

Accepted Manuscript

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

Demartini Eugenio, Vecchiato Daniel, Tempesta Tiziano, A.M. Gaviglio Anna, Viganò Roberto



PII: S0309-1740(18)30070-6
DOI: doi:[10.1016/j.meatsci.2018.07.031](https://doi.org/10.1016/j.meatsci.2018.07.031)
Reference: MESC 7645
To appear in: *Meat Science*
Received date: 26 January 2018
Revised date: 8 May 2018
Accepted date: 26 July 2018

Please cite this article as: Demartini Eugenio, Vecchiato Daniel, Tempesta Tiziano, A.M. Gaviglio Anna, Viganò Roberto , Consumer preferences for red deer meat: A discrete choice analysis considering attitudes towards wild game meat and hunting. Mesc (2018), doi:[10.1016/j.meatsci.2018.07.031](https://doi.org/10.1016/j.meatsci.2018.07.031)

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

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

Demartini Eugenio^a, Vecchiato Daniel^{b,*}, Tempesta Tiziano^b, Gaviglio Anna A. M.^a, Viganò Roberto^{c,d}

^aVESPA, Department of Health, Animal Science and Food Safety, University of Milano, Via Celoria 10, 20133 Milano (MI), Italy

^bLEAF, Department of Land, Environment, Agriculture and Forestry, University of Padova, Campus di Agripolis, Viale dell'Università 16, 35020 Legnaro (PD), Italy

^cAlpVet, Studio Associato AlpVet, Crodo (VB), Italy

^dArs.Uni.VCO, Ass.ne per lo sviluppo della cultura, degli studi universitari e della ricerca nel Verbano Cusio Ossola, Via Antonio Rosmini, 24 - 28845 - Domodossola (VB) - Italy

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 toward wild game meat and hunting might influence such preferences. This is achieved by combining the results of a *k*-means clustering analysis of the attitudes collected by means of two valuation scales with a choice experiment (CE). According to our results, a positive attitude toward wild game meat has an effect on the willingness to pay 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. Looking only at the mean estimates for carpaccio without considering heterogeneity would lead to neglecting 18% of the sample with a positive willingness to pay (WTP) for this attribute level.

Keywords

Red deer, Meat, Wild meat, Choice experiment, Consumer preferences, Hunting

*corresponding author: daniel.vecchiato@unipd.it

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 in comparison 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 red meat, 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 maintain 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 healthy and 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 linked to wild game meat consumption, namely the possible chemical (Paulsen, Bauer, Vodnasnky, Winkelmayr, & Smulders, 2011) and microbiological contamination (Atanassova, Apelt, Reich, & Klein, 2008; Avagnina et al., 2012; Gill, 2007). All the most common large wild ungulates have been investigated in term of toxic metals residuals. For example, Lehel et al. (2016) found that the consumption of Hungarian meat of roe deer may expose to very low concentration of lead and mercury, while no risk have been calculated for cadmium and arsenic. A second study underlines also that the threat for venison consumer is strictly related to the pollution of the areas where the animals reside (Durkalec et al., 2015). Considering the microbiological safety issue, wild game meat consumption may present some risks related to *Toxoplasma spp.* (Formenti et al., 2016; Formenti et al., 2015), *Hepatitis E Virus* (HEV) (Martelli et al., 2017), *Cryptosporidium spp.* e *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; Winkelmayr & 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 source of microbial corruption. The same reasoning applies when considering meat quality. Indeed, good hunting practices guarantee the decrease of the pH of the meat preserving the optimal sensory characteristics of the product (Pollard, Stevenson-Barry, & Littlejohn, 1999; Viganò, Aprico, et al., 2017; Viganò, Cottini, & Fili, 2017; Wiklund, Manley, & Littlejohn, 2004). Finally, the microbiological risks linked to wild game meat consumption may increase during the meat preparation phase. For instance, the risks from *Toxoplasma gondii* can be removed by eating at 67°C the meat (Dubey, Kotula, Sharar, Andrews, & Lindsay, 1990) or freezing at -12°C for 48 hours (Kotula et al., 1991). On the other hand, HEV is removed by heating at 71°C for 20 minutes, but resists for 30 days at -20°C (Cook & van der Poel, 2015).

Building on these considerations, it is important to underline that only wild large ungulates meat deriving from animals that live in unpolluted areas, hunted and prepared according to good and strict practices should be considered a good substitute of 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 in the past few years, the adverse outcomes of the (possible) overconsumption of red meat (Larsson & Orsini, 2013; Pan et al., 2012). Wild game meat may 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 understand consumers' attitudes towards hunting as a method of meat provision:

- (1) the purchase of hunted game may 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 has increased in 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 address 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 toward 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 role 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 toward 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 that is collected from respondents. Second, policy-makers may 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 those directly involved in the supply chain for wild game meat.

2 Material and methods

This study combines the CE and a series of questions related to respondents' attitudes towards wild game meat and hunting (Figure 1) in the same questionnaire. The CE helps us understand consumer preferences and determine the monetary value placed by consumers on the various

attributes considered. Moreover, two specific attitudinal scales were created to measure the impact of attitudes on preferences. Specifically, *k*-means clustering was separately applied on the items of the two scales, which allowed 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 toward wild game meat and hunting for explaining consumer preferences, along with the other attributes included in the CE.

[Figure 1 about here]

To determine if 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 performances, confirming that the items capture the selected attitudes, for sake of brevity, the results of the reliability and validity analysis are presented in supplementary materials.

2.1 Attitudinal scales

2.1.1 Scale used for the measurement of attitudes toward large wild ungulates meat

The scale used to measure consumers' attitudes toward 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 Figure 2. Consumers' attitudes were estimated by asking the degree to which they agree with some statements describing the product using the dimensions of the food values. The measures are collected using a 6-point Likert scale, along with an "I don't know" option. Although the original scale includes 11 items, we used 12 items because we introduced one item and modified another one to determine the perceived convenience of large wild ungulate meat. Specifically, respondents were asked to evaluate if the product is easy to find and to cook instead of asking if they think it is "convenient" (the ease with which food is cooked and/or consumed), as proposed by Lusk and Briggeman (2009) in their Food Values scale. The other values considered include safety, nutritional properties, taste, price, naturalness, appearance, environmental impact, fairness, tradition and origin. Notably, all the items are interpreted in the same direction; the higher the score that is attributed, the better the product is perceived with respect to the item considered.

[Figure 2 about here]

2.1.2 Scale used for the measurement of attitudes toward hunting

A new scale was created to specifically evaluate consumers' attitudes towards hunting. Figure 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., 2015; Ljung et al., 2012) and the researchers' personal evaluations of what might determine the positive or negative feelings of individuals towards hunting. First, negative attitudes may be caused by perceptions of its environmental impact; thus, two items control for this issue. The first one 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 may be concerned about hunting regulations. Three specific items are used to measure this construct; in fact, consumers are asked if they think that hunting is "well regulated", "conducted in compliance with the laws" and "practised by people that respect regulations". Finally, we asked if the participants perceived hunting as "traditional" and as a "food production activity that provides food that is suitable for human consumption". We add this question because even if 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 used also in this scale, and the same considerations as discussed in the previous paragraph were included for the case of wild game meat evaluations.

[Figure 3 about here]

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 to 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, 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. A 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. Most of the participants are not hunters (96%) nor do they have a relative who hunts (91%). It is worth noting that the educational level of the sample is above the regional average. This is quite common in questionnaire-based survey, due to self-selection and non-response bias (Hudson, Seah, Hite, & Haab, 2004). The authors acknowledge that this might be a limitation of the study and might introduce some bias in the average estimates of the models in terms of comparison 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.

[Table 1 about here]

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 asking respondents to choose among alternative version of a product, it simultaneously allows to infer the preference for the product and how much the characteristics of such product contribute in determining such preference. In fact, one of CE's theoretical pillars derives from Lancasterian 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 in the experiment design, varying the attribute levels in order to build different choice sets (Figure 4). Each choice set is composed by 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 the Lancasterian 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 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.

As consumers could 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, where RDM was among the available dishes along with beef, a common dish at restaurants. Asking 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. Meat types include 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 to be a strong driver of consumers’ choices (Radder, 2002); therefore, we used stew and carpaccio.

[Table 2 about here]

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’ profit. One of the objectives of the study is 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 costs 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 stew.

Two commonly recognized 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). Therefore, we introduced three options for the origin attribute, including 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 markets prices in the study area. To reduce all possible combinations of the full factorial design, we used a labelled, orthogonal and balanced fractional factorial design that includes 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 to state his/her preferences among the two proposed alternatives and the no-buy option four times. One of the 48 choice sets used is presented in Figure 4. Our experimental design was labelled; therefore, option A in the choice task was always RDM, while option B was always beef.

[Figure 4 about here]

Considering that consumers stated their preferences in a hypothetical context, their choices may be affected by hypothetical bias (Carlsson, Frykblom, & Lagerkvist, 2005; David A 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 Figure 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 that do not consider the interaction of preferences with individual attitudes were tested (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 effect of the covariates on individuals' preferences (MNL2 and RPL2 models).

[Figure 5 about here]

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

(1)

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

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 1 for the carpaccio presentation of the dish;
- *Ita* is a dummy assuming the value 1 if the meat origin is Italy;
- *Alps* is a dummy assuming the value 1 if the meat origin is Italian Alps; and,
- *Price* is a continuous variable for the price attribute.

(2)

$$\begin{aligned} U(X_i) = & \beta_{deer} \cdot RDM + \beta_{beef} \cdot Beef \\ & + \beta_{RDMDWEnt} \cdot RDMWEnt + \beta_{RMDHEnt} \cdot RDMHEnt + \beta_{RDMCarp} \cdot RDMCarp \\ & + \beta_{RDMIta} \cdot RDMIta + \beta_{RDMAlps} \cdot RDMAlps + \beta_{bCarp} \cdot BCarp + \beta_{bIta} \cdot BIta \\ & + \beta_{bAlps} \cdot BAlps + \beta_{price} \cdot Price \end{aligned}$$

In the second utility specification (2), we introduced several interaction variables. Two interaction variables were taken from the *k*-mean clustering analysis (see paragraph 3.2) and aim 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 that are classified as positively disposed towards wild game meat;
- *RDMHEnt* interacts the RDM ASC with those who are 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 who are 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 between *Carp*, *Ita* and *Alps* and 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 if 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 Italian Alps) rather than 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:

(3)

$$WTP_i = -\frac{\beta_i}{\beta_{price}}$$

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 toward 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% consume at least one type of meat 2-3 times per week and 44% consume red meat at least 2-3 times per week. The information on consumers' attitudes towards wild game meat and hunting is 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 think 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). On the other hand, consumers state that it is not easy to cook (3.48) nor is it easy to find (3.39).

Regarding the attitudes for hunting, the participants consider it to be traditional (4.04) and a suitable activity for producing food (3.77) and 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 report having positive attitudes, the rate of "I don't know" responses show that consumers have strong beliefs for some items, while they are not able to express their opinions for 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 much higher rate than their responses regarding its quality or if it comes from Italy. Eighteen percent of the respondents do not know if hunting activity is well regulated or if hunters respect the national laws.

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

The attitudinal responses were used to classify each respondent as positively or negatively disposed towards wild game meat (*RDMWE_{nt}*) and hunting (*RDMHE_{nt}*) to control if and how consumers' preferences towards RDM relates to consumers attitudes toward 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 includes those consumers that appear positively disposed towards the product, while the second cluster includes those consumers that can be classified as negatively disposed.

Specifically, those who recognize the good attributes of wild game meat refer to the taste, the tradition and the nutritional properties. On the other hand, 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 that are negatively disposed, the dislike for the product is explained first by a negative perception of its environmental properties, 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 includes 366 (50.7%) respondents, and the other 355 (49.3%) consumers have negative views of hunting.

Respondents who have a good perception of hunting recognize 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, however, seem 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: (i) control the validity of the estimation of parameters in terms of magnitude, sign and significance; (ii) check for the presence of heterogeneity in the preferences among respondents; and finally, (iii) find the model that will produce the most reliable results. CE data were analysed using Stata 13 software with the *clogit()* package for MNL models and the *mixlogit()* package (Hole, 2007) for RPL models. The results (Table 5) indicate 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, meaning that the higher the price is, the lower the utility of respondents. Furthermore, the results show that the RPL models perform quite better than the MNL models according to all the statistical indicators (McFadden adj R², AIC and BIC). Thus, the results for the RPL1 and RPL2 models will be considered for the remainder of the discussion.

[Table 5 about here]

The RPL models performed better than the MNL models, indicating that preferences present a certain amount of heterogeneity. This is confirmed by the fact that all the attribute levels that were assumed to be normally distributed in the RPL1 and RPL2 models have a significant standard deviation, with the exception of *RDMHEnt*, *RDMAIps* and *BIIta* 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 could represent a subset of consumers who possess homogeneous preferences for RDM. In addition, as deer typically live in mountainous areas, it is rational to assume that most of the consumers consider 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), and 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 are lower than those obtained with the MNL2 model, where heterogeneity is not taken into consideration, despite applying the same utility specification. Furthermore, when the WTP estimates for RDM and beef are compared, it is possible to notice that, on average, the mean WTP estimates obtained from the RPL2 model are lower than those obtained with the RPL1 model.

[Table 6 about here]

This trend is due to the interaction terms introduced in the RPL2 model. This model, in fact, accounts for the effect 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 as the mean of the RPL1 model for the attribute RDM after deducing the impact of consumers' attitudes. In the RPL2 model, respondents have 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) have a mean WTP of 5.15 €/dish (total 15.20 €/dish). For both RDM and beef, respondents show a positive WTP for 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 is 7.20 €/dish higher than that coming from Austria, while that of RDM coming from the Italian Alps is roughly the same (7.56 €/dish). Therefore, the respondents did not place a great premium price on RDM from the Italian Alps with respect to Italy, probably because they assume that RDM, even if it is Italian, comes from the Italian Alps, where red deer are hunted. Regarding the presentation of the dish, for both meat types, the WTP for carpaccio is 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 that used for carpaccio (90 g). Therefore, the price of the serving is expected to be lower, i.e., the preference for the option presenting "90 g of carpaccio" is expected to be lower compared to 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 take, 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 preferences and therefore individual WTPs. When evaluating the heterogeneity of individual WTPs, it is important to understand the potential of niche markets (Campbell & Doherty, 2013) for RDM. Thus, we analysed the kernel density functions (Figure 6) and then the respective inverse cumulative density distribution (ICDF) (Figure 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 have 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 is described in detail in Lusk and Hudson (2004). These authors stress the importance of reporting the distribution of individual WTPs for NFP in agribusiness studies, where sellers can exercise some degree of market power and are interested considering the demand curve to find the price that maximises their profit rather than the mean price people are willing to pay. In this respect, the ICDF can be considered to be 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 on 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 (Figure 6) for the values on the right (which are therefore greater) of a certain WTP (reported on the X axis).

Our analysis (Figure 7) indicates that nearly 75.3% of the sample has a positive WTP for RDM meat, 17.8% for RDM presented as carpaccio and 98.1% for RDM with Italian origins. This is important, particularly for the attribute levels with a negative mean WTP, such as carpaccio, and it helps us 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 have the WTP as much or more for RDM presented as carpaccio than stew.

[Figure 6 about here]

[Figure 7 about here]

4 Discussion

The results of our study provide quite interesting insights regarding the wild game meat market in Italy and in particular 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 a good appreciation for RDM and have the WTP that is nearly 12% more for this kind of meat compared to 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 et al., 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 willingness to pay for carpaccio is lower than stewed meat, a niche market exists for carpaccio RDM because 18% of the sample has 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 show 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 toward wild game meat and hunting based on their preferences. In our opinion, this 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 can be considered as having a positive attitude toward wild game meat (Table 4), while 50.7% is 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) confirms previous research findings that highlight how positive attitudes towards a product (*DWEnt*) (Ljung et al., 2015; Ljung et al., 2012) or being positively disposed to hunting (*DHEnt*) (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 toward wild game meat is more than 3 times greater of that in favour of hunting. Therefore, a person with a positive attitude toward wild game meat has a WTP of 18€ for RDM, while the WTP of one who has a positive attitude toward 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 highlighted 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 available for sale at food retailers or traditional groceries, which implies that the average Italian consumers have never bought, cooked and evaluated the product in his/her household setting. This fact must be considered when trying to sell wild game meat directly to consumers through food shops. On the other hand, the most interesting insights stem from the main reason why some people do not enjoy 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 their awareness about their role in society, which may 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, 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 that have a good perception of hunting recognize 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, seem 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. This 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 visualize marketing niches at a glance, which is 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 kind of meat compared to 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 as having a positive attitude toward wild game meat, while 50.7% is classified as having a positive opinion of hunting. Positive attitudes towards a product (*DWEnt*) or being positively disposed to hunting (*DHEnt*) increases the WTP for wild game meat. According to our results, a positive attitude toward wild game meat has an effect on the willingness to pay 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 WTPs allowed 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 to be an essential tool for researchers interested in analysing niche markets.

Figures

Figure 1 – Framework of the analysis

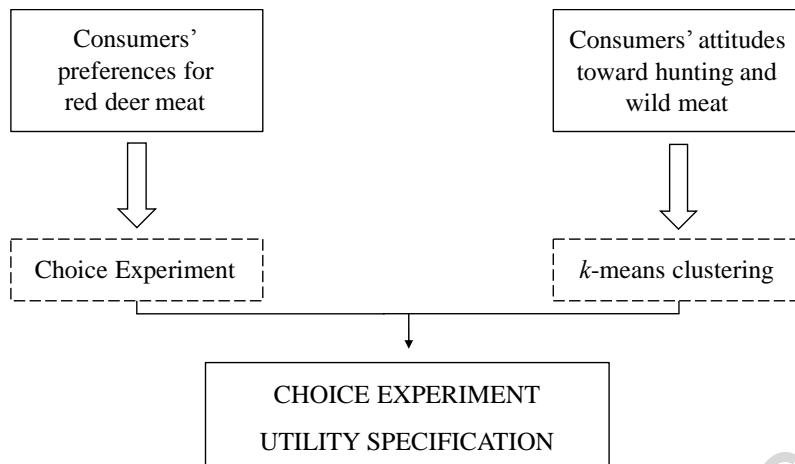


Figure 2 - Scale used to evaluate attitudes toward large wild ungulates meat

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

Figure 3 - Scale used to evaluate attitudes toward hunting

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

Figure 4 - A representative choice set used in the choice experiment; translated from Italian

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€
<input type="radio"/> I would choose A <input type="radio"/> I would choose B <input type="radio"/> I would not choose either of the two options	

Figure 5– CE data analysis workflow

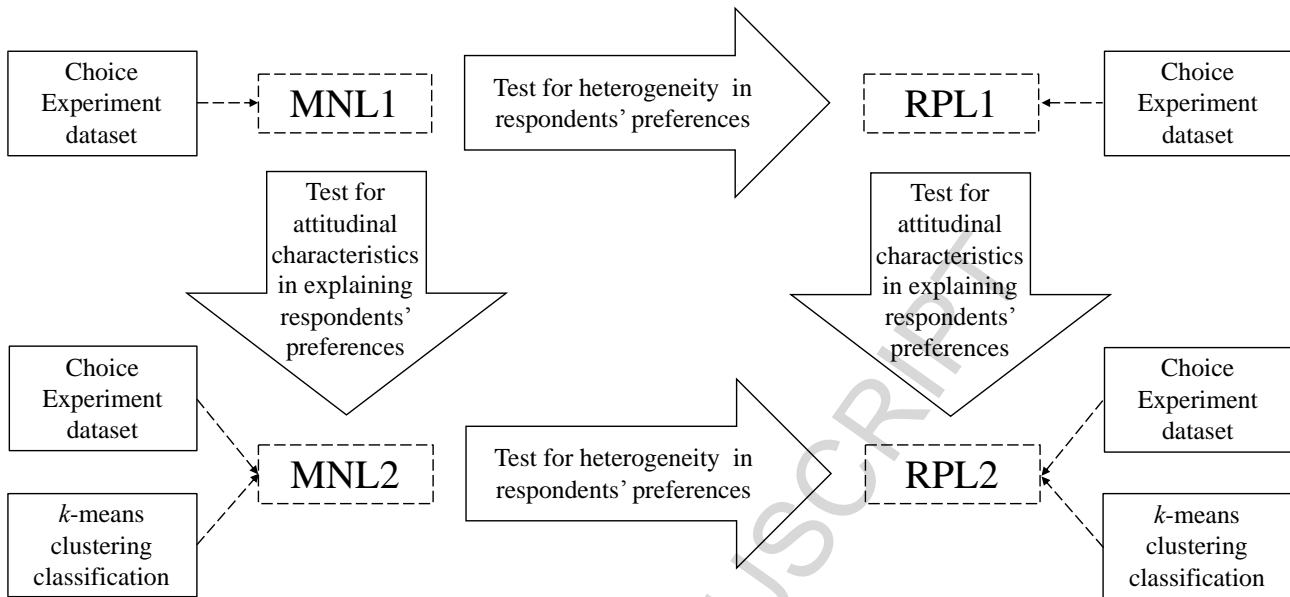


Figure 6 - Kernel density functions of WTP distributions of the random parameters in RPL2 model

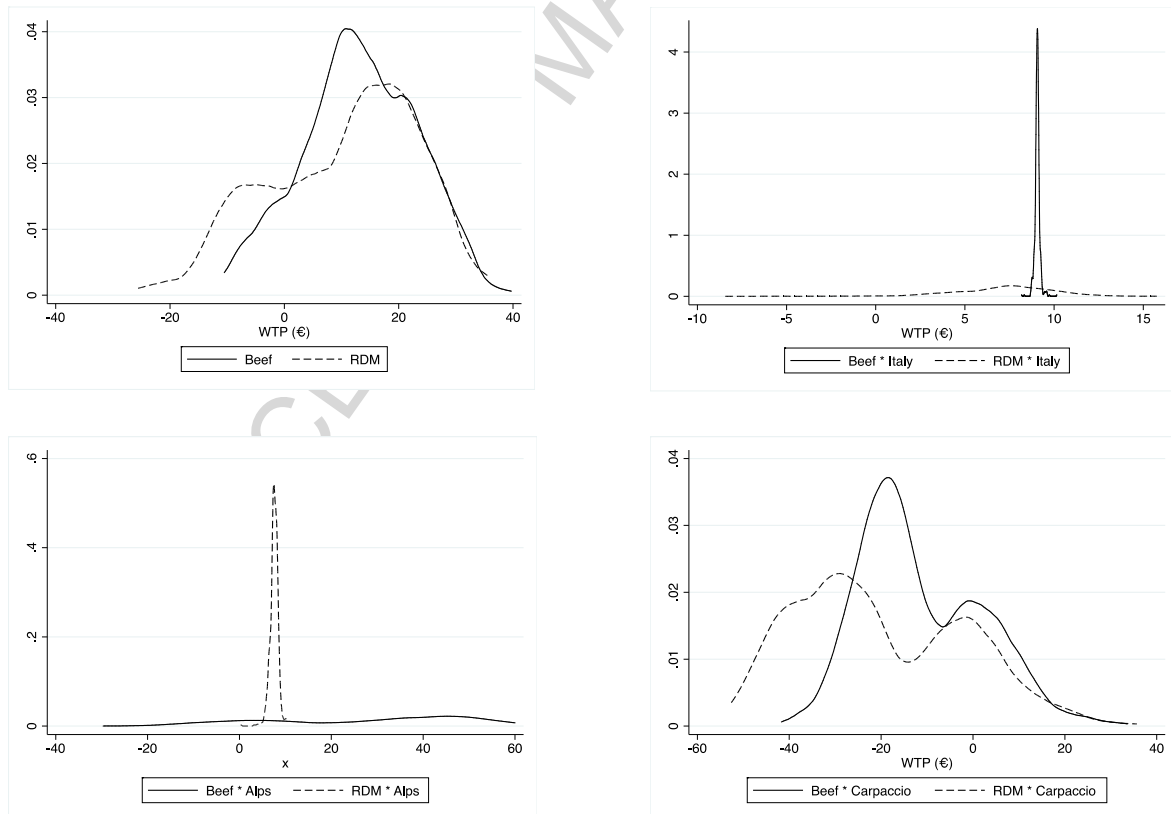
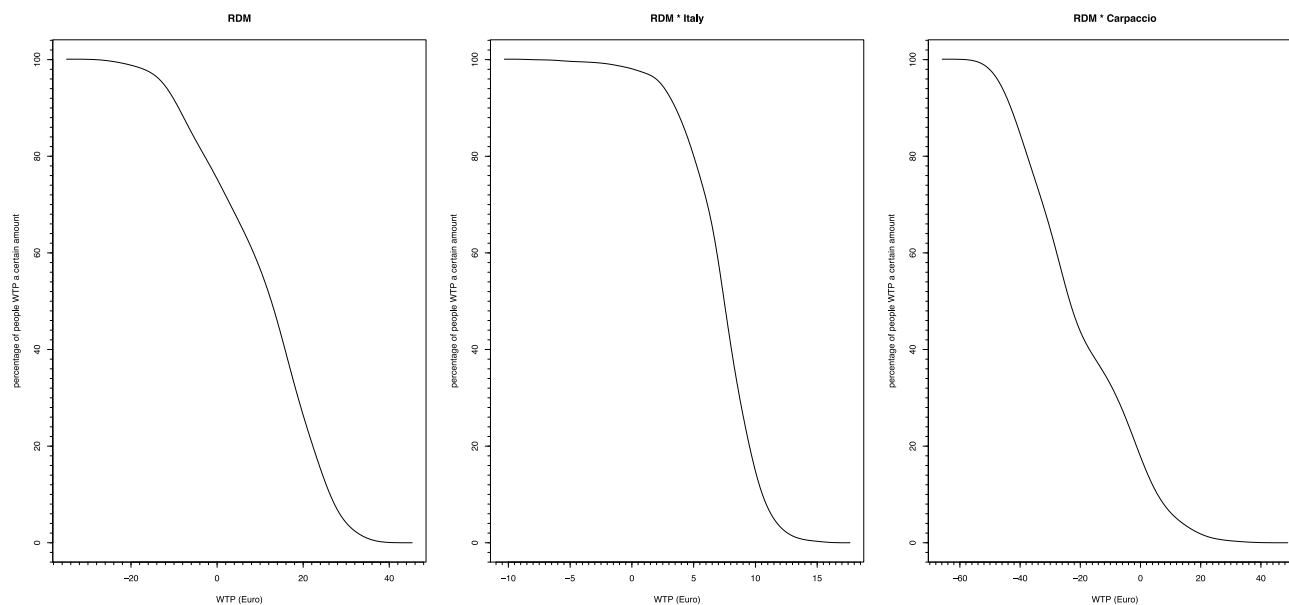


Figure 7 – Inverse cumulative density distributions of individual WTP for the RDM random parameters



Tables

Table 1 - Sample demographic characteristics

Variable	N	%
<i>Gender</i>		
Male	368	0.51
Female	353	0.49
<i>Age</i>		
20-35	247	0.34
36-45	239	0.33
over 45	235	0.33
<i>Area of residence</i>		
Flat areas	366	0.51
Internal mountains	322	0.45
Internal hills	31	0.04
Sea/lake hills	2	0.00
<i>Education</i>		
Elementary school	28	0.04
Middle school	136	0.19
High school	346	0.48
Bachelor's	117	0.16
Master's degree or PhD	94	0.13
<i>Number of children ≤ 18 years old</i>		
0	577	0.80
1	108	0.15
2	32	0.04
≥ 3	3	0.00

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

Table 3 – Sample consumption habits

Variable	N	%
<i>Have you consumed wild game meat in the last year?</i>		
No	212	0.29
Yes	509	0.71
<i>How many times do you eat any type of meat?</i>		
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
<i>How many times do you eat red meat in a month?</i>		
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

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

Variable	I don't know				Clusters characteristics				
	Mean	Std. Deviation	N	%	Positive		Negative		p-value ¹
					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 ²				
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 compared 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 ³				
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

¹F-test; ²Positively disposed obs. = 409; Negatively disposed obs. = 312; ³Positively disposed obs. = 366; Negatively disposed obs. = 355

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]***
<i>N obs.</i>	8652	8652	8652	8652
LL	-2,765.82	-2,403.34	-2,652.91	-2,328.45
adj. R^2	0.127	0.241	0.163	0.265
AIC	5,543.64	4,828.68	5,327.83	4,696.89
BIC	5,586.03	4,906.4	5,405.55	4,838.2

Note: 95% confidence intervals appear in squared brackets

* $p < 0.050$, ** $p < 0.010$, *** $p < 0.001$

° random parameters are assumed to be normally distributed

°° the names of the variables used in the utility formulas appear in brackets

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

References

- Atanassova, V., Apelt, J., Reich, F., & Klein, G. (2008). Microbiological quality of freshly shot game in Germany. *Meat Science*, 78(4), 414-419. doi:<https://doi.org/10.1016/j.meatsci.2007.07.004>
- Avagnina, A., Nucera, D., Grassi, M. A., Ferroglio, E., Dalmaso, A., & Civera, T. (2012). The microbiological conditions of carcasses from large game animals in Italy. *Meat Science*, 91(3), 266-271. doi:<https://doi.org/10.1016/j.meatsci.2012.01.025>
- Barrios-Garcia, M. N., & Ballari, S. A. (2012). Impact of wild boar (*Sus scrofa*) in its introduced and native range: a review. *Biological Invasions*, 14(11), 2283-2300. doi:10.1007/s10530-012-0229-6
- Bethlehem, J. (2010). Selection Bias in Web Surveys. *International Statistical Review*, 78(2), 161-188. doi:10.1111/j.1751-5823.2010.00112.x
- Bruinderink, G. W. T. A. G., & Hazebroek, E. (1996). Ungulate Traffic Collisions in Europe Colisiones de Trápico con Ungulados en Europa. *Conservation Biology*, 10(4), 1059-1067. doi:10.1046/j.1523-1739.1996.10041059.x
- Bureš, D., Bartoň, L., Kotrba, R., & Hakl, J. (2015). Quality attributes and composition of meat from red deer (*Cervus elaphus*), fallow deer (*Dama dama*) and Aberdeen Angus and Holstein cattle (*Bos taurus*). *Journal of the Science of Food and Agriculture*, 95(11), 2299-2306. doi:10.1002/jsfa.6950
- Campbell, D., & Doherty, E. (2013). Combining discrete and continuous mixing distributions to identify niche markets for food. *European Review of Agricultural Economics*, 40(2), 287-312. doi:10.1093/erae/jbs018
- Carlsson, F., Frykblom, P., & Lagerkvist, C. J. (2005). Using cheap talk as a test of validity in choice experiments. *Economics Letters*, 89(2), 147-152.
- Chang, K.-L., Xu, P., Warmann, J., Lone, T., Munzimi, Z.-S., & Opuko, E. (2016). Consumer Characteristics and Willingness to Pay for Locally Produced Product: A Case Study of Ribeye Steaks in the Northern Great Plains. *Journal of Agriculture, Food Systems, and Community Development*, 4(1), 99-121.
- Cook, N., & van der Poel, W. H. M. (2015). Survival and Elimination of Hepatitis E Virus: A Review. *Food and Environmental Virology*, 7(3), 189-194. doi:10.1007/s12560-015-9196-2
- Cosmina, M., Demartini, E., Gaviglio, A., Mauracher, C., Prestamburgo, S., & Trevisan, G. (2012). Italian consumers' attitudes towards small pelagic fish. *New Medit*, 11(1), 52-58.
- de Godoy, R. C. B., Deliza, R., Gheno, L. B., Licodiedoff, S., Frizon, C. N. T., Ribani, R. H., & dos Santos, G. G. (2013). Consumer perceptions, attitudes and acceptance of new and traditional mate tea products. *Food Research International*, 53(2), 801-807. doi:<https://doi.org/10.1016/j.foodres.2013.02.054>
- De Liberato, C., Berrilli, F., Marangi, M., Santoro, M., Trogu, T., Putignani, L., . . . Giangaspero, A. (2015). *Giardia duodenalis* in Alpine (*Rupicapra rupicapra rupicapra*) and Apennine (*Rupicapra pyrenaica ornata*) chamois. *Parasites & Vectors*, 8(1), 650. doi:10.1186/s13071-015-1243-1
- Dhar, R., & Simonson, I. (2003). The Effect of Forced Choice on Choice. *Journal of Marketing Research*, 40(2), 146-160.
- Dubey, J. P., Kotula, A. W., Sharar, A., Andrews, C. D., & Lindsay, D. S. (1990). Effect of High Temperature on Infectivity of *Toxoplasma gondii* Tissue Cysts in Pork. *The Journal of Parasitology*, 76(2), 201-204. doi:10.2307/3283016
- Duff, J. P. (2017). A review of zoonotic disease of UK wild game. In P. Paulsen, A. Bauer, & F. J. M. Smulders (Eds.), *Game meat hygiene - Food safety and security* (pp. 51-59). Wageningen; Netherlands: Wageningen Academic Publishers.

- Durkalec, M., Szkoda, J., Kolacz, R., Opaliński, S., Nawrocka, A., & Zmudzki, J. (2015). *Bioaccumulation of Lead, Cadmium and Mercury in Roe Deer and Wild Boars from Areas with Different Levels of Toxic Metal Pollution* (Vol. 9).
- Font-i-Furnols, M., & Guerrero, L. (2014). Consumer preference, behavior and perception about meat and meat products: An overview. *Meat Science*, 98(3), 361-371.
- Formenti, N., Gaffuri, A., Trogu, T., Viganò, R., Ferrari, N., & Lanfranchi, P. (2016). Spread and genotype of *Toxoplasma gondii* in naturally infected alpine chamois (*Rupicapra r. rupicapra*). *Parasitology Research*, 115(5), 2115-2120. doi:10.1007/s00436-016-4981-x
- Formenti, N., Trogu, T., Pedrotti, L., Gaffuri, A., Lanfranchi, P., & Ferrari, N. (2015). *Toxoplasma gondii* Infection in Alpine Red Deer (*Cervus elaphus*): Its Spread and Effects on Fertility [corrected]. *PLoS One*, 10(9), e0138472. doi:10.1371/journal.pone.0138472
- Gaviglio, A., Demartini, E., & Marescotti, M. (2017). The creation of a local supply chain for large wild ungulates meat: Opportunities and limitation from an Italian alpine case study. *Quality - Access to Success*, 18(S2), 215-222.
- Gaviglio, A., Marescotti, M., & Demartini, E. (2018). The Local Value Chain of Hunted Red Deer Meat: A Scenario Analysis Based on a Northern Italian Case Study. *Resources*, 7(2), 34.
- Geisser, H., & Reyer, H.-U. (2004). Efficacy of hunting, feeding, and fencing to reduce crop damage by wild boars. *Journal of Wildlife Management*, 68(4), 939-946.
- Gill, C. O. (2007). Microbiological conditions of meats from large game animals and birds. *Meat Science*, 77(2), 149-160. doi:<https://doi.org/10.1016/j.meatsci.2007.03.007>
- Gracia, A., & Maza, M. T. (2015). Determinants of the intention to purchase an autochthonous local lamb breed: Spanish case study. *Meat Science*, 110, 212-219. doi:<http://dx.doi.org/10.1016/j.meatsci.2015.07.020>
- Hamlin, R. (2016). Functional or constructive attitudes: Which type drives consumers' evaluation of meat products? *Meat Science*, 117, 97-107. doi:<http://dx.doi.org/10.1016/j.meatsci.2016.02.038>
- Hauber, A. B., González, J. M., Groothuis-Oudshoorn, C. G. M., Prior, T., Marshall, D. A., Cunningham, C., . . . Bridges, J. F. P. (2016). Statistical Methods for the Analysis of Discrete Choice Experiments: A Report of the ISPOR Conjoint Analysis Good Research Practices Task Force. *Value in Health*, 19(4), 300-315. doi:<http://dx.doi.org/10.1016/j.jval.2016.04.004>
- Henchion, M., McCarthy, M., Resconi, V. C., & Troy, D. (2014). Meat consumption: Trends and quality matters. *Meat Science*, 98(3), 561-568.
- Hensher, D. A. (2010). Hypothetical bias, choice experiments and willingness to pay. *Transportation Research Part B: Methodological*, 44(6), 735-752.
- Hensher, D. A., Rose, J. M., & Greene, W. H. (2005). *Applied choice analysis: a primer*. Cambridge: Cambridge University Press.
- Hoffman, L. C., & Bigalke, R. C. (1999). *Utilising wild ungulates from southern Africa for meat production: potential research requirements for the new millennium*. Paper presented at the Congress of the Wildlife Management Association of South Africa.
- Hoffman, L. C., Crafford, K., Muller, N., & Schutte, D. W. (2003). Perceptions and consumption of game meat by a group of tourists visiting South Africa. *South African journal of wildlife research*, 33(2), 125-130.
- Hoffman, L. C., Muller, M., Schutte, D. W., Calitz, F. J., & Crafford, K. (2005). Consumer expectations, perceptions and purchasing of South African game meat. *South African Journal of Wildlife Research-24-month delayed open access*, 35(1), 33-42.
- Hoffman, L. C., & Wiklund, E. (2006). Game and venison – meat for the modern consumer. *Meat Science*, 74(1), 197-208. doi:<http://dx.doi.org/10.1016/j.meatsci.2006.04.005>
- Hole, A. (2007). Fitting mixed logit models by using maximum simulated likelihood. *Stata Journal*, 7(3), 388-401.

- Hu, W., Batte, M. T., Woods, T., & Ernst, S. (2012). Consumer preferences for local production and other value-added label claims for a processed food product. *European Review of Agricultural Economics*, 39(3), 489-510.
- Hudson, D., Seah, L.-H., Hite, D., & Haab, T. (2004). Telephone presurveys, self-selection, and non-response bias to mail and Internet surveys in economic research. *Applied Economics Letters*, 11(4), 237-240. doi:10.1080/13504850410001674876
- Kotula, A. W., Dubey, J. P., Sharar, A. K., Andrews, C. D., Shen, S. K., & Lindsay, D. S. (1991). Effect of Freezing on Infectivity of Toxoplasma Gondii Tissue Cysts in Pork. *Journal of Food Protection*, 54(9), 687-690. doi:10.4315/0362-028x-54.9.687
- Lancaster, K. J. (1966). A New Approach to Consumer Theory. *Journal of Political Economy*, 74(2), 132. doi:10.1086/259131
- Lancsar, E., Fiebig, D. G., & Hole, A. R. (2017). Discrete Choice Experiments: A Guide to Model Specification, Estimation and Software. *PharmacoEconomics*, 35(7), 697-716. doi:10.1007/s40273-017-0506-4
- Larsson, S. C., & Orsini, N. (2013). Red meat and processed meat consumption and all-cause mortality: a meta-analysis. *American journal of epidemiology*, kwt261.
- Lehel, J., Laczay, P., Gyurcsó, A., Jánoska, F., Majoros, S., Lányi, K., & Marosán, M. (2016). Toxic heavy metals in the muscle of roe deer (*Capreolus capreolus*)—food toxicological significance. *Environmental Science and Pollution Research*, 23(5), 4465-4472. doi:10.1007/s11356-015-5658-1
- Levy, P. S., & Lemeshow, S. (2013). *Sampling of populations: methods and applications*: John Wiley & Sons.
- Li, W., Deng, L., Wu, K., Huang, X., Song, Y., Su, H., . . . Peng, G. (2017). Presence of zoonotic *Cryptosporidium scrofarum*, *Giardia duodenalis* assemblage A and *Enterocytozoon bienersi* genotypes in captive Eurasian wild boars (*Sus scrofa*) in China: potential for zoonotic transmission. *Parasites & Vectors*, 10, 10. doi:10.1186/s13071-016-1942-2
- Lim, K. H., Hu, W., Maynard, L. J., & Goddard, E. (2014). A Taste for Safer Beef? How Much Does Consumers' Perceived Risk Influence Willingness to Pay for Country-of-Origin Labeled Beef. *Agribusiness*, 30(1), 17-30.
- Ljung, P. E., Riley, S. J., & Ericsson, G. (2015). Game meat consumption feeds urban support of traditional use of natural resources. *Society & Natural Resources*, 28(6), 657-669.
- Ljung, P. E., Riley, S. J., Heberlein, T. A., & Ericsson, G. (2012). Eat prey and love: Game-meat consumption and attitudes toward hunting. *Wildlife Society Bulletin*, 36(4), 669-675.
- Loureiro, M. L., & Umberger, W. J. (2007). A choice experiment model for beef: What US consumer responses tell us about relative preferences for food safety, country-of-origin labeling and traceability. *Food policy*, 32(4), 496-514.
- Lusk, J. L., & Briggeman, B. C. (2009). Food values. *American Journal of Agricultural Economics*, 91(1), 184-196.
- Lusk, J. L., Brown, J., Mark, T., Proseku, I., Thompson, R., & Welsh, J. (2006). Consumer behavior, public policy, and country-of-origin labeling. *Applied Economic Perspectives and Policy*, 28(2), 284-292.
- Lusk, J. L., & Hudson, D. (2004). Willingness-to-Pay Estimates and Their Relevance to Agribusiness Decision Making. *Applied Economic Perspectives and Policy*, 26(2), 152-169. doi:10.1111/j.1467-9353.2004.00168.x
- Lusk, J. L., & Schroeder, T. C. (2006). Auction Bids and Shopping Choices. In *Advances in Economic Analysis & Policy* (Vol. 6).
- Lusk, J. L., & Tonsor, G. T. (2016). How Meat Demand Elasticities Vary with Price, Income, and Product Category. *Applied Economic Perspectives and Policy*, 38(4), 673-711. doi:10.1093/aep/ppv050
- Martelli, W., Trogu, T., Ferrari, N., Formenti, N., Viganò, R., Pedrotti, L., & Luzzago, C. (2017). Hepatitis E Virus in wild ungulates: serological evidence in chamois and red deer in the

- alps and genetic assessment of viral variants in Europe. *Atti del IV Congresso Nazionale di Ecopatologia della Fauna*. ISBN: 9788894297300.
- Mauracher, C., Tempesta, T., & Vecchiato, D. (2013). Consumer preferences regarding the introduction of new organic products. The case of the Mediterranean sea bass (*Dicentrarchus labrax*) in Italy. *Appetite*, 63(Supplement C), 84-91. doi:<https://doi.org/10.1016/j.appet.2012.12.009>
- Murphy, J. J., Allen, P. G., Stevens, T. H., & Weatherhead, D. (2005). A meta-analysis of hypothetical bias in stated preference valuation. *Environmental and Resource Economics*, 30(3), 313-325.
- Newman, C. L., Turri, A. M., Howlett, E., & Stokes, A. (2014). Twenty years of country-of-origin food labeling research: a review of the literature and implications for food marketing systems. *Journal of Macromarketing*, 34(4), 505-519.
- Pan, A., Sun, Q., Bernstein, A. M., Schulze, M. B., Manson, J. E., Stampfer, M. J., . . . Hu, F. B. (2012). Red meat consumption and mortality: results from 2 prospective cohort studies. *Archives of internal medicine*, 172(7), 555-563.
- Papadopoulos, N., & Heslop, L. A. (2014). *Product-country images: Impact and role in international marketing*: Routledge.
- Papanagiotou, P., Tzimitra-Kalogianni, I., & Melfou, K. (2013). Consumers' expected quality and intention to purchase high quality pork meat. *Meat Science*, 93(3), 449-454. doi:<http://dx.doi.org/10.1016/j.meatsci.2012.11.024>
- Paulsen, P., Bauer, A., Vodnasnky, M., Winkelmayer, R., & Smulders, F. J. M. (2011). *Game Meat Hygiene in Focus - Microbiology, Epidemiology, Risk Analysis and Quality Assurance*. Wageningen; Netherlands: Wageningen Academic Publishers.
- Pollard, J. C., Stevenson-Barry, J. M., & Littlejohn, R. P. (1999). Factors affecting behaviour, bruising and pH in a deer slaughter premises. *Proceedings: New Zealand Society of Animal Production*, 59, 148-151.
- Radder, L. (2002). Restaurants and venison marketing: a South African experience. *Food Service Technology*, 2(3), 109-114. doi:10.1046/j.1471-5740.2002.00044.x
- Ramanzin, M., Amici, A., Casoli, C., Esposito, L., Lupi, P., Marsico, G., . . . Russo, C. (2010). Meat from wild ungulates: ensuring quality and hygiene of an increasing resource. *Italian Journal of Animal Science*, 9(3), e61.
- Sales, J., & Kotrba, R. (2013). Meat from wild boar (*Sus scrofa* L.): A review. *Meat Science*, 94(2), 187-201. doi:<https://doi.org/10.1016/j.meatsci.2013.01.012>
- Stolzenbach, S., Bredie, W. L. P., & Byrne, D. V. (2013). Consumer concepts in new product development of local foods: Traditional versus novel honeys. *Food Research International*, 52(1), 144-152. doi:<https://doi.org/10.1016/j.foodres.2013.02.030>
- Tempesta, T., & Vecchiato, D. (2013). An analysis of the territorial factors affecting milk purchase in Italy. *Food Quality and Preference*, 27(1), 35-43. doi:<https://doi.org/10.1016/j.foodqual.2012.06.005>
- Tidball, K. G., Tidball, M. M., Larson, L. R., Curtis, P. D., Poindexter, L., & Stedman, R. C. (2014). Locavore Preferences for Wild Fish and Game: Implications for Wildlife-based Recreation in New York State.
- Tomasevic, I., Novakovic, S., Solowiej, B., Zdolec, N., Skunca, D., Krocko, M., . . . Djekic, I. (2018). Consumers' perceptions, attitudes and perceived quality of game meat in ten European countries. *Meat Science*, 142, 5-13. doi:10.1016/j.meatsci.2018.03.016
- Tonsor, G. T., & Shupp, R. S. (2011). Cheap talk scripts and online choice experiments: "looking beyond the mean". *American Journal of Agricultural Economics*, 93(4), 1015-1031.
- Train, K. (2009). *Discrete Choice Methods with Simulation* (Second ed.): Cambridge University Press.
- Triumf, E. C., Purchas, R. W., Mielnik, M., Maehre, H. K., Elvevoll, E., Slinde, E., & Egelanddsdal, B. (2012). Composition and some quality characteristics of the longissimus muscle of

- reindeer in Norway compared to farmed New Zealand red deer. *Meat Science*, 90(1), 122-129.
- Valencak, T. G., Gamsjäger, L., Ohrnberger, S., Culbert, N. J., & Ruf, T. (2015). Healthy n-6/n-3 fatty acid composition from five European game meat species remains after cooking. *BMC research notes*, 8(1), 273.
- Vecchiato, D., & Tempesta, T. (2015). Public preferences for electricity contracts including renewable energy: A marketing analysis with choice experiments. *Energy*, 88(Supplement C), 168-179. doi:<https://doi.org/10.1016/j.energy.2015.04.036>
- Viganò, R., Aprico, J., Besozzi, M., Formenti, N., Trogu, T., Donazzolo, C., . . . Lanfranchi, P. (2017). Evaluation of pH in game meat of red deer hunted in autumn in the Western Italian Alps. In P. Paulsen, A. Bauer, & F. J. M. Smulders (Eds.), *Game meat hygiene - Food safety and security* (pp. 241-246). Wageningen; Netherlands: Wageningen Academic Publishers.
- Viganò, R., Cottini, A., & Fili, F. (2017). *Filiera Eco-Alimentare: La valorizzazione delle carni di selvaggina: la gestione di prodotto sostenibile come strumento di stimolo al miglioramento ambientale dei territori alpini.*: ISBN: 9788898357086.
- Wiklund, E., Manley, T. R., & Littlejohn, R. P. (2004). Glycolytic potential and ultimate muscle pH values in red deer (*Cervus elaphus*) and fallow deer (*Dama dama*). *Rangifer*, 24(2), 87-94. doi:10.7557/2.24.2.305
- Winkelmayer, R., & Paulsen, P. (2008). Direct marketing of meat from wild game in Austria. A guide to Good Practice according to Regulations (EEC) 852 and 855/2004. *Fleischwirtschaft*, 88, 122-125.

Highlights

- We analysed consumer attitudes for wild game meat and hunting
- *k*-means clustering was used to categorize respondents according to their attitudes
- Consumer preferences were analyzed with a choice experiment (CE)
- Consumer attitudes were considered in the CE along with consumer choices
- A positive attitude for wild meat has a greater influence on WTP than that for hunting