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(Article begins on next page)

1 **Beef meat preferences of consumers from Northwest Italy: analysis of choice attributes**

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6

7 **ABSTRACT**

8 In this research the importance of several choice attributes of beef for Piedmontese consumers was  
9 examined. The survey was conducted on a sample of consumers in sixteen meat stores in Piedmont,  
10 Northwest Italy. A choice experiment (Best-Worst scaling methodology) was used to identify  
11 consumer preferences and five clusters of purchaser. The responses were also analyzed on the basis  
12 of two variables, the frequency of meat consumption and the place of purchase. Piedmontese  
13 consumers considered “price” as the most important factor in meat purchasing, but “animal  
14 welfare” considerations played some part too.

15

16

17 *Keywords:* choice factors, consumer, beef meat, Best Worst Analysis, price, animal welfare

18

## 19 **1. INTRODUCTION**

20 The analysis of the consumer perception of meat attributes is important to understand and predict its  
21 behavior (Grunert *et al.*, 2004). Meat experience-consumption characteristics and quality attributes  
22 determine purchasing decisions (Becker, 2000; Curtis *et al.*, 2006). Moreover, consumer attitudes  
23 are influenced by the values and social rules which are determined by multiple aspects of everyday  
24 life for individuals or groups of people (Knight and Barnett, 2008; Boogaard *et al.*, 2006; Toma *et*  
25 *al.*, 2012).

26 In a study conducted by Loureiro and Umberger (2007) experiments were carried out to analyze the  
27 consumer willingness to pay (WTP) a premium for a product guaranteed for meat attributes such as  
28 labels, traceability, origin, tenderness and certifications. The results underline how consumers  
29 would prefer to pay a premium, in the first place for a safe and certified meat, then for a traceable  
30 meat, a guaranteed origin meat and, finally, for a tender meat. The organoleptic quality of the  
31 product, therefore, assumes less importance compared to the guarantees of safety of the product.  
32 Bonny *et al.* (2016, 2017) reported that tenderness, flavor liking and overall liking had similar  
33 weights when consumers score eating quality. However, much of the literature indicates that  
34 tenderness is the most important factor in determining consumer satisfaction (Huffman *et al.*, 1996;  
35 Alfnes *et al.*, 2008; Verbeke *et al.*, 2010a). This is confirmed especially when it is submitted in a set  
36 of quality attributes ascertained on the basis of the actual experience-consumption of the product  
37 (tenderness, juiciness, flavor desirability and overall palatability (Bernues *et al.*, 2003; Aalhus *et al.*,  
38 2004; Morgan *et al.*, 1991; Curtis *et al.*, 2006). It is also demonstrated that a classification scheme  
39 for tenderness as well as meat quality would be appreciated by European consumers (Verbeke *et al.*,  
40 2010a). If the set of quality attributes submitted to consumer includes those relating to organoleptic  
41 characteristics and credence quality attributes of meat - those that cannot be ascertained even after  
42 the normal use of the product (e.g. animal feeding guarantee, environmentally friendly production,  
43 respect for the animal welfare, etc.) (Becker, 2000), consumer considers safety as the most  
44 important attribute for beef meat choice (Cicia and Colantuoni, 2010).

45 Also meat color was studied in different works as a choice attribute: the red color of beef positively  
46 influenced consumer likelihood to purchase (Carpenter *et al.*, 2001). However, the use of color as a  
47 cue in the quality perception process not always added to the accuracy of the prediction of quality  
48 beef aspects (Grunert *et al.*, 2001; Grunert, 2004).

49 In an American research of Curtis *et al.* (2006), from the analysis of 18 beef meat qualities analysis,  
50 a classification in function of attributes importance was made: “extremely important” (freshness,  
51 taste/flavor, safety guaranteed meat, tenderness, leanness and price), “very important” (cut type,  
52 humane treatment, environmentally friendly, marbling, naturally raised, feed type, packaging,  
53 organic label, muscle texture, sale/promotion) and “important” (origin and brand). This latter trend  
54 is opposite to the European consumers’ opinion for whom the indication of meat origin- mandatory  
55 in the EU- takes on significant importance and is associated to product safety (Ehmke, 2006;  
56 Schupp and Gillespie 2001), and to traceability guarantee (Ehmke, 2006; Verbeke and Ward, 2006;  
57 Giraud and Halawany, 2006). In particular, consumers have a positive willingness-to-pay for their  
58 own country of origin meat products (Ehmke, 2006; Umberger *et al.*, 2002; Loureriro and  
59 Umberger 2003).

60 In addition, European quality certifications as the Protected Designation of Origin (PDO) and the  
61 Protected Geographical Indication (PGI) are meat choice attributes that relate to the quality and  
62 safety of products, especially for Italian consumers (Aprile *et al.*, 2012).

63 The voluntary certification of meat can concern the good farming practices related to animal  
64 welfare (Faucitano *et al.*, 2017). Consumer attention towards animal welfare was confirmed by  
65 several studies conducted at European level (Boogaard *et al.*, 2006; Vanhonacker *et al.*, 2008; Troy  
66 & Kerry, 2010; Toma *et al.*, 2012). The concept is, moreover, being closely linked to increased  
67 meat quality and influenced the WTP of consumers for certified animal friendly products (Toma *et*  
68 *al.*, 2012; Napolitano *et al.*, 2010): so it becomes important for both the agents operating in the meat  
69 supply-chain and the consumer the use of trademarks or labels, for example, certifying a farming  
70 system respectful of the animal's well-being (Gracia *et al.*, 2009; Harper and Henson, 2001;

71 McEachern *et al.*, 2007; Napolitano *et al.*, 2010). In this regard, they are recognized as an added  
72 value of voluntary labeling product certifications that guarantee the provision of additional  
73 information on the product to the consumer that facilitate meat traceability (Loureiro and Umberger,  
74 2007; Angulo and Gil, 2007; Villalobos *et al.*, 2010).

75 In our study, in order to understand which meat attributes influence the Nord-West Italy consumer  
76 behavior, preferences and beef meat consumption have been analyzed employing Best Worst  
77 Scaling.

78 This methodology, below BW, was introduced by Finn and Louviere (1992) in the early 1990s of  
79 the last century and, given the growing use in the scientific context, Marley and Louviere (2005)  
80 summarized earlier theoretical work and developed an integrative theoretical approach of the  
81 methodology. A choice experiment was conducted in this research to analyze the importance of 12  
82 attributes of beef and understand if the place of purchase and the meat consumption frequency  
83 affect preference structure and the meat-buying habits in Piedmont. The Best Worst analysis was  
84 also used to understand if within the sample could be identified clusters with homogeneous  
85 preferences. Currently no known published research compares consumers beef meat purchase habit,  
86 behavior and preferences relating to the considered meat attributes in function of meat consumption  
87 frequency and point of purchase.

88

## 89 **2. MATERIALS AND METHODS**

### 90 ***2.1 Data collection***

91 To investigate on Piedmontese consumers purchasing behavior, attitudes and preference about beef  
92 an *ad hoc* questionnaire was developed. A total of 401 individuals participated in the study, which  
93 was conducted at sixteen points of sale of meat (8 familiar points of sales of fresh cutting meat  
94 (trusted butchers, TB), 6 meat points of sale of two mass retail channels where packaged, fresh and  
95 processed meat were sold (MS) and 2 farm butchers (B)).

96 Face-to-face interviews were made using paper questionnaires (see Appendix A) from April to July  
 97 2015, from Monday to Sunday, in two time slots (9 a.m. to 1 p.m. and 4 p.m. to 8 p.m.). The  
 98 questionnaire was subdivided in three main sections. The first section included questions related to  
 99 socio-demographical characteristics: age (under 30, from 31 to 45, from 46 to 55 and over 55),  
 100 gender (female or male), educational status (primary school, lower secondary school, upper  
 101 secondary school, bachelor or master's degree - first stage of tertiary education - 3 or 5 years  
 102 degree) and employment (employed, retired, entrepreneur, student, unemployed and housewife).  
 103 The second section of the questionnaire was on meat purchasing behavior and consumption.  
 104 Quantitative and qualitative consumption of meat, and in particular of beef meat, were examined,  
 105 asking about the weekly consumption of meat and beef, the habitual meat point of sale, which cut  
 106 types of beef were usually consumed and the beef trend consumption in the last five years. The  
 107 preferences of Piedmontese consumers were analyzed in the third section which focused on the  
 108 meat attributes chosen for the Best Worst scaling.

109

## 110 **2.2 Meat attributes**

111 The choice of 12 meat attributes (Table 1) was made after an in-depth review of articles published  
 112 in international journals.

113 *Table 1. Meat attributes used for the Best Worst analysis*

<i>Meat qualitative attributes</i>		
Price	Brand	Animal welfare
Country of origin	Color	Taste/flavor
Traceability	Nutritional information	Tenderness
Animal breed	Organic label	Quality certifications

114

115 The attributes chosen were:

116 *1. Price.* Price is a key element in purchasing decisions. In general, it is used as an indicator of  
 117 quality when not enough information is available to evaluate the product and in situations of risk.  
 118 Generally the purchase of cheaper products reduces the financial risk, while a particularly high

119 price represents a protection from poor quality product (Simon H., *et al.*, 2013; Panza R., 2013;  
120 Imami *et al.*, 2011; Aalhus *et al.*, 2004; Villalobos *et al.*, 2010; Girgenti *et al.*, 2016).

121 2. *Country of origin*. Evidence from numerous marketing studies indicate that the assessments made  
122 by consumers are significantly influenced by the origin of the products. For the consumer the  
123 information on geographical origin can serve both to identify the product and to assess its quality  
124 (Curtis *et al.*, 2006; Pencin E., 2014; Loureiro *et al.*, 2007; Erdem *et al.*, 2010; Villalobos *et al.*,  
125 2010; Al-Sulaiti *et al.*, 1998).

126 3. *Traceability*. The traceability increases the certainty and safety of the product, even in case of  
127 risk for the consumer (Loureiro *et al.*, 2007; Troy & Kerry, 2010; Erdem *et al.*, 2010; Villalobos *et*  
128 *al.*, 2010).

129 4. *Animal breed*. Animal breed is usually associated to the animal origin. The breed is an important  
130 factor in obtaining a quality meat product and the meat industry uses this attribute as a grading  
131 indicator of quality (Bernues *et al.*, 2003; Troy and Kerry, 2010).

132 5. *Brand*. The brand is an indicator of quality, because it allows the consumer to identify the  
133 product and to link it with past experiences or information about the manufacturer (or seller)  
134 (Villalobos *et al.*, 2010).

135 6. *Color*. Color is one of the attributes that most influence the choice at the time of purchase.  
136 Indeed, large retail outlets and traditional retailers in local markets perform rigorous selections  
137 based on visual criteria before putting the product on sale or use commercial lights to promote  
138 expensive red meat (Troy and Kerry, 2010).

139 7. *Nutritional information*. Some of meat attributes linked with human health, such as fat and  
140 cholesterol content, influence especially beef meat consumption (Troy and Kerry, 2010; Curtis *et*  
141 *al.*, 2006).

142 8. *Organic label*. Organic certification is recognized in various studies as an attribute that influences  
143 positively consumer choices at the time of purchase (Gaviglio *et al.*, 2013; Troy & Kerry, 2010;  
144 Sackett *et al.*, 2011; Villalobos *et al.*, 2010). The consumer generally expresses a negative view of

145 excessive manipulation and lack of naturalness in the production and processing of beef products  
146 (Verberke *et al.*, 2010); so, the organic label attribute can represent an added value for beef meat.

147 9. *Quality certifications*. Certain retail suppliers require quality certifications related to process and  
148 product ethics, and also on the environmental impact of the products (Angulo and Gil, 2007;  
149 Loureiro and Umberger, 2007; Sackett *et al.*, 2011; Villalobos *et al.*, 2010). For example, carbon  
150 footprint label (voluntary certification) is perceived by consumers as an indication of quality and  
151 sustainability of businesses because it certifies the product's environmental sustainability (among  
152 others objectives, it requires the analysis and accounting of CO2 emissions) (MATTM – Italian  
153 Ministry of the Environment and Protection of Land and Sea).

154 10. *Animal welfare*. Consumers are influenced by information about animal welfare regarding  
155 ethical aspects due to the link between animal welfare and meat quality. The consumer is also  
156 willing to pay a premium for an animal friendly product (Toma *et al.*, 2012; Napolitano *et al.*, 2010;  
157 Verbeke and Viaene, 1999; Troy and Kerry, 2010; Sackett *et al.*, 2011; Villalobos *et al.*, 2010). The  
158 link made between animal welfare and meat quality by the consumer can have different meanings.  
159 It can be considered only the ethical aspect of the animal welfare concept, but it can also be based on a  
160 more anthropocentric interpretation of the same. In this regard, for example, the animal suffering is  
161 associated with animal disease (Gregory and Granding, 1998), and thus also with pharmacological  
162 treatments which are harmful to humans. On the other hand, the animal reared in free range, with  
163 high welfare standards, is seen as a healthier animal that will give a high quality product.

164 11. *Tenderness*. This organoleptic attribute was extensively studied and considered an important  
165 attribute for meat choice by consumers (Curtis *et al.*, 2006; Troy & Kerry, 2010; Aalhus *et al.*,  
166 2004).

167 12. *Taste / flavor*. With tenderness, taste and flavor of meat were attributes that can be directly  
168 influenced by livestock producers through breeding and diet. (Curtis *et al.*, 2006; Troy and Kerry,  
169 2010; Aalhus *et al.*, 2004).

170



171 **2.3 Data analysis using Best-Worst Scaling**

172 Best-Worst methodology consists of a measuring technique in which respondents are asked to  
173 choose their most favorite attribute (the best) and their least favorite attribute (the worst) from a set  
174 of attributes (Cohen & Markowitz, 2002; Girgenti *et al.*, 2016). BW score can be considered an  
175 extension of the pairwise comparison method, since it offers similar benefits and more information  
176 with fewer questions (Cohen and Orme, 2004). This methodology provides a more discriminating  
177 way of measuring the degree of importance that respondents attach to each factor (for example, if  
178 compared with the Likert scale), since the respondents can choose only two attributes, which they  
179 consider as respectively the most and least important for each set of choice. Other benefits of using  
180 this method are related to the fact that avoids problems of distortion of the scores, since there is  
181 only one way to choose the most and the least important attribute, regardless of the cultural  
182 background of the interviewee. To choose how many times each attribute should be presented to  
183 respondents, as well as the number of attributes included in each set of choices, Orme (2012)  
184 recommendations was implemented. A range of 3–5 attributes should be included in each set of  
185 choices, and that each attribute should be presented to the respondent between 3 and 5 times.  
186 According to these recommendations, we chose to include 4 attributes per subset (Table 2), and to  
187 present each attribute 3 times within the questionnaire.

188

189 *Table 2. Example of attributes subset. Respondents had to indicate which of the four presented*  
190 *attributes was considered the best and which worst.*

<u>MOST INFLUENTIAL</u>	<u>ATTRIBUTES</u>	<u>LEAST INFLUENTIAL</u>
○	Tenderness	○
○	Certifications	○
○	Brand	○
○	Animal welfare	○

191

192 MaxDiff designer (v.2.0.2; Sawtooth Software, Orem, UT, USA) was used to distribute each of the  
193 12 chosen attributes into 4 different versions of the questionnaire. Each of these versions consisted  
194 of nine subsets, each including four attributes.

195 Following Orme (2012) multiple factors were considered by the algorithm in the BW analysis:  
196 single frequency count (how many times each factor appears within the experimental design),  
197 double frequency count (how many times a specific couple of factors appears in the same  
198 experimental design), connectivity (all the directly connected factors) and ranking frequency (it  
199 reports how many times each factor was placed first, second, third or fourth in the table).

200 The experimental design (done prior to data collection) obtained by using MaxDiff designer  
201 considers the effect of the alternative ranking that lead, for this precise reason, to the creation of 4  
202 different versions of the experimental design itself. The experimental scheme was generated from  
203 the program in a way to obtain a balanced design, where each factor appears in equal amount. A  
204 two-way balance was also favoured in the design, which meant that the design was directed towards  
205 how often paired combinations of the attributes appeared together, and each pair of attributes  
206 appeared together (Lagerkvist, 2013). As the average B–W scores take positive and negative values,  
207 and therefore sum to zero, they are often perceived as difficult to interpret. For instance, in the case  
208 of importance measurement, a negative B–W value does not indicate negative importance, but  
209 rather low (below average) importance. According to the aim of this study the software Sawtooth  
210 MaxDiff Web 8.4.6 (SSI-version 8.4.6; [www.sawtoothsoftware.com](http://www.sawtoothsoftware.com)) was used. The total responses  
211 for each best and worst attribute were calculated by using by the software using a cyclical algorithm  
212  $k(k-1)/2$  possible paired comparisons. An estimation analysis of the scores was made using the  
213 Hierarchical Bayes Estimation (HB) technique performed in SPSS, version 21.1. for Windows. The  
214 samples were divided into clusters according to the weight that the individual respondent assigned  
215 to the different attributes as per the Latent Class Clustering technique. The Sawtooth software by  
216 default creates 4 segmentations, each containing the division of the sample from 2 to 5 clusters  
217 respectively. To identify the most appropriate segmentation for our case study, some indicators  
218 were taken into consideration, such as Log-Likelihood (LL), Consistent Akaike Information  
219 Criterion (CAIC) and Bayesian Information Criterion (BIC). The confidence limit applied in the  
220 estimation of the attribute scores was set at 95% and the standard deviation was used as a raw

221 indicator of variability present within the sample. In order to understand whether one attribute is  
222 preferred to another within the same sample of respondents, we applied the Repeated Measures T-  
223 Test with 2 tailed by comparing the rescaled scores for the attribute of each individual respondent,  
224 which was obtained from the HB calculation. For segmentation into clusters, the p-value for each  
225 attribute was calculated following a homogeneity of variance test. The software used for the  
226 quantitative analysis was SPSS.21.0 for Windows.

227 Therefore, the segmentation hypothesis that required the lowest number of BIC among the 4  
228 produced by the Software, was chosen as the best representation ([www.sawtoothsoftware.com](http://www.sawtoothsoftware.com),  
229 Dekhili S. *et al.*, 2011).

230 The weight of each attributes, obtained thanks to the HB and IClass analysis, are reported in the raw  
231 score section. The raw scores represent the weight of each attribute and they are calculated for each  
232 person interviewed by the Logit Multinomial (MNL) method, which is an option in the Sawtooth  
233 software.

234 Preferences of meat attributes by the considered consumer sample were analyzed by gender, age,  
235 educational level, employment and mean of weekly meat consumption, as well as the point of meat  
236 purchase. In particular data analysis was carried out considering four subsets of consumers: A  
237 (which consume meat 1-2 times in the week), B (3-5 times in the week), C (up to 10 times for  
238 week) and D (more than 10 times).

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246 **3. RESULTS**

247 The socio-demographic characteristics of the 401 respondents are reported in Table 3.

248

249 *Table 3. Socio- demographic characteristics of the considered sample.*

<i>Sample (n=401)</i>		
Gender	Women	61%
	Men	39%
Age	≤30 years old	16%
	Between 31 and 45 years old	34%
	Between 46 and 55 years old	18%
	>55 years old	32%
Educational Status	Primary School	4%
	Lower Secondary School	24%
	Upper Secondary School	54%
	Bachelor or Master's Degree	18%
Employment	Housewife	9%
	Unemployed	2%
	Employed	45%
	Entrepreneu	18%
	Retired	23%
	Student	3%

250

251 In this study the majority of survey respondents were female (61%) and people with an age between  
 252 31 and 45 years old (34%). Respondents were not equally distributed in regard to social aspects as  
 253 age, educational level and employment. Bachelor or Master's degrees represented 18% of the  
 254 sample, while 24% had a lower secondary school certificate and 4% of considered consumers were  
 255 characterized by a primary school certificate. The majority of interviewed were represented by  
 256 qualified consumers (54%) with upper secondary study certificate. According to ISTAT (National  
 257 Institute for Statistics), the main supplier of official statistical information in Italy. The educational  
 258 level of the components of the considered sample deferred little or correspond (in the case of  
 259 graduates) to the national one (Table 4).

260

261 *Table 4. Comparison between educational levels of the considered sample (Piedmont) and the*  
 262 *Italian population*

<b>Educational level</b>	<b>Sample</b>	<b>Italy <sup>1</sup></b>
Primary School	4%	7%
Lower Secondary School	24%	33%
Upper Secondary School	54%	42%
Bachelor or Master's Degree	18%	18%

<sup>1</sup>Source: www.istat.it, data of 2016

263

264 Regarding occupation, 45% of respondents was represented by employees and 23% of retirees.  
 265 Unemployed and students were poorly represented in the considered sample, covering respectively  
 266 2% and 3% of the total. Housewives were 9%, while a 17% of the interviewed was represented by  
 267 entrepreneurs. 48% of the considered sample consumed weekly meat from 3 to 5 times (consumers  
 268 B), 37% of interviewed consumed meat 1-2 times in a week (consumers A), while 12% up to 10  
 269 times weekly (C). A small part of the sample (3%) consumed meat more than 10 times a week  
 270 (consumers D). Differences of beef with respect to generally meat weekly consumption emerged  
 271 from data elaboration (Table 5).

272

273 *Table 5. Weekly meat and beef consumption of interviewed consumers.*

	<b>Weekly consumption</b>	
	<b>Meat</b>	<b>Beef meat</b>
1-2 times	37%	70%
3-5 times	48%	25%
Up to 10 times	12%	4%
More than 10 times	3%	1%

274

275 Among the interviewed, beef was hardly consumed in the diet of consumers C and D. For all  
 276 considered consumer subsets, the beef meat consumption was inversely proportional to that of meat  
 277 in general. Interviewees preferences of the points of meat purchase were reported in Table 6.

278

279

280

281

282 *Table 6. Points of meat purchase chosen by consumers interviewed.*

<i>Point of meat purchase</i>	
Trusted butcher	60%
Supermarket	30%
Butcher randomly chosen	4%
Farm butcher	4%
Discount store	1%
Farmer's market	1%

283

284 The consumers interviewed at the trusted butchers (TB) confirmed their loyalty to the place of meat  
 285 purchase, which was not occasional, but routine. In fact, 62% of them bought meat only at the  
 286 butcher of the interview location. 20% of consumers interviewed in the TB frequented both these  
 287 places and the supermarkets. 8% was only there by chance and normally they preferred to buy meat  
 288 at the large retail chains, while 10% of these respondents bought meat at any butchers (butcher  
 289 randomly chosen), discount stores, farm butchers and farmer's markets. The respondents at MS  
 290 considered in the study claimed to bought meat at the place of the interview (66%) or they preferred  
 291 to buy meat at the butcher of their trust (43%). 54% of respondents in the B point of purchase  
 292 declared that habitually bought meat at the place of the interview. 15% of respondents from this  
 293 store also bought meat at the large retail chains, while 10% of these consumers only bought meat at  
 294 the supermarket. 4% of these consumers chose any butcher as point of meat purchase.

295

### 296 ***3.1 Data elaboration***

297 The BW analysis allowed to identify the most important meat attributes considered by consumers  
 298 during purchase decision. The number of times that a parameter was chosen as the Best or the  
 299 Worst (count report) and the average raw score for each factor, considered the sample in general  
 300 terms, are reported in Table 7.

301

302

303

304 *Table 7. Best Worst Scaling count report (number of BEST and number of WORST) and BW*  
 305 *average raw score considering the entire sample.*

<i>Attributes</i>	<i>Number of Best</i>	<i>Number of Worst</i>	<i>Number of B-W</i>	<i>BW average raw score</i>
Animal welfare	435	177	258	0,740
Brand	330	224	106	0,320
Color	264	369	-105	-0,307
Country of origin	196	412	-216	-0,581
Nutritional information	238	472	-234	-0,673
Organic label	301	233	68	0,178
Price	480	179	301	0,892
Quality certifications	241	279	-38	-0,147
Animal breed	357	170	187	0,532
Taste/flavour	291	303	-12	-0,052
Tenderness	282	284	-2	-0,018
Traceability	194	507	-313	-0,884

306

307 Considering the entire sample, consumer choices were influenced especially by price with an  
 308 highest average raw score equal to 0,892. The second most significant quality factor for beef meat  
 309 purchase was animal welfare (average raw score equal to 0,740). A negative means raw score  
 310 linked with a factor signifies that it was not commonly chosen as the Best factor. The worst values  
 311 were attributed to traceability (-0,884) and nutritional characteristics (-0,673).

312 Only five factors (price, animal welfare, animal breed, brand and organic label) were effectively  
 313 important for Piedmontese consumers in the meat purchase decision considering the mean BW raw  
 314 scores. On the other hand, the less important beef meat characteristics were: tenderness, flavor,  
 315 quality certification, color, animal origins, nutritional characteristics and traceability.

316 The sample classification by means of the lClass analysis method was performed choosing the  
 317 clustering which had the lowest BIC value (Table 8): between the 4 different choices (from 2 to 5  
 318 groups) the 5 groups clustering was therefore adopted and chosen as the most representative method  
 319 to represent the different meat purchase behaviours.

320

321 *Table 8. IClass analysis results: comparison between the considered indicator (LL -Log-Likelihood,*  
 322 *CAIC - Consistent Akaike Information Criterion and BIC - Bayesian Information Criterion).*

Groups	LL <sup>1</sup>	CAIC <sup>2</sup>	BIC <sup>3</sup>
2	-9339,852	18907,043	18884,043
3	-9198,325	18742,602	18707,602
4	-9123,730	18712,024	18665,024
5	-9068,848	18720,872	18661,872

<sup>1</sup>LL : Log-Likelihood. <sup>2</sup>CAIC: Consistent Akaike Information Criterion.  
<sup>3</sup>BIC: Bayesian Information Criterion (BIC).

323  
 324  
 325

326 The sample division in clusters with different numerosities is reported in Table 9. There are  
 327 important differences in term of preferences expressed between the 5 groups. Only three meat  
 328 attributes had the same sign in all the clusters (negative of the traceability, positive for brand and  
 329 animal breed). On the other hand, all the other 9 beef meat attributes were differently considered  
 330 into the different clusters. In this group of attributes, two of them (country of origin and price) have  
 331 the same sign (respectively positive and negative in 4 clusters and both differ in the cluster of  
 332 “undecided consumer”).

333 In order to classify more comprehensively the characteristics of respondents belonging to the five  
 334 selected clusters each group has been named in function of the most influential meat attributes.

335 The main group (32,5%), called "Price sensitive" gathered consumers more attentive to price during  
 336 meat purchase, but not indifferent to animal welfare. The second largest group (26,3% of the  
 337 respondents) belongs to the cluster "Undecided consumer" (all the 12 raw scores are next to zero).

338 The third group in numerical terms (17,5%) was called "Territorial", and its major interest was  
 339 focused on the beef meat color, on animal breed and on the brand. The cluster "Animal welfare  
 340 sensitive consumers" with 12,9% of the total respondents collects inside the biggest supporters of  
 341 animal welfare, not at all interested in the nutritional information on the label. In conclusion, the  
 342 smaller group (10,8%) called "Health conscious consumers", was the one in which the preferences  
 343 expressed by consumers were of difficult interpretation: though in absolute terms the main attribute  
 344 chosen in the group is that of price, this is still lower than that of “price sensitive”, and the meat



345 color is significantly positioned in second place. Moreover, major importance was assigned to the  
 346 “nutrition information” attribute in this cluster where assume a net positive relevance unlike what  
 347 happens in other clusters.

348

349 *Table 9. Mean BW Raw score for the five clusters representative of considered consumers sample:*  
 350 *price sensitive, undecided, territorial animal welfare sensitive, health conscious.*

Cluster dimension	<i>Price sensitive</i>	<i>Undecided</i>	<i>Territorial</i>	<i>Animal welfare sensitive</i>	<i>Health conscious</i>
	32,5%	26,3%	17,5%	12,9%	10,8%
<i>Attributes</i>	<i>Raw score</i>				
Traceability	-1,245	-0,002	-0,974	-1,039	-1,602
Price	1,835	-0,141	0,310	0,925	1,348
Brand	0,323	0,040	0,380	0,570	0,624
Animal breed	0,721	0,006	0,696	0,334	0,624
Color	-0,674	-0,389	1,310	-1,276	1,219
Animal welfare	1,185	0,375	-0,078	1,535	-0,420
Country of origin	-0,636	0,023	-1,180	-0,251	-1,340
Organic label	0,659	-0,028	0,183	-0,582	0,026
Nutritional information	-1,678	-0,244	0,180	-1,475	1,103
Tenderness	0,227	0,186	-0,505	0,299	-0,921
Quality certifications	-0,494	0,086	0,209	-0,001	-0,374
Taste/flavour	-0,224	0,088	-0,531	0,961	-0,268

351

352 The number in which each factor was qualified as the Best or the Worst considering the entire  
 353 sample was analyzed in function of the weekly beef meat consumption frequency (Table 10). The  
 354 Raw score for all the meat factors were showed.

355 The distribution of the preferences expressed by the consumers concerning the previously described  
 356 factor does not change among A, B and C/D meat consumers groups. The price and the animal  
 357 welfare were always, respectively, the most and the second most important attribute that a customer  
 358 evaluates. Between these latter factors, the biggest gap can be found in the meat consumers group B  
 359 (which consumed meat from 3 to 5 times per week), while for the group A of consumers, these two  
 360 values were comparably equal followed shortly by meat tenderness. Nutritional characteristics and  
 361 traceability were considered of lowest importance by A consumers. Similar values can be found for  
 362 the B and C/D groups of consumers. Furthermore, for this latter group meat color plays a  
 363 remarkable role during meat purchase.

364 Table 11 reports the Mean Raw Score for each meat attribute concerning the sample population  
365 segmentation in function of the point of meat purchase. The general term “other place of purchase”  
366 includes farmer markets, butchers randomly chosen, farm butchers and discount stores. The  
367 consumers that usually buy meat from the large retail sales were remarkably interested to the meat  
368 color. The least important factors were animal origin, traceability and nutritional information.

369 *Table 10. Best Worst Count and Mean Raw score in function of weekly frequency of meat consumption in the considered consumers groups (A, B, C*  
 370 *and D<sup>1</sup>)*

Consumers groups	A				B				C				D			
	<i>n.</i> <i>Best</i>	<i>n.</i> <i>Worst</i>	<i>n.</i> <i>B-W</i>	<i>BW mean</i> <i>raw score</i>	<i>n.</i> <i>Best</i>	<i>n.</i> <i>Worst</i>	<i>n.</i> <i>B-W</i>	<i>BW mean</i> <i>raw score</i>	<i>n.</i> <i>Best</i>	<i>n.</i> <i>Worst</i>	<i>n.</i> <i>B-W</i>	<i>BW mean</i> <i>raw score</i>	<i>n.</i> <i>Best</i>	<i>n.</i> <i>Worst</i>	<i>n.</i> <i>B-W</i>	<i>BW mean</i> <i>raw score</i>
Animal welfare	168	67	101	0,738	185	91	94	0,606	62	14	48	1,197	18	6	12	0,991
Brand	108	77	31	0,233	168	113	55	0,371	44	21	23	0,645	10	10	0	0,034
Color	92	131	-39	-0,283	138	164	-26	-0,192	28	55	-27	-0,747	6	19	-13	-1,052
Country of origin	82	155	-73	-0,477	84	200	-116	-0,682	20	52	-32	-0,821	10	8	2	0,066
Nutritional information	77	192	-115	-0,897	109	215	-106	-0,653	34	48	-14	-0,361	19	17	2	0,159
Organic label	111	89	22	0,123	144	102	42	0,255	35	34	1	0,097	10	9	1	0,206
Price	168	74	94	0,677	234	75	159	1,052	71	19	52	1,395	9	9	0	-0,051
Quality certifications	99	106	-7	-0,056	92	133	-41	-0,291	30	27	3	0,014	20	12	8	0,746
Animal breed	115	78	37	0,310	181	70	111	0,678	41	17	24	0,654	19	5	14	1,058
Taste/flavour	107	107	0	0,004	150	140	10	0,018	23	46	-23	-0,666	12	9	3	0,239
Tenderness	118	91	27	0,206	135	137	-2	-0,025	25	37	-12	-0,289	5	20	-15	-1,282
Traceability	87	165	-78	-0,578	81	261	-180	-1,137	19	62	-43	-1,117	6	20	-14	-1,113

371

372 <sup>1</sup> Consumers were classified in function of weekly frequency of meat consumption: A= which consume meat 1-2 times in the week; B = 3-5 times in the week; C= up to 10 times for week; D= more  
 373 than 10 times.

374

375

376 *Table 11. Best Worst Count and Mean Raw score for the meat attributes: differences in function of declared meat point of purchase (supermarkets,*  
 377 *trusted butcher, other places of purchase).*

Place of purchase	<i>Large scale retail distribution</i>				<i>Trusted butcher</i>				<i>Other places of purchase</i>			
	Attributes	n. Best	n. Worst	n. B-W	BW mean raw score	n. Best	n. Worst	n. B-W	BW mean raw score	n. Best	n. Worst	n. B-W
Animal welfare	59	49	10	0,167	255	89	166	0,859	112	39	73	0,887
Brand	58	54	4	0,039	189	115	74	0,383	84	46	38	0,452
Color	78	53	25	0,462	115	227	-112	-0,579	69	85	-16	-0,213
Country of origin	41	89	-48	-0,720	114	212	-98	-0,477	38	114	-76	-0,837
Nutritional information	58	84	-26	-0,404	98	292	-194	-1,002	78	92	-14	-0,153
Organic label	52	67	-15	-0,216	159	104	55	0,251	90	62	28	0,316
Price	73	41	32	0,468	293	76	217	1,170	111	59	52	0,663
Quality certifications	56	52	4	0,022	123	156	-33	-0,198	61	67	-6	-0,139
Animal breed	53	30	23	0,335	213	94	119	0,623	84	44	40	0,495
Taste/flavour	59	64	-5	-0,070	163	159	4	0,017	64	76	-12	-0,212
Tenderness	62	41	21	0,286	159	166	-7	-0,058	61	74	-13	-0,165
Traceability	44	69	-25	-0,369	108	299	-191	-0,989	39	133	-94	-1,094

#### 378 4. DISCUSSION

379

380 In this study the consumer beef meat preferences were studied by means of the Best Worst scaling  
381 methodology in order to identify the most relevant factors in meat purchase behavior in the  
382 Piedmontese region.

383 The BW method concerns the analysis of all data focusing on the consumer behavior as a function  
384 of beef meat point of purchase as well as the weekly meat consumption. Face-to-face interviews  
385 were conducted using paper questionnaires and an intercept survey method choosing people  
386 randomly: the interviewer's presence allowed to assist consumers during form filling, especially in  
387 the BW section.

388 Five of the 12 considered factors related to product description (price, animal welfare, animal breed,  
389 brand, organic label) were selected by the respondents as most important. The remaining factors  
390 were considered less relevant by consumers during meat purchase. Among the above mentioned 5  
391 meat attributes, the most relevant ones were price and then animal welfare. Already in Curtis *et al.*  
392 (2006) consumers considered the price as an "extremely important" attribute during meat choice.  
393 Also Davidson *et al.* (2003) and Lagerkvist (2013) confirmed our results, which justify the price  
394 consideration first of all other meat characteristics such as origin or nutritional aspects. In this  
395 regard, note how from the clusters' segmentation of the sample has been identified the "Price  
396 sensitive" group as the one most represented by the respondents. However, this latter result is in  
397 contrast with the declarations reported in other researches in which price attribute is less important  
398 than origin, information regarding animal treatment and organoleptic aspects (Verbeke *et al.*,  
399 2010b; Schnettler *et al.*, 2009; Glitsch, 2000). In our research, the high quality of the considered  
400 product (in many cases of Piedmontese cattle breed) (Brugiapaglia *et al.*, 2014; Wheeler *et al.*,  
401 2001; Destefanis *et al.*, 1993; Tatum *et al.*, 1990) probably reduces the importance of the evaluation  
402 of some aspects (organoleptic quality, certifications, origin), making the meat price as the  
403 discriminating attribute during purchase. Currently, the economic crisis induces consumers to focus

404 their attention on product prices and on quality-price correlation. Food demand is in any case driven  
405 by the price, but evaluation of price sensitivity is also increasingly driven by more complex and  
406 heterogeneous attributes (Grunert, 2001; Wakefield and Inman, 2003). This is confirmed also for  
407 meat and, in particular, for beef meat (Schnettler *et al.*, 2009; Bernabéu and Tendero, 2005). In our  
408 study the importance of price is always associated with other attributes that were put to the  
409 interviewed at the same time.

410 Animal welfare is the second most relevant attribute considered during meat purchase by  
411 Piedmontese consumers. If in Schnettler *et al.* (2009) the price importance by the consumer during  
412 meat purchase was confirmed, animal welfare is perceived as a desirable condition, but consumers  
413 are not willing to pay significantly more when buying meat in order to gain information about  
414 animal handling. Some other studies indicate that animal welfare is relatively less important than  
415 other attributes, such as animal feeding or origin (Bernués *et al.*, 2003). On the contrary, Napolitano  
416 *et al.* (2007) concluded that if the meat is acceptable in terms of sensory properties, information  
417 about animal welfare allows the consumers to gain a more positive perception of the product and  
418 increase meat acceptability in Italy. In our study, the cluster of "Animal welfare sensitive", which  
419 accounted for 12,9% of the sample, was represented by consumers with preferences in accordance  
420 to Napolitano *et al.* (2007). Then, animal welfare conditions are of high relevance (Tonsor and  
421 Wolf, 2011) and represent a wise approach to some of meat quality aspects (colour, tenderness,  
422 nutritional properties) and food safety, since it is strictly related to the animal growth and life style  
423 (Lagerkvist, 2013; Schwartzkopf-Genswein *et al.*, 2012; Castellini *et al.*, 2002). The ever-growing  
424 interest of part of the consumers toward animal welfare has been clearly seen from the answers  
425 collected during the interviews. Recent studies focusing on EU indicated that consumers are willing  
426 to eat animal friendly meat because they associate it with higher quality and health (Special  
427 Eurobarometer, 2007; Borra and Tarantola, 2015). However, in Miele (2010) differences of animal  
428 welfare importance by consumers emerged in a comparison works included Southern and  
429 Scandinavian European countries (seven in total): across the involved countries, French and Dutch

430 consumers were the less interested, the British were at the center, while Hungarian, Swedish ,  
431 Norwegian and Italian consumers were the most interested at the animal welfare issue. This interest  
432 is also expressed in Kjærnes and Lavik (2008).

433 In our research emerges as animal breed information is a discriminant attribute during meat  
434 purchase in Piedmont and may also influence consumer expectations. Information about production  
435 systems can be a determinant of beef preference (Napolitano *et al.*, 2010), thus providing a potential  
436 tool for meat differentiation (Morales *et al.*, 2013). The breeding of Piedmontese cattle breed is of  
437 great importance in Piedmont and consumer recognizes this farming system, typically managed  
438 outdoors and based on pasture for part of beef production systems, as a discriminating factor during  
439 meat purchasing (Colombino and Giaccaria, 2015). In our research, meat from Piedmontese cattle  
440 breed was bought in one of the considered mass retail channel, in both the farm butchers and in four  
441 of the trusted butchers. Pasture grazing system is also perceived by consumers as a lower  
442 environmental impact system, as natural and animal friendly (Hersleth *et al.*, 2012; Schnettler *et al.*,  
443 2010).

444 Also the brand, in our study, was mostly associated with the mark of the Italian Consortium of  
445 Piedmontese beef. Brand may be placed on the packaging, in the case of packaged meat, or, in the  
446 case of trusted butchers, at the place of meat purchase (e.g. the brand of certified meat of the  
447 Piedmont breed). Much of the information that consumers receive regarding meat is provided  
448 through adverts, information campaigns, labels or brands (Font-i-Furnols and Guerrero, 2014). In  
449 any event, the brand presence on meat is synonymous with a guarantee of wholesomeness,  
450 traceability and authenticity of the product (Bredahl, 2004; Grunert *et al.*, 2004 ; Van Wezemael *et*  
451 *al.*, 2010). Brands are more interesting for consumers who also use them to infer expected beef  
452 quality (Verbeke and Ward, 2006).

453 Attributes related to organoleptic characteristics as tenderness, taste/flavor and color were  
454 considered less important for the sample considered as a whole. This result is in contrast to the  
455 literature (Glitsch, 2000), but without considering the geographical context of our research; in fact,

456 our results probably depend by the fact that almost 70% of interviewed bought Piedmont beef meat,  
457 which is characterized by the widely spread double muscled phenotype, associated with light red  
458 colour, very low content of intramuscular fat and high tenderness (Brugiapaglia *et al.*, 2014;  
459 Wheeler *et al.*, 2001; Destefanis *et al.*, 1993). So, there are good probabilities that a large part of the  
460 sample (60% of them bought meat by trusted butchers) considered the organoleptic quality as a  
461 precondition of the meat that they usually buy. However, meat color plays a remarkable role during  
462 purchase for interviewed who consume a lot of meat during the week and buy especially at  
463 supermarkets. A different perception of the color attribute has been previously evidenced by  
464 Kubberød (2002) who highlights how the socio-economic environment influences the consumer  
465 behavior.

466 In the case of the organic label, other authors recognize consumer interest in organic production.  
467 The information contained in the labels are becoming increasingly important in consumer  
468 preferences (Napolitano *et al.* 2010, Janssen and Hamm 2012). The interpretation of “organic”  
469 characteristic of meat is well explained in Grunert *et al.* (2004) in which organic production was  
470 associated by consumer with healthy meat, animal welfare and environment sustainability, and also  
471 with good taste; because in addition to being a credence characteristic, the "organic" attribute is also  
472 partly an experience characteristic (Grunert and Andersen, 2000).

473 The two attributes that Piedmontese consumers considered less important when purchasing meat  
474 were traceability and nutritional characteristics. This result is surprising if compared with what is  
475 reported in literature (Morales *et al.*, 2013; Stranieri and Banterle, 2015); however, as mentioned  
476 before in this analysis, it probably derives from the particular product type that is being evaluated in  
477 our research: consumers, especially in Piedmont, considered these meat attributes a precondition  
478 during Piedmontese breed beef purchase (Colombino and Giaccaria, 2015). Information about  
479 traceability was not perceived as an important quality cue to consumers, as reported also in  
480 Lagerkvist (2013).



481 Previous research is in contrast with our results about the importance of the country of origin  
482 (Hoffman, 2006), which is normally linked with safety (Ehmke, 2006; Schupp and Gillespie 2001)  
483 and a guarantee of traceability (Ehmke, 2006; Verbeke and Ward, 2006; Giraud and Halawany,  
484 2006) during meat choice. The meat origin knowledge by the consumer of the considered sample  
485 probably was not important because the meat of Piedmont breed is, in the major of cases, certified  
486 in terms of origin (Colombino and Giaccaria, 2015).

487 The clusters' analysis evidenced that a third of respondents was characterized by preferences  
488 equally distributed among the proposed attributes of meat and therefore were defined as "Undecided  
489 consumers"; this group was followed, in terms of group dimension, from those who give more  
490 attention to the territorial nature of the product (defined as "Territorial"); residual categories were  
491 the most sensitive to the issue of animal welfare.

492 Meat attributes, if considered together, can compensate, one the consequence of the other, or in  
493 other cases be opposed, and all contribute to generating the quality of the global product: in a recent  
494 work emerged that the combination of the various complementary approaches seems promising  
495 improve the forecast of global quality of beef, especially for consumers, but also for all supply  
496 chain stakeholders (Hocquette *et al.*, 2014). in particular, the quality concept of beef meat contain  
497 all characteristics of the product itself (e.g. in terms of tenderness, palatability, nutritional value,  
498 safety) but also all extrinsic qualities more or less associated with beef (such as e.g. livestock  
499 practices, animal welfare, carbon footprint, price for consumers, income for producers). all these  
500 aspects are more or less mutually linked (Hocquette *et al.*, 2014; 2012).

501 The analysis in function of the two variables "weekly consumption" and "point of purchase"  
502 provide different results. Different consumption frequencies substantially do not modify the rank of  
503 preferences: the groups A, B and C have the same three most important attributes (price, animal  
504 welfare and animal breed) and the two least important (country of origin, nutritional information  
505 and traceability). However, the results of Barrena and Sanchez (2009) study highlighted that meat  
506 abstracted attributes (especially the attributes of beliefs) during meat choice were high relevant for

507 individuals at high frequency of meat consumption. This result is confirmed in our study, in which  
508 emerged the importance of brand and of organic label for consumers C and of quality certifications  
509 for consumers D. Meat purchasers who consume a lot of meat during the week included in the worst  
510 attributes of meat even the organoleptic characteristics of the product.

511 In our choice experiment, several differences of consumer behavior in function of point of meat  
512 purchase emerged from the analysis. Consumers that usually bought meat in supermarket focused  
513 their attention on meat price and color. Secondly, these consumers have focused their attention on  
514 animal breed, tenderness, brand and animal welfare. Finally, meat traceability and nutritional  
515 characteristics were evaluated as the least important attributes during the purchase. Indeed,  
516 confident Piedmontese meat consumers purchased at supermarket and considered their acquired  
517 products as guaranteed from the point of view of traceability. This result is conforming to other  
518 research in which consumers like to assume that all food on sale in supermarkets has a safety  
519 guarantee (Grunert *et al.*, 2004; Colombino and Giaccaria, 2015). Nutritional characteristics when  
520 analyzed only in the beef choice were not perceived by consumers as discriminating characteristics  
521 during the purchase: probably this is do as the consumer does not perceive substantial differences,  
522 especially for the considered sample which is accustomed to a high quality standard of meat of  
523 Piedmontese cattle breed (Brugiapaglia *et al.*, 2014).

524 As resulted in Goodman (2009), large scale retailers give always more space to “organic”,  
525 “typical” or “traditional” products. This process of convergence between local production and  
526 commercial spaces of large scale retailers directly involves the protection and enhancement of  
527 Piedmontese meat.

528 In our research, if the meat price remains at the first place of importance and animal breed ranks  
529 third, animal welfare emerges as the second most important choice attribute for consumers that  
530 habitually buy meat from butchers. The importance of animal welfarte as an attribute for beef meat  
531 choice emerges also in a recent study conducted by Slow Food (Borra and Tarantola, 2015).

532 Nutritional information, traceability, color and country of origin are the less important attributes  
533 chosen by these consumers at the butcher level. Despite the less positive assessment for these last  
534 attributes is surprising, considering the behavior of meat choice in general (Pethick *et al.*, 2011),  
535 these results can demonstrate how the evaluation of the attributes in question is important to  
536 discriminate a wide choice of products, with different characteristics. Contextualizing the attitude of  
537 the consumers described in our study, which bought meat from the trusted butchers, who sold a  
538 specific product with peculiar characteristics, such as the meat of Piedmontese cattle (well-defined  
539 nutritional characteristics and certified origin), the evaluation of nutritional characteristics, origin or  
540 traceability, probably passed second, almost obvious.

541 The result related to color attribute evaluation during meat purchase at a trusted butcher is  
542 according to Grunert *et al.* (2004) in which the high degree of importance attached to buying from a  
543 butcher shows that consumers prefer to entrust the purchase decision to an expert, who would be  
544 more capable of predicting the outcome of the meal than themselves.

545 Consumers interviewed by “Other places of purchase” assumed price and animal welfare as the  
546 most important attributes for meat choice, while country of origin as the worst. 70% of these  
547 interviewed bought meat in discount store or in butcher randomly chosen by the consumer giving  
548 little attention to the place of meat purchase; therefore, it is not surprising the little relevance that  
549 these consumers showed with respect to the origin of the product. The other part of this category of  
550 consumers chose as a place of meat purchase farm butchers or farmer markets. In general, apart  
551 from the two constants concerning price and animal welfare, the place of purchase of the meat  
552 emerges as a factor in relation to consumer expectations. these latter changing in function of the  
553 information available at the shopping place (e.g., the product itself, its package, appearance, label,  
554 context, advertising or price) that generate new expectations (Font-i-Furnols and Guerrero, 2014).

555

556

557

558 **5. CONCLUSIONS**

559 The Best–Worst methodology proved to be a useful tool to evaluate consumer preferences in  
560 function of the frequency of meat consumption and the meat place of purchase. From the presented  
561 work a discrimination between the importance of each meat choice-attribute was made;  
562 furthermore, from our research the differences of preferences in subsets of the sample characterized  
563 by a typical behavior during meat purchase. In our choice experiment, the high quality of the  
564 product expected by the consumer probably reduces the importance of attributes that, in other  
565 contexts, would be carefully assessed (traceability, organoleptic and nutritional characteristics),  
566 increasing the consumer focus on price and animal welfare. Future research should focus on the  
567 analysis of meat consumption comparing Piedmonts breed with other breeds (for example with  
568 Garonnaise and Limousine breeds which are traditionally raised and consumed in Italy) (Hanus,  
569 2000; Cozzi, 2007) and extend the current research in the national - international context.

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