to classify each respondent as positively or negatively disposed towards wild game meat (*RDMWEnt*) and hunting (*RDMHEnt*) to control whether and how consumers' preferences towards RDM relates to consumers attitudes towards wild game meat and/or hunting. The classification procedure included a *k*-means clustering analysis that resulted in the identification of two clusters; their characteristics are shown in Table 4.

The *k*-means analysis compares the mean attitudes towards the meat of large wild ungulates in two clusters and shows that one group of 409 (56.7%) respondents has more positive attitudes than the remaining 312 (43.3%) respondents. Thus, the first cluster included those consumers that appeared positively disposed towards the product, while the second cluster included those consumers that can be classified as negatively disposed.

Specifically, those who recognised the good attributes of wild game meat referred to the taste, the tradition and the nutritional properties. Conversely, the least important attributes characterising the cluster are convenience in terms of cooking and buying, and the perception of quality, compared to the market price. For the participants who were negatively disposed, the dislike for the product is explained first by a negative perception of its environmental properties and then by issues related to difficulties in cooking and quality compared to price.

Our interpretation regarding the results for the clusters that indicate the attitudes towards wild ungulates meat is similar to the results of the *k*-means cluster analysis applied to the attitudes towards hunting activity. Specifically, the cluster of well-disposed respondents included 366 (50.7%) respondents, and the other 355 (49.3%) consumers had negative views of hunting.

Respondents with a good perception of hunting recognised that it is traditional and that it can be considered both a good way to produce food suitable for human consumption and a tool for reducing the overpopulation of wild animals. The negatively disposed respondents,

Table 4
Expression of agreement with statements regarding wild game meat and hunting and description of the clusters using the two attitudinal scales.

Variable	Mean	Std. Deviation	I don't know		Clusters characteristics				
			N	%	Positive		Negative		p-value[a]
					Mean	Std. Deviation	Mean	Std. Deviation	
"I think that wild game meat [from red deer, roe deer, chamois and wild boar]..."					Attitudes towards game meat[b]				
It is safe to eat	4.51	1.26	75	0.10	4.99	1.00	3.76	1.26	< 0.001
It possesses good nutritional properties	4.61	1.14	115	0.16	5.02	0.90	3.94	1.18	< 0.001
It tastes good	4.70	1.30	71	0.10	5.21	0.94	3.90	1.38	< 0.001
Its price is fair relative to product quality	4.18	1.21	181	0.25	4.10	1.73	1.86	1.84	< 0.001
It comes from a natural production process that does not involve advanced technologies	4.39	1.32	173	0.24	4.75	1.19	3.71	1.28	< 0.001
It is easy to find	3.39	1.43	87	0.12	3.80	1.39	2.75	1.26	< 0.001
It is easy to cook	3.48	1.38	125	0.17	3.64	1.59	1.88	1.61	< 0.001
It is appealing	4.34	1.41	43	0.06	4.94	1.10	2.96	1.72	< 0.001
Its production method respects the environment	4.22	1.39	168	0.23	4.50	1.50	1.58	1.72	< 0.001
It is a source of income in mountainous areas	4.44	1.42	81	0.11	4.91	1.19	3.73	1.43	< 0.001
It is traditional	4.58	1.35	71	0.10	5.07	1.04	3.84	1.42	< 0.001
It has mainly an Italian origin	3.89	1.53	174	0.24	4.33	1.39	3.11	1.45	< 0.001
"I think that hunting..."					Attitudes towards hunting activity[c]				
It is traditional	4.04	1.68	50	0.07	5.10	0.99	2.89	1.52	< 0.001
It is well regulated	3.52	1.51	133	0.18	4.59	1.01	2.41	1.07	< 0.001
It is conducted in compliance with the laws	3.40	1.54	127	0.18	4.43	1.15	2.20	0.98	< 0.001
It is practised respecting the environment	3.45	1.56	116	0.16	4.54	1.08	2.21	1.01	< 0.001
It reduces problems related to the overpopulation of wild animals in our rural and mountainous areas	3.75	1.71	76	0.11	4.88	1.16	2.48	1.27	< 0.001
It can be considered a food production activity suitable for human consumption	3.77	1.62	51	0.07	4.81	1.11	2.63	1.30	< 0.001
It is practised by people who respect the regulations	3.18	1.51	126	0.17	4.14	1.23	2.07	0.95	< 0.001

[a] *F*-test.
[b] *Positively disposed* obs. = 409; *Negatively disposed* obs. = 312.
[c] *Positively disposed* obs. = 366; *Negatively disposed* obs. = 355.

however, seemed more worried about the conduct of hunters with respect to the law in general and particularly, with regard to the environment.

3.3. CE results

Four econometric models were estimated to: (1) control for the validity of the estimation of parameters in terms of magnitude, sign and significance; (2) check for the presence of heterogeneity in the preferences among respondents; and finally, (3) find a model that would produce the most reliable results. CE data were analysed using Stata, version 13, software with the *clogit()* package for MNL models and the *mixlogit()* package (Hole, 2007) for RPL models. The results (Table 5) indicated that the parameters are stable across the models and that, according to the assumption of rationality of the consumer, the sign of the price attribute is always negative, indicating that the higher that the price is, the lower that the utility of respondents was. Furthermore, the results showed that the RPL models performed much better than the MNL models according to all of the statistical indicators (McFadden adj R2, AIC and BIC). Thus, the results for the RPL1 and RPL2 models are considered for the remainder of the discussion.

The RPL models performed better than the MNL models, indicating that preferences present a certain amount of heterogeneity, as confirmed by all of the attribute levels that were assumed to be normally distributed in the RPL1 and RPL2 models having a significant standard deviation, with the exception of *RDMHEnt*, *RDMAlps* and *BIta* in the RPL2 model. The absence of heterogeneity in the preferences in these attributes can be explained by the fact that people in favour of hunting being able to represent a subset of consumers possessing homogeneous preferences for RDM. In addition, as deer typically live in mountainous areas, it is rational to assume that most of the consumers believe that RDM comes from the Alps. As many prior studies have noted, the preference for national products, in terms of food, is quite common (Newman, Turri, Howlett, & Stokes, 2014; Papadopoulos & Heslop, 2014), thus, the same reasoning applies for beef from Italy. *DWEnt* was treated as a fixed parameter in the RPL2 model because according to a preliminary analysis, the preferences were homogeneous for this parameter.

The WTP estimates reported in Table 6 show that, on average, the mean WTP estimates obtained from the RPL2 model were lower than those obtained with the MNL2 model, in which heterogeneity was not considered, despite applying the same utility specification. Furthermore, when the WTP estimates for RDM and beef are compared, it is possible to note that, on average, the mean WTP estimates obtained from the RPL2 model were lower than those obtained with the RPL1 model.

This trend is due to the interaction terms introduced in the RPL2 model. This model, in fact, accounts for the effects of consumers' attitudes towards wild game meat and hunting on preferences for RDM. Thus, the WTP for RDM in the RPL2 model can be considered the mean of the RPL1 model for the RDM attribute after deducing the impact of consumers' attitudes. In the RPL2 model, respondents had a higher average WTP for beef (13.22 €/dish) than for RDM (10.05 €/dish). However, if we consider RDM enthusiasts (56.7% of the sample), the WTP for RDM increases by 18.97 €/dish (29.02 €/dish total), while people that are in favour of hunting (50.7% of the sample) had a mean WTP of 5.15 €/dish (total 15.20 €/dish). For both RDM and beef, respondents showed a positive WTP based on the local origin of the product (either Italy or the Italian Alps), compared to meat coming from abroad (Austria, in our case). More specifically, the WTP for RDM from Italy was 7.20 €/dish higher than that coming from Austria, while that of RDM coming from the Italian Alps was roughly the same (7.56 €/dish). Therefore, the respondents did not place a great premium price on RDM from the Italian Alps compared to Italy, likely because they assumed that RDM, even if it is Italian, comes from the Italian Alps, where red deer are hunted. Regarding the presentation of the dish, for

Table 5
Choice experiment results.

	MNL1	RPL1	MNL2	RPL2
Estimated parameters°°				
RDM	0.92[0.50,1.33]***	2.45[1.43,3.46]***	0.59[0.11,1.06]*	1.76[0.40,3.11]*
Beef	0.83[0.41,1.24]***	2.18[1.18,3.18]***	0.58[0.13,1.03]*	2.31[1.03,3.59]***
Carpaccio	−0.67[−0.79,-0.56]***	−1.97[−2.39,-1.55]***		
Italy	0.77[0.65,0.90]***	1.65[1.31,1.99]***		
Alps	1.08[0.95,1.20]***	2.52[2.11,2.93]***		
RDM * WEnt (RDMHEnt)			1.05[0.87,1.23]***	3.31[2.46,4.17]***
RDM * HEnt (RDMHEnt)			0.21[0.04,0.39]*	0.90[0.17,1.63]*
RDM * Carpaccio (RDMCarp)			−1.02[−1.18,-0.85]***	−3.52[−4.35,-2.68]***
RDM * Italy (RDMIta)			0.53[0.26,0.80]***	1.26[0.54,1.97]***
RDM * Alps (RDMAlps)			0.79[0.51,1.08]***	1.32[0.66,1.99]***
Beef * Carpaccio (BCarp)			−0.42[−0.58,-0.25]***	−1.96[−2.60,-1.32]***
Beef * Italy (BIta)			0.87[0.60,1.14]***	1.58[1.00,2.16]***
Beef * Alps (BAlps)			1.46[1.20,1.73]***	4.87[3.67,6.06]***
Price	−0.04[−0.07,-0.00]*	−0.13[−0.21,-0.05]**	−0.04[−0.08,-0.00]*	−0.17[−0.28,-0.07]**
SD of random parameters°				
RDM		2.81[2.32,3.31]***		3.29[2.57,4.02]***
Beef		2.28[1.84,2.72]***		2.78[2.18,3.39]***
Carpaccio		3.14[2.59,3.69]***		
Italy		1.89[1.38,2.41]***		
Alps		2.15[1.60,2.70]***		
RDM * HEnt (RDMHEnt)				0.06[−0.96,1.09]
RDM * Carpaccio (RDMCarp)				4.72[3.59,5.85]***
RDM * Italy (RDMIta)				1.67[0.51,2.83]**
RDM * Alps (RDMAlps)				0.83[−0.47,2.13]
Beef * Carpaccio (BCarp)				3.97[2.96,4.98]***
Beef * Italy (BIta)				0.21[−1.89,2.31]
Beef * Alps (BAlps)				5.82[4.16,7.48]***
N obs.	8652	8652	8652	8652
LL	−2765.82	−2403.34	−2652.91	−2328.45
adj. R^2	0.127	0.241	0.163	0.265
AIC	5543.64	4828.68	5327.83	4696.89
BIC	5586.03	4906.4	5405.55	4838.2

Note: 95% confidence intervals appear in squared brackets.
° random parameters are assumed to be normally distributed.
°° the names of the variables used in the utility formulas appear in brackets.
* $p < .050$.
** $p < .010$.
*** $p < .001$.

both meat types, the WTP for carpaccio was lower than that for stew (−20.14 €/dish for RDM, −11.23 €/dish for beef). Nevertheless, these data should be interpreted carefully. In fact, carpaccio is more suitable as an appetiser, and the amount of meat in a stewed dish (180 g) is double than that used for carpaccio (90 g). Therefore, the price of the serving is expected to be lower; i.e., the preference for the option presented as “90 g of carpaccio” is expected to be lower than that for a portion of “180 g of stew”. Furthermore, it is worth noting that carpaccio is uncooked meat; therefore, a certain portion of the sample is likely to be averse to this attribute. However, if we consider, for example, the WTP of an RDM enthusiast (29.02 €/dish) and lower it by the WTP for the carpaccio presentation (−20.14 €/dish), the final WTP for the carpaccio serving for RDM enthusiasts is roughly 8.88 €/dish, which is still positive.

The relevant and significant impact of consumers' attitudes on their WTPs suggests that different segments of consumers might represent a potential market for RDM. To explore such a hypothesis, it is necessary to move from considering the sample mean WTPs to individual

Table 6
Mean willingness to pay estimates - €/dish.

	WTP* - MNL1	WTP* - RPL1	WTP* - MNL2	WTP* - RPL2
RDM	25.42 [10.66,40.18]	18.84 [13.24,24.45]	14.59 [7.40,21.78]	10.05 [5.98,14.11]
Beef	22.94 [10.52,35.36]	16.78 [12.45,21.11]	14.48 [8.44,20.52]	13.22 [10.26,16.19]
Carpaccio	−18.68 [−37.27,-0.10]	−15.17 [−25.13,-5.20]		
Italy	21.47 [0.20,42.73]	12.71 [4.41,21.00]		
Alps	29.86 [0.41,59.31]	19.40 [6.85,31.94]		
RDM * WEnt			26.13 [2.06,50.20]	18.97 [7.30,30.63]
RDM * HEnt			5.33 [−1.20,11.86]	5.15 [0.19,10.11]
RDM * Carpaccio			−25.36 [−48.74,-1.98]	−20.14 [−32.37,-7.92]
RDM * Italy			13.32 [−0.48,27.12]	7.20 [1.40,13.00]
RDM * Alps			19.79 [0.45,39.14]	7.56 [1.62,13.51]
Beef * Carpaccio			−10.35 [−20.61,-0.10]	−11.23 [−18.44,-4.02]
Beef * Italy			21.63 [0.91,42.36]	9.06 [2.92,15.20]
Beef * Alps			36.47 [2.75,70.18]	27.85 [10.90,44.80]

* €/dish, confidence intervals appear in squared brackets.

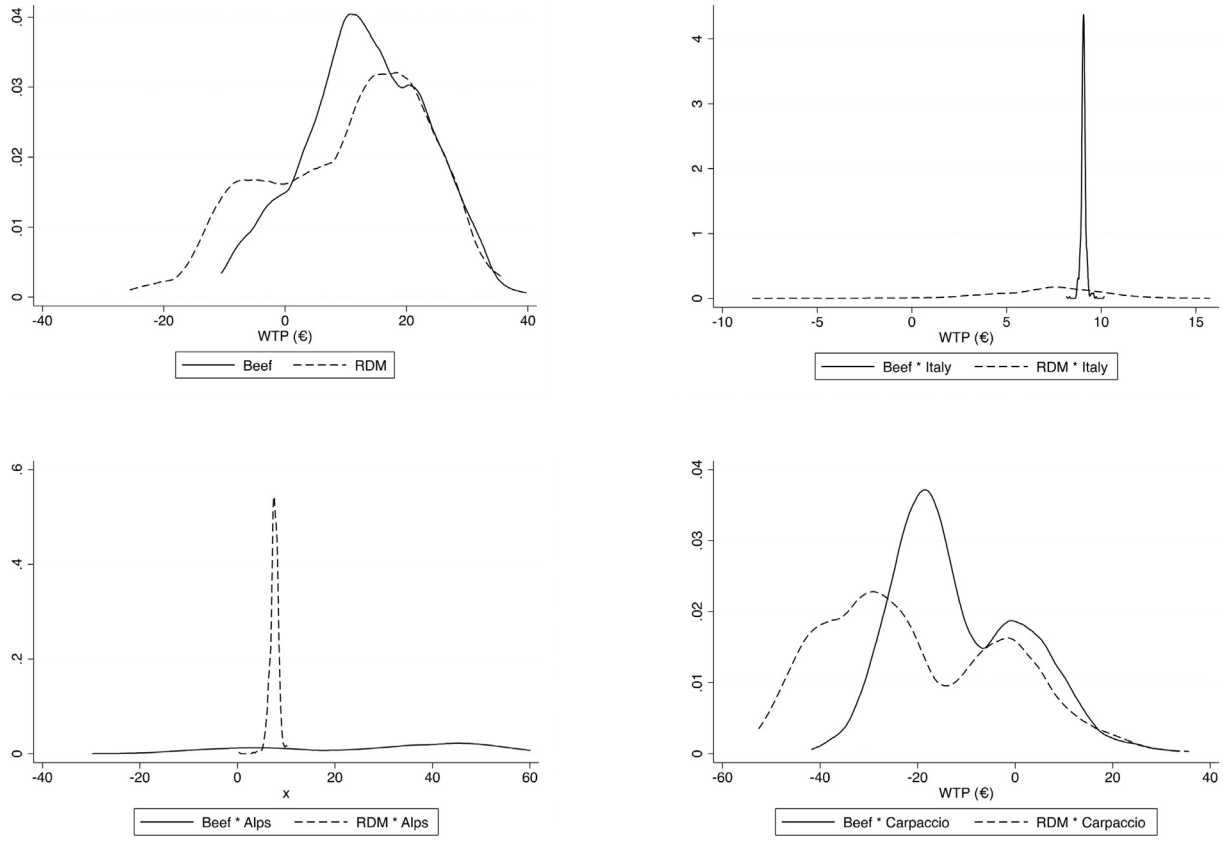

Fig. 6. Kernel density functions of WTP distributions of the random parameters in the RPL2 model.

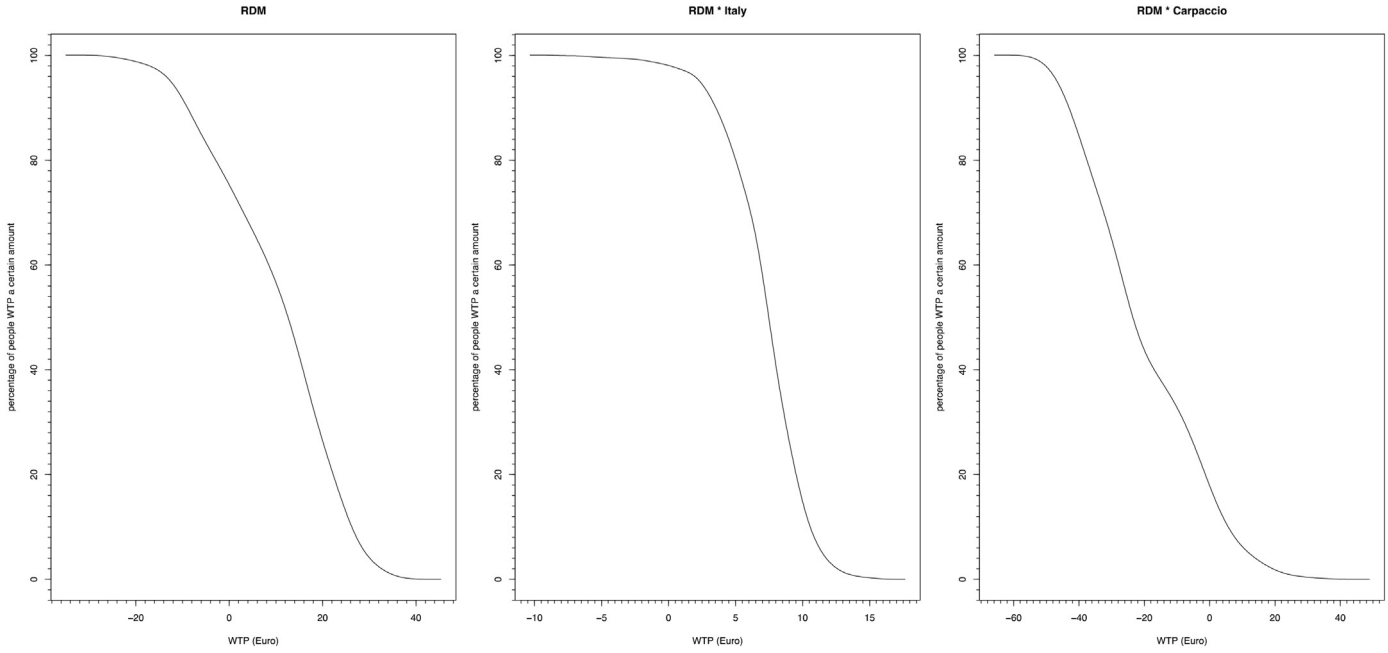

Fig. 7. Inverse cumulative density distributions of individual WTP for the RDM random parameters.

preferences and therefore individual WTPs in order to examine the potential of niche markets (Campbell & Doherty, 2013) for RDM. Thus, we analysed the kernel density functions (Fig. 6) and then the respective inverse cumulative density distribution (ICDF) (Fig. 7) of the individual WTPs obtained from the random parameters in the RPL2 model (Lusk & Hudson, 2004; Lusk & Schroeder, 2006; Vecchiato & Tempesta, 2015). The ICDF allows us to determine the number of respondents in the sample that has a WTP that is greater or equal to a specific price. Therefore, it allows us to find the market share for each price of a specific good. The importance of niche markets and the role of the ICDF in identifying these markets and the profit-maximising price are described in detail in Lusk and Hudson (2004). These authors emphasised the importance of reporting the distribution of individual WTPs for NFP in agribusiness studies, in which sellers can exercise some

degree of market power and are interested in considering the demand curve to find the price that maximises their profit, rather than the mean price that people are willing to pay. In this respect, the ICDF can be considered an approximation of a demand curve, under the assumption that price equals the WTP, and the quantity purchased by each individual equals one. The ICDF can then be used in conjunction with simulations of the frequency of purchases to relax the hypothesis of individual quantity purchased and to mimic a classic demand curve. From a mathematical viewpoint, the dependent variable in the ICDF is the integral of the kernel density function (Fig. 6) for the values on the right (which are therefore greater) of a certain WTP (reported on the X axis).

Our analysis (Fig. 7) indicates that nearly 75.3% of the sample had a positive WTP for RDM meat, 17.8% for RDM presented as carpaccio and 98.1% for RDM with Italian origins. This outcome is important, particularly for the attribute levels with a negative mean WTP, such as carpaccio, and it helps us to determine whether the heterogeneity of the preferences of respondents can identify niche markets with a positive WTP. In this respect, there is a niche market for RDM presented as carpaccio that includes nearly 18% of the respondents. These respondents had the WTP as much or more for RDM presented as carpaccio than for stew.

4. Discussion

The results of our study provide quite interesting insights regarding the wild game meat market in Italy and particularly the market for RDM.

The first objective of our study was to analyse consumers' general preferences and WTP for RDM. Our results indicate that, on average, consumers show good appreciation for RDM and have WTP that is nearly 12% more for this type of meat than for beef ceteris paribus (RPL1 model). Furthermore, this study confirms previous findings reported in the consumer research literature on the origin of food products. Our study shows that the preference for local or national food is strong even for wild game meat, which aligns with studies conducted by other authors on other food products (Lim et al., 2014; Loureiro & Umberger, 2007; Lusk et al., 2006; Mauracher, Tempesta, & Vecchiato, 2013; Tempesta & Vecchiato, 2013). Local products, from either Italy or the Alps, are preferred over imported products; however, consumers have the same preference for meat from Italy and the Italian Alps. One original attribute considered in our analysis is the preparation of the meat; our results show that although, on average, the WTP for carpaccio is lower than that for stewed meat, a niche market exists for carpaccio RDM because 18% of the sample had a positive WTP for this dish. Our analysis aligns with previous findings on people's stated willingness to try new preparations of traditional products (Cosmina et al., 2012; de Godoy et al., 2013; Stolzenbach, Bredie, & Byrne, 2013). The results showed that the introduction of RDM carpaccio could be a valid strategy for expanding the RDM market; however, the price of the dish should be carefully determined. In fact, keeping the price of RDM carpaccio 5€ lower than its stewed counterpart would expand the niche market to 26% of the sample in this study.

The second objective of our study was to verify consumer attitudes towards wild game meat and hunting based on their preferences. In our opinion, this objective is a key aspect for the expansion of the wild game meat market and has important consequences for the provision of sustainable meat that preserves local food and traditions and has important nutritional properties. We separated our respondents using *k*-means clustering analysis. According to our results, 56.7% of the sample could be considered to have a positive attitude towards wild game meat (Table 4), while 50.7% was classified as having a positive opinion of hunting (Table 4). The inclusion of this characterisation in our CE analysis (RPL2 model - Table 5 and Table 6) confirmed previous research findings that highlighted how positive attitudes towards a product (*DWEnth*) (Ljung et al., 2012; Ljung et al., 2015) or being positively disposed towards hunting (*DHEnth*) (Tidball et al., 2014) increases the WTP for wild game meat. Nevertheless, attitudes towards the product had a stronger effect than hunting in determining the probability of choosing RDM. The effect of a positive attitude towards wild game meat is more than 3 times greater of that in favour of hunting. Therefore, a person with a positive attitude towards wild game meat has a WTP of 18€ for RDM, while the WTP of one who has a positive attitude towards hunting drops to 5€ (RPL2 model - Table 6).

In considering what determines these positive attitudes, we could derive some implications. For instance, consumers recognize that wild game meat has good nutritional properties. Thus, this aspect should be emphasised when marketing venison. Furthermore, respondents who are positively disposed to RDM appear to be unfamiliar with buying and cooking it and are unsure about the quality cues that could be used to evaluate it. We assume that this unfamiliarity is related to the fact that wild game meat is not being available for sale at food retailers or traditional groceries, indicating that the average Italian consumers has never bought, cooked or evaluated the product in his/her household setting. This fact must be considered when attempting to sell wild game meat directly to consumers through food shops. In contrast, the most interesting insights stem from the main reason why some people dislike hunting. The cluster analysis revealed that the main issue responsible for negative attitudes towards hunting is that some hunters violate the regulations. Thus, a public intervention in terms of hunters training and regulation is required to increase hunters' awareness about their role in society, which can also decrease consumers' scepticism.

The respondents who appreciated the good attributes of wild game meat referred to the taste, the tradition and the nutritional properties. For this cluster, the least important attributes include the convenience of cooking and buying the product as well as the perception of quality compared to the market price. For the negatively disposed respondents, the dislike for the product is explained first by a negative perception of environmental properties and then by issues related to difficulties in cooking and quality compared to price.

The cluster of respondents who were in favour of hunting included 366 respondents, and the remaining 355 consumers belonged to the cluster that was poorly disposed to hunting. Respondents with a good perception of hunting recognised that it is a tradition and is both a good way to produce food suitable for human consumption and a tool for reducing the overpopulation of wild animals. The respondents who were averse to hunting, however, seemed more worried by the conduct of hunters regarding the law in general and particularly with regard to the environment.

Regarding the third objective of our study, one interesting aspect that emerged from our research is that the analysis of the mean WTP values might be misleading, particularly for niche market products. In fact, the analysis of the heterogeneity of the preferences of the respondents revealed that although the mean WTP for certain attributes was negative, the heterogeneity of preferences showed that important niche markets might still exist, which was the case of the carpaccio attribute of RDM, for which 18% of the respondents had a positive WTP. Therefore, when an attribute presents a certain degree of heterogeneity among respondents, we suggest computing and evaluating the inverse cumulative distribution function of its individual WTP. This approach provides a graphic representation of the dispersion of the preferences and helps researchers to visualize marketing niches at a glance – a powerful tool for marketing and policy decisions.

5. Conclusions

This paragraph summarizes the main findings of our research. On average, consumers show a good appreciation for RDM and have the WTP that is nearly 12% more for this type of meat than for beef ceteris paribus (RPL1 model). Our study shows that the preference for local or national food is strong even for wild game meat: 56.7% of the sample can be considered to have a positive attitude towards wild game meat,

while 50.7% is classified as having a positive opinion of hunting. Positive attitudes towards a product (*DWEnth*) or being positively disposed to hunting (*DHEnth*) increases the WTP for wild game meat. According to our results, a positive attitude towards wild game meat has an effect on the WTP for RDM that is more than 3 times greater than being in favour of hunting. The analysis of the heterogeneity of the preferences of the respondents using the inverse cumulative distribution function of individual WTP allowed us to find the presence of a quite important niche market for the food served as carpaccio, for which 18% of the respondents had a positive WTP.

This paper confirms that venison can be considered to be a meat for modern consumers, as suggested by Hoffman and Wiklund (2006), and we are reasonably confident that our study provides some new, useful information. The analysis of consumers' preferences for the different attributes of RDM, in fact, demonstrated that a traditional and local food can be marketed as an innovative food. The CE method was beneficial for collecting a large amount of information at a relatively low cost, proving it to be an essential tool for researchers interested in analysing niche markets.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.meatsci.2018.07.031.

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