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**Consumers' willingness to buy innovative traditional food products: the case of Extra-Virgin Olive  
Oil extracted by ultrasound**

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## **Consumers' willingness to buy innovative traditional food products: the case of Extra-Virgin Olive Oil extracted by ultrasound**

### **Highlights**

- Willingness to buy extra-virgin olive oil extracted by ultrasound is investigated
- About half of those interviewed were willing to buy the product
- The best predictor of willingness to buy is the perception of the product's high quality

### **Abstract**

Innovation is fundamental for all agri-food companies to increase competitiveness, however the industrial process of extra virgin olive oil (EVOO) has changed very little over the last few decades. As it is a traditional food product (TFP), the main obstacle to innovation is precisely its traditional nature. According to the literature, any innovation regarding TFPs should be considered in terms of the specific product, and that market success mainly depends upon the perceptions and traits of consumers. The present study tested the willingness of consumers to buy an innovative EVOO obtained by ultrasound extraction (*ultrasonic EVOO*) through an ordered logit model. The major insight from our study is that consumers who are the most willing to buy the product are those who formed a positive quality perception after being introduced to the key characteristics of the new product. In addition, its acceptability seems to be higher for consumers who prefer EVOO with a fruity and not sweet taste, for consumers who attach great importance to the taste of food and with a higher than average educational level. This predominant role of perception in the acceptance of innovative TFPs should thus be researched further.

### **Keywords:**

extra virgin olive oil, traditional food product, innovation in tradition, ultrasound, consumers' willingness to buy

## 51 1. Introduction

52 Olive oil is one of the most important food products of Mediterranean countries in terms of both the production  
53 and consumption. Spain, Italy, and Greece, produce 72% and consume 48% of the world's olive oil (FAO,  
54 2017). In this study, we focus on extra virgin olive oil (EVOO), which is the highest quality olive oil. As it is  
55 strictly linked to the gastronomic heritage of the Mediterranean and is characterized by minimum processing  
56 and particular sensory properties, EVOO can be considered as a traditional food product (TFP) (Guerrero et  
57 al., 2009; Vanhonacker et al., 2010).

58 Despite the widely recognized advantages of innovation for the competitiveness of firms operating in global  
59 food markets, the EVOO industrial process has changed very little over the last few decades. The last major  
60 revolution in the olive oil technology was the introduction of the horizontal centrifuge, coupled with the  
61 malaxation machine (Amirante et al., 2010).

62 There are several factors that inhibit the introduction of further EVOO innovations, however the main obstacle  
63 seems to be its embedded traditionality (i.e. strict adherence to traditional methods of production). In fact,  
64 tradition and innovation are almost opposite concepts (Guerrero et al., 2012), thus the introduction of  
65 innovation in TFPs is more problematical compared to other agri-food products (Almli et al., 2011b; Guerrero  
66 et al., 2009). At a general level, because TFPs are mainly appreciated by consumers for their naturalness and  
67 particular sensory properties, the innovation of TFPs may be accepted provided that it does not harm the  
68 naturalness and does not change the sensory profile of the product (Vanhonacker et al., 2013). In addition,  
69 because the hedonic features attached to TFPs seem to lower consumers' perception of the healthiness and  
70 nutrition of such products (Pieniak et al., 2009), innovations aimed at improving the healthiness and nutritional  
71 profile of TFPs are more easily accepted by consumers, as long as they do not change the other characteristics  
72 of the products (Almli et al., 2011a).

73 Several studies have also highlighted the possibility of targeting the innovation of TFPs at specific clusters of  
74 consumers. In general, consumers who seem to best appreciate the innovation of TFPs have been portrayed  
75 as being middle-aged to elderly, foodies, ethnocentric and attached to familiar foods (Vanhonacker et al.,  
76 2010). While, a heterogeneity in consumer acceptance has been found by Guerrero and others (2009), who  
77 detected an increased openness in females and urban consumers. Innovations that enhanced the nutritional  
78 value of TFPs mostly attracted consumers who were particularly interested in the healthiness of food (Almli &  
79 Hersleth, 2013). Furthermore, innovations in TFPs seem to be best accepted by the habitual consumers of a  
80 specific product (Vanhonacker et al., 2013).

81 Other studies have shown that consumer acceptance of innovation in TFPs also depends on the type of  
82 product and innovation (Guerrero et al., 2009), however the results have been controversial. Almli and others  
83 (2011a) estimated a low probability of success in introducing a specific innovation for a traditional French  
84 cheese (Epoisses) and a traditional Norwegian cheese (Jarlsberg). Conversely, the introduction of an organic  
85 production for Pecorino Romano cheese (Napolitano et al., 2010), the enrichment of Omega-3 in mozzarella  
86 cheese (Vecchio et al., 2016) and the extended shelf life of Canestrato di Moliterno cheese (Pilone et al., 2015)  
87 appeared to be successful. Hersleth and others (2011) tested the acceptance of several innovations for a  
88 traditional dry-cured ham and found different degrees of acceptance for the attributes in different groups of  
89 consumers. In particular, the highest acceptance was found for consumers mainly characterized by an  
90 openness to new foods. Similar results were obtained by Fenger and others (2015), who partially overcame

91 the problem of consumers' reluctance to accept innovation by adding storytelling to the description of new  
92 meat products.

93 Many studies have also investigated consumer preferences for EVOO, distinguishing between traditional and  
94 non-traditional countries (e.g. Boncinelli et al., 2017; Roselli et al., 2016). Some focused on the increasing  
95 importance of the health benefits derived from consuming EVO oils (Roselli et al., 2017), however to the best  
96 of our knowledge no study has analysed consumers' willingness to buy an EVOO with process innovations.

97 This study investigates consumers' willingness to buy an innovative EVOO obtained by ultrasound extraction  
98 (hereby defined as ultrasonic EVOO). The application of ultrasound is one of the most promising new  
99 technologies that can be applied to the extraction of EVOO with several significant advantages in terms of  
100 technical efficiency (e.g. higher yield extraction), healthiness (higher content of polyphenols with antioxidant  
101 effects), and sensory profile (less bitter and pungent taste than conventional products (Amirante & Clodoveo,  
102 2017), as is specified in detail in the next section. Despite these advantages, consumers could not accept this  
103 innovation in a TFP such as EVOO. Because the majority of products incorporating innovations fail to gain any  
104 success on the market (Dijksterhuis, 2016), it is fundamental to consider the point of view of consumers during  
105 the early stages of innovation, in order to prevent new products from failing with the subsequent waste of  
106 resources (van Kleef et al., 2005).

107 A consumer survey was carried out in Apulia in southern Italy, where there is a wide production of EVOO and  
108 per capita consumption of olive oil is very high (16 kg/year per capita) (Coldiretti, 2016; ISMEA, 2017).  
109 Specifically, a web-based questionnaire was administrated to a sample of 961 EVOO consumers.

110 The article is organized as follows. Section 2 describes the main features of the ultrasonic EVOO and its  
111 extraction process. Section 3 reports the methodology employed (data, empirical model and estimation).  
112 Section 4 discusses the results obtained. Section 5 summarizes the findings and highlights the main practical  
113 implications for the introduction of the ultrasonic EVOO on the market.

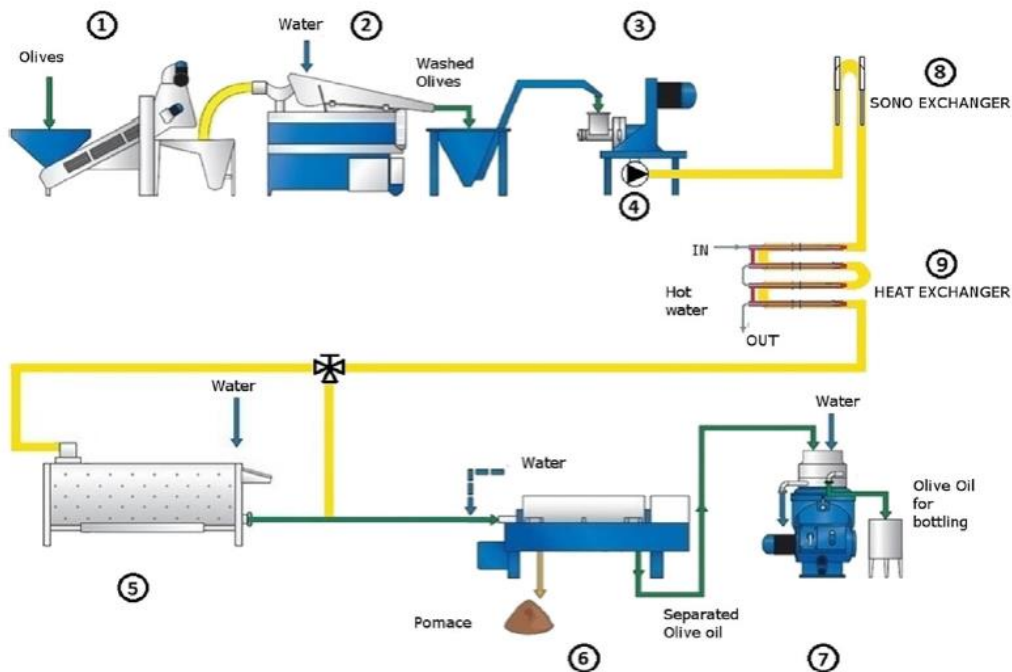
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## 115 **2. Brief description of the innovative extraction process**

116 Despite the plethora of scientific studies aimed at increasing the quality of EVOO and the efficiency of the  
117 extraction plants, the industrial process common to all categories of olive oil has changed very little over the  
118 last 20 years (Amirante et al., 2008; Clodoveo et al., 2014).

119 Currently, the extraction process is not continuous, unless the industrial plants use a series of malaxation  
120 machines working in parallel. This system guarantees the continuity of the process without interrupting the  
121 activity of the machines upstream and downstream of the malaxer. However, the malaxation phase still  
122 represents the "bottleneck" of the entire extraction process, and involves significant economic investment  
123 (Clodoveo, 2012). Academic and industrial researchers have been searching for a technological solution for  
124 the development of innovative virgin olive oil extraction plants (Clodoveo et al., 2015). Many emerging  
125 technologies have recently been developed (Clodoveo & Hbaieb, 2013). Of these, ultrasound extraction  
126 (Figure 1) seems to be the most promising due to its mechanical and slightly thermal effects, which do not  
127 increase energy and water needs compared to the conventional processes.

128



129

130 **Figure 1. Modified olive oil extraction process (Amirante & Clodoveo, 2016)**

131 *Note: 1. reception stage; 2. washing stage; 3. crushing stage; 4. pump; 5. malaxing stage; 6. separation stage;*  
 132 *7. clarification stage; 8. ultrasonic probes; 9. heat exchanger.*

133

134 Ultrasound extraction has several advantages due to the mechanical and thermal processes involved (Almeida  
 135 et al., 2017; Bejaoui et al., 2016; Jiménez et al., 2007). The ultrasound technology induces the rupture of cell  
 136 walls, recovering the oil and minor compounds trapped in the uncrushed olive tissue, increasing the working  
 137 capacity of the extraction plant and, at the same time, reducing the process time (Clodoveo, 2013). The  
 138 chemical and organoleptic evaluation of the product, performed according to Regulation No 61/2011,  
 139 confirmed that the quality parameters comply with the extra virgin olive oil category (Clodoveo et al., 2017). In  
 140 addition, its tocopherol, carotenoid, and phenolic content was higher than in a conventional product. The  
 141 significant increase in polyphenols in the sonicated oils can also be attributed to the effect of ultrasound on the  
 142 activity of polyphenol oxidase, the main enzyme responsible for the phenol oxidation (Clodoveo et al., 2016).  
 143 Finally, according to the panel test results reported by Clodoveo et al. (2017), the EVOO obtained by treating  
 144 the olive paste with ultrasound was characterized by a more “harmonic” taste than those obtained with the  
 145 traditional method, with the former being perceived as less bitter and pungent but more fruity.

146

### 147 **3. Materials & Methods**

#### 148 *3.1 Data collection*

149 The data were collected through an online-based questionnaire developed through the Google platform. The  
 150 sample was selected through snowball sampling, which was adopted due to the lower incidence of social  
 151 desirability bias in the respondents, which is usually prevalent in other types of interviews; albeit it is not easy  
 152 to reach a good representativeness of the sample (Szolnoki & Hoffmann, 2013). The sample selection was

153 also restricted to households from Apulia (Italy), due to the prominence of this area in both the production and  
154 consumption of EVOO within the Italian scenario (Coldiretti, 2016; ISMEA, 2017), hence consumers are likely  
155 to have a high familiarity with the product.

156 First, the survey investigated consumers' buying habits in relation to EVOO. Then, some questions assessed  
157 the preferences in relation to the different sensory dimensions, with a fruity, bitter and sweet taste  
158 characterizing the sensory profile of EVOO. In this case, sensory dimensions are especially important, as the  
159 new product will be slightly different compared to conventional products. In particular, we asked respondents  
160 how important for them each sensory feature characterizing EVOO was.

- 161 • “For you, how important is it that the EVOO you consume is fruity?” (*Fruity\_preference*)
- 162 • “For you, how important is it that the EVOO you consume is sweet?” (*Sweet\_preference*)
- 163 • “For you, how important is it that the EVOO you consume is bitter?” (*Bitter\_pungent\_preference*)

164 Next, some questions focused on the profile of respondents according to their general food habits and  
165 preferences. Lacking an appropriate scale devoted to the innovation of TFPs, we put together insights from  
166 the literature with a selection of relevant items from existing scales (Pieniak et al., 2009).

167 In order to assess the respondents' health concerns and interests in healthy eating we selected the following  
168 relevant items from Pieniak et al. (2008):

- 169 • “Health means a lot to me” (*Health\_1*);
- 170 • “I care about health” (*Health\_2*);
- 171 • “Health is very important to me” (*Health\_3*);
- 172 • “It is important to me that the food I eat on a typical day is good for my physical and mental health”  
173 (*Health\_4*);
- 174 • “It is important to me that the food I eat on a typical day keeps me healthy (*Health\_5*)”;
- 175 • “It is important to me that the food I eat on a typical day is nutritious (*Health\_6*)”.

176 The importance that respondents attached to the taste of food was measured with relevant items from Roininen  
177 et al. (2001):

- 178 • “I reward myself by buying something really tasty” (*Taste\_1*);
- 179 • “It is important to me to eat delicious food on weekdays as well as weekends” (*Taste\_2*);
- 180 • “When I eat, I concentrate on enjoying the taste of food” (*Taste\_3*).

181 The openness to new foods was then investigated with relevant items from the “Food Neophobia Scale” (Pliner  
182 & Hobden, 1992) and from the “Food Technology Neophobia Scale” (Cox & Evans, 2008):

- 183 • “I am constantly sampling new and different foods” (*Openness\_1*);
- 184 • “The benefits of new food technologies are often grossly overstated” (*Openness\_2*).

185 The influence of extrinsic cues was assessed with items from the relevant literature (Brunsø et al., 2002;  
186 Cheung et al., 2014; Grunert, 2005):

- 187       • “I care about the information on food labels” (*Label*);
- 188       • “The brand is very important for my food choices” (*Brand*);
- 189       • “Advertising has an influence on my food choices” (*Advertising*).

190       At this point, respondents were asked to imagine a common shopping situation where the innovative product  
191       is regularly sold in the usual EVOO channels of distribution: “*Imagine yourself in the place where you usually*  
192       *do your shopping, and you find an EVOO with the indication on the label - EXTRACTED BY ULTRASOUND*  
193       *– answer the following questions, giving your immediate reactions to this product*”. Firstly, respondents were  
194       asked to express their opinion on the perceived quality of the product:

- 195       • “In your opinion, does this product possess different quality features compared to those extracted with  
196       conventional methods?” (*Perceived\_quality*)

197       This variable identified whether a positive quality inference for the innovative product was registered. In  
198       particular, the answers followed an ordinal ranking:

- 199       [1] The quality is lower than the traditional product  
200       [2] The quality is the same as the traditional product  
201       [3] The quality is higher than the traditional product.

202       Respondents’ willingness to buy the ultrasonic EVOO was then measured, through the following question:

- 203       • “Would you be willing to buy ultrasonic EVOO?” (*willingness\_to\_buy*)

204       The answers were categorized into five options with an increasing level of willingness to buy the product  
205       (ordinal ranking):

- 206       [1]     *I am not willing to buy this product;*
- 207       [2]     *I am not willing to buy the product, but I plan to look for more information about it;*
- 208       [3]     *I would be willing to buy the product if the price was lower than the product I usually buy;*
- 209       [4]     *I would be willing to buy the product at the same price as the product I usually buy;*
- 210       [5]     *I would be willing to buy the product at a higher price than the product I usually buy.*

211       At the end, various demographics were collected: in particular, we asked for details regarding the household  
212       responsible for purchasing (such as age, sex and education).

213       A total of 961 EVOO consumers took part in the survey. The survey was completed, on average, in 5 minutes.

214

### 215       3.2 Preliminary analysis

216       The sample was composed by 961 EVOO consumers. The average age of respondents was 39 and the  
217       majority were female (55.4%). The average size of the households was between three and four people. Almost  
218       45% of the sample had a university or postgraduate educational level and about 68% had a monthly family  
219       income of up to € 3,000.



220 According to EVOO buying habits, the majority of respondents bought EVOO once or twice a year (54%),  
 221 mostly through direct channels such as mills or farms (73%), in containers of 3 litres or more (78%), at a price  
 222 of less than 7 €/litre (70%). In addition, for the majority of households within the sample, EVOO was the main  
 223 source of fat in the diet, beside the use of minor quantities of other edible oils (see Table 1).

224

225 **Table 1. Respondents' buying habits**

<b>How often do you buy extra virgin olive oil?</b>	<b>#</b>	<b>%</b>
Once or twice per year	515.0	53.6
More than twice per year but not monthly	224.0	23.3
Monthly	222.0	23.1
<b>Do you also buy other vegetable oils (e.g. seed oils)?</b>		
No, not at all	378.0	39.3
Yes, but to a lesser extent	547.0	56.9
Yes, many	36.0	3.7
<b>Where do you usually buy extra virgin olive oil?</b>		
Large-scale retailer (hypermarket, supermarket, minimarket, discount)	133.0	13.8
Specialty shop (e.g. gourmet shop, wine shop)	27.0	2.8
Mill or farm	701.0	73.0
More than 1 channel (large-scale retailer and other channels)	100.0	10.4
<b>In what format do you usually buy extra virgin olive oil?</b>		
≤0.50 L	8.0	0.8
0.75 or 1 L	201.0	20.9
3 - 5 L	522.0	54.3
> 5 L	230.0	23.9
<b>What is the price you usually pay to buy extra virgin olive oil?</b>		
< 4 €/L	85.0	8.8
4 - 7 €/L	584.0	60.8
7 - 10 €/L	277.0	28.8
> 10 €/L	15.0	1.6

226

227 As shown in Table 2, the respondents reacted almost equally to the idea of buying ultrasonic EVOO, with 49%  
 228 of the sample stating they were not willing to buy the product (answers 1 and 2) and 51% stating that they  
 229 were willing to (answers 3, 4 and 5).

230

231 **Table 2. Frequency of the willingness to buy ultrasonic EVOO**

	#	%
<b>Would you be willing to buy ultrasonic EVOO?</b>		
[1] <i>I am not willing to buy this product;</i>	97	10.2
[2] <i>I am not willing to buy the product, but I plan to look for more information about it;</i>	374	38.9
[3] <i>I would be willing to buy the product if the price was lower than the product I usually buy;</i>	82	8.5
[4] <i>I would be willing to buy the product at the same price as the product I usually buy;</i>	325	33.8
[5] <i>I would be willing to buy the product at a higher price than the product I usually buy.</i>	83	8.6

232

233 The descriptive statistics of the other items in the questionnaire then helped to profile the respondents in this  
 234 study. In their view, on average, the most important element for food choice was its healthiness (see Table 3).  
 235 What subsequently influenced the food choice was the taste of food. Of the extrinsic elements, label was the  
 236 most important (average value 5.59 out of 7), followed, respectively by brand (average value 3.91 out of 7)  
 237 and advertising (average value 2.50 out of 7).

238

239 **Table 3. Frequency of the items collected in the questionnaire**

Variable*	Mean	Std. Dev.	Min	Max
Health_1	6.31	1.27	1	7
Health_2	6.19	1.33	1	7
Health_3	5.95	1.35	1	7
Health_4	6.42	1.22	1	7
Health_5	6.16	1.33	1	7
Health_6	5.72	1.48	1	7
Taste_1	6.04	1.35	1	7
Taste_2	5.76	1.47	1	7
Taste_3	5.23	1.60	1	7
Label	5.59	1.56	1	7
Brand	3.91	1.79	1	7
Advertising	2.50	1.52	1	7

240 \* *Likert scale from 1 to 7 where 7 means higher level of importance*

241

242 In order to explain the determinants of the willingness to buy ultrasonic EVOO, we performed, first, a factor  
 243 analysis on the items shown in table 4. The factor loadings confirmed that the items actually converged into  
 244 four latent variables. The first factor is composed of all the elements characterizing consumers concerned  
 245 about general and food-related health and who are also those most prone to read labels: we define this latent

246 variable as “*Health*”. The second factor summarizes the importance that consumers attach to the taste of food.  
 247 This factor can be summarized by the latent variable “*Taste*”. The third factor includes consumers openness  
 248 to new foods and food technologies , which we define as “*Openness*”. The forth factor describes the joint  
 249 influence played by the extrinsic cues (i.e. label, brand and advertising) that can be summarized in the latent  
 250 variable “*Extrinsic*”. There were no significant cross-loadings harming the salient effects depicted by the whole  
 251 matrix.

252

253 **Table 4 – Rotated Factor Loadings**

Variable	<i>Health</i>	<i>Taste</i>	<i>Openness</i>	<i>Extrinsic</i>	Uniqueness
<i>Health_1</i>	<b>0.8667</b>	0.2645	0.0399	0.0539	0.1744
<i>Health_2</i>	<b>0.8779</b>	0.2602	0.0328	0.0626	0.1567
<i>Health_3</i>	<b>0.8839</b>	0.1336	-0.0071	0.0883	0.1931
<i>Health_4</i>	<b>0.857</b>	0.3064	0.0525	0.0316	0.1679
<i>Health_5</i>	<b>0.8929</b>	0.2171	0.058	0.0257	0.1515
<i>Health_6</i>	<b>0.8466</b>	-0.0135	-0.0134	0.0739	0.2775
<i>Label</i>	<b>0.6107</b>	0.12	0.2753	0.0741	0.5314
<i>Taste_1</i>	0.5304	<b>0.6895</b>	0.0837	0.0189	0.2359
<i>Taste_2</i>	0.3179	<b>0.8651</b>	0.1072	0.0734	0.1336
<i>Taste_3</i>	0.1309	<b>0.8733</b>	0.0592	0.1601	0.1912
<i>Openness_1</i>	0.0228	0.1024	<b>0.8175</b>	0.1372	0.3018
<i>Openness_2</i>	0.2243	0.2799	<b>0.6132</b>	0.212	0.4504
<i>Brand</i>	0.1514	0.1515	0.0772	<b>0.8124</b>	0.2883
<i>Advertising</i>	-0.0654	0.0406	0.2257	<b>0.8175</b>	0.2748

254

255 Subsequently, as shown in Table 5, a reliability measurement was performed. The reliability coefficients enable  
 256 us to assume that the measurement is consistent. For *Health* and *Taste*, we used Cronbach’s alpha, while for  
 257 *Openness* and *Extrinsic*, we performed the Pearson correlation coefficient, as there were two-item scales.  
 258 These values suggest whether the factors can be used to build latent variables for the explanatory model. This  
 259 was possible for all the factors, apart from *Openness* whose items seemed to be quite independent one from  
 260 another and, thus, not an appropriate measure of *neophobia*.

261

262 **Table 5 – Reliability measurement for each factor**

	<i>Health</i>	<i>Taste</i>	<i>Openness</i>	<i>Extrinsic</i>
Reliability	0.9366	0.8636	0.3279	0.5177

263

264 *3.3 Model specification*

265 The collected data were integrated and combined in an explanatory model showing the predictors of the  
266 willingness to buy the ultrasonic EVOO. Since the dependent variable ranges from one to five for the increasing  
267 levels of willingness to buy, an ordered probability model can be used (Greene & Hensher, 2010). In particular,  
268 we chose the ordered logit model that represents an extended logit model specifically for ordinal data  
269 (Winkelmann and Boes 2006). It is based on the following specification:

270  $y_w^* = \beta' x_w + \varepsilon_w,$

271 where:  $E[\varepsilon_w|x_w] = 0$        $\varepsilon_i$  i.i.d. Logistic (0,1);  $w = 1, \dots, W.$  (1)

272

273 The term  $y_w^*$  represents the willingness to buy the ultrasonic EVOO. The term  $x_w$  represents the explanatory  
274 variables and  $\varepsilon_w$  is the stochastic term. The  $\varepsilon_i$  has a standard logistic distribution.

275 The explanatory variables used in the model are those coming from the factor analysis (*Health, Taste,*  
276 *Openness, Extrinsic*), taste preferences (*Fruity\_preference, Sweet\_preference, Bitter\_pungent\_preference*),  
277 the perceived quality of ultrasonic EVOO (*Perceived\_quality*), and demographic (education).

278 The model was estimated using the Stata software version 14, in a stepwise procedure that selects the most  
279 representative model.

280

281 **4. Results**

282 The model estimation enabled us to examine consumers' willingness to buy innovative TFPs, as influenced  
283 by their individual characteristics and traits. Table 6 reports the estimation results.

284

285 **Table 6. Estimation results: ordered logistic regression**

Variables	Coef.	p-value	Std. Err.	Odds Ratio
<i>Health</i>	0.05	0.426	0.063	
<b>Taste</b>	<b>0.17</b>	0.009	0.063	1.18
<i>Extrinsic</i>	-0.07	0.281	0.063	
<b>Fruity_preference</b>	<b>0.13</b>	0.000	0.036	1.14
<b>Sweet_preference</b>	<b>-0.08</b>	0.041	0.038	0.93
<i>Bitter_pungent_preference</i>	0.03	0.371	0.033	
<b>Perceived_quality</b>	<b>1.19</b>	0.000	0.095	3.28
<b>Education</b>	<b>0.14</b>	0.049	0.071	1.15

286 #obs: 961

287 Note: the significant coefficients are highlighted in bold

288

289 The coefficients relative to each variable show which elements might influence the willingness to buy ultrasonic  
290 EVOO. The most important element that increases the consumer willingness to buy ultrasonic EVOO is the  
291 perception that this new technology might actually improve the quality of the product (+1.19). The trait of  
292 assigning great importance to the pleasant taste of food also increases the likelihood to buy the innovative  
293 product (+0.17). Regarding the demographics, education seems to play a role: respondents with a higher  
294 education were more willing to buy the ultrasonic EVOO (+0.14). No significant effect was found for the food-  
295 related health concerns of consumers or by assigning importance to the extrinsic attributes of products. In  
296 terms of the sensory properties of EVOOs, liking a fruity taste increases the willingness to buy the new product  
297 (+0.13), while the opposite is valid for the respondents who showed a preference for a sweet taste (-0.08);  
298 thus, no significant effect was found for the preference for a bitter and pungent taste of the EVOO.

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## 300 **5. Discussion and conclusions**

301 The analysis of the literature highlighted that the innovation of traditional food products (TFPs) should be  
302 considered at the narrow level of the individual product, and that the market success of the innovation mainly  
303 depends upon the perceptions and traits of consumers.

304 Since there is no market yet for ultrasonic EVOO, in this study we investigated consumers' willingness to buy  
305 the product. At this very early stage, about half of the surveyed consumers stated that they were willing to buy  
306 the new product, although only a small portion (9%) stated that they were willing to pay more for it. An  
307 econometric model was thus developed to understand which consumer traits could best predict the possible  
308 market success of the product.

309 The major insight from our study is that consumers who are most willing to buy the product are those who  
310 formed a positive quality perception after being introduced to the salient characteristic of the new product  
311 (extracted by ultrasound). This result is in line with previous studies that assigned a pivotal role to perceptions  
312 in the quality judgment of food products (e.g. Grunert, 2005). In turn, perceptions are able to shape  
313 expectations, which are also able to influence the subsequent experience of the product (Piqueras-Fiszman &  
314 Spence, 2015). This has also been confirmed for the acceptance of innovative TFPs, in which storytelling has  
315 been successfully used in describing products, in order to positively influence the perceptions of consumers  
316 before the product trial (Fenger et al., 2015). Thus, shaping perceptions in relation to the product seems to be  
317 the most powerful element to foster the willingness to buy ultrasonic EVOO. Then, it would be beneficial to  
318 further investigate how to positively influence perceptions in order to improve the likelihood of success of these  
319 products.

320 Although the literature suggested that consumers who attach much importance to taste prefer unhealthy foods,  
321 in this case they seemed ready to adopt a health-enhanced food. However, our model found no effects for  
322 either food-related health concerns or the importance of the extrinsic attributes of products.

323 Consumers' sensory preferences also played a role in predicting the willingness to buy ultrasonic EVOO.  
324 Consumers who showed a preference for fruity EVOO had a higher willingness to buy the new product, while  
325 the opposite was true for consumers who preferred EVOO with a sweet taste. Previous studies showed that  
326 consumers' preferences for different EVOO sensory profiles are quite heterogeneous (Del Giudice et al.,

327 2015). Some studies have highlighted that trained consumers, as well as experts, positively value EVOOs with  
328 enhanced bitter and pungent features, while consumers with less familiarity with the product mostly prefer  
329 fruity and sweet EVOOs (Caporale et al., 2006; Del Giudice et al., 2015; Recchia et al., 2012; Valli et al., 2014).  
330 Bitter and pungent features in food are generally not appreciated by consumers mainly due to evolutionary  
331 reasons, however exposure and information can affect this preference (Cavallo et al., 2017; Drewnowski &  
332 Gomez-Carneros, 2000), which is why experts and trained consumers appear to be able to recognize EVOOs  
333 with a higher health potential (Delgado & Guinard, 2011). There is ample evidence that EVOOs with a bitter  
334 and/or pungent taste have an increased content in polyphenols (Vitaglione et al., 2013). The opposite is valid  
335 for a sweet taste, which is generally considered antithetical to a bitter and pungent taste (Valli et al., 2014). On  
336 the other hand, fruity sensory properties in EVOOs are generally appreciated by both experts and trained  
337 consumers (Delgado & Guinard, 2011). Thus the effect of taste preferences are mediated by a degree of  
338 familiarity and knowledge with the product (Caporale et al., 2006; Cavallo & Piqueras-Fiszman, 2017; Delgado  
339 & Guinard, 2011), and, generally, less familiar consumers are less likely to adopt innovations (Del Giudice &  
340 Pascucci, 2010).

341 In terms of demographics, consumers with higher level of education were more willing to buy the ultrasonic  
342 EVOO. This is in line with other studies showing that a higher education level can be a predictor of an increased  
343 willingness to accept new food products, because more educated consumers tend to process information  
344 faster (Costa-Font et al., 2008; Traill et al., 2005; Verbeke, 2005).

345 These results can be used in developing various marketing indications in order to foster the success of  
346 ultrasonic EVOO. Providing extensive and detailed information on the product, especially in terms of its  
347 benefits, could be the most important marketing approach for three main reasons: it can be used to highlight  
348 the healthy features of the new product, it can increase consumers' familiarity with the product, and it can  
349 positively shape their expectations even before trying the product. In addition, the consumers who are most  
350 likely to adopt the innovation, at an early stage, are those living in the traditional EVOO producing and  
351 consuming areas (as they have a higher degree of familiarity with the product) and in the segments of the  
352 population with higher levels of education.

353 This study also has various limitations. Firstly, the investigation of the possible acceptance of the new product  
354 was carried out before a real market has actually been created and, thus, there may be a hypothetical bias in  
355 consumers' evaluations. In addition, more sophisticated methods are needed to estimate whether and to what  
356 extent consumers are willing to pay more. The study was also based on a sample characterized by a relatively  
357 high educational, which may mean that consumers were well knowledgeable about processing techniques.  
358 Furthermore, an analysis of a national sample would provide insights that could be extended to a national  
359 level.

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