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Do Italian consumers value health claims on extra-virgin olive oil?

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1. Introduction

Search, experience and credence attributes affect consumer acceptance of, and preferences for, extra-virgin olive oil (EVOO) (Del Giudice et al., 2015). Search attributes are product features that can be evaluated before purchasing or consuming a product (Nelson, 1970), for instance, price, colour, packaging size and packaging material. Experience attributes are product characteristics that can only be accurately assessed after the product is purchased and consumed (Nelson, 1970), such as sensory features. Lastly, credence attributes are product features that consumers cannot evaluate before or after consuming the good (Darby & Karni, 1973). Indeed, EVOO products may encompass a wide set of credence attributes such as country of origin, geographical indication (GI), product category (e. g. extra-virgin or virgin), production method (e.g. organic), other production specifics (e.g. 'cold extraction' or 'first cold pressing', 'olive variety'), and lastly whether the product provides health benefits.

Marketing and consumer literature have explored the impact of the above search, experience and credence attributes on consumer acceptance of, and preferences for EVOO largely via choice-based conjoint analysis and experiments (Del Giudice et al., 2015). Scholars report that, on average, consumers prefer EVOO with low-price, greenish-yellow colour, and packaged in glass bottles <1 L in volume (Muñoz et al., 2015; Bernabéu & Díaz, 2016; Sayadi et al., 2017). Neutral taste is also preferred to the pungent and bitter taste (Valli et al., 2014; Del Giudice et al., 2015; Cavallo et al., 2019; Vecchio et al., 2019).

The literature on consumer preferences for credence attributes on EVOO is extensive and has repeatedly shown that consumers prefer domestic EVOO to foreign one and that geographical indications (GIs) affect EVOO choices and preferences. Consumer willingness to pay premium prices for EVOO with GI logos has been found systematically (Panico et al., 2014; Ballco & Gracia, 2020) and such premium for GIs increases with consumer knowledge/awareness of with the GI logo (Grunert & Aachmann, 2016). Researchers also agree that consumers prefer organic and eco-friendly EVOOs for which they are willing to pay a premium (Giannoccaro et al., 2019; Tempesta & Vecchiato, 2019). Scholars also found that indication of the olive variety on the label affects olive oil price in relation to consumers' knowledge/expectations regarding taste (e.g. fruity, pungent, etc.). EVOO obtained from olive varieties which are expected to provide a neutral taste is sold at higher price compared to standard EVOO (Ballco & Gracia, 2020; Roselli et al., 2020). Researchers also pointed out as information on EVOO extraction methods, such as "cold extraction" (i.e. obtained at a temperature below 27 °C by percolation or centrifugation of the olive paste), was positively related to a higher price, since consumers value the organoleptic and health benefits associated with extraction practices. Indeed, consumers

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perceive EVOO obtained by "cold-extraction" as having lower acidity and higher content of chemicals beneficial for health (Perito et al., 2019).

Scholars have recently focused on consumer acceptance of, preferences for, health claims on EVOO,[1] indicated as a promising credence attribute for differentiating EVOO and allowing fair returns for the work of producers (Roselli et al., 2017). Health claims have proved to add value to food products, such as in the dairy sector (Bimbo et al., 2016), whereas their ability to add value to EVOO products has only been marginally explored with conflicting results (Boncinelli et al., 2016; Perito et al., 2019, Picchieri et al., 2020a,b). To the best of our knowledge, only four studies have tested the importance of health claims for consumers purchasing EVOO products. Boncinelli et al. (2017) surveyed a representative sample (n = 1000) of Italian consumers and found that health claims play a marginal role in the selection of EVOO products, whether health claims are tested jointly with the indication of origin and organic attributes. The latter two product's features were always preferred over health claims from consumers. Instead, Perito et al. (2019) testing consumer preferences for a wider set of credence and search attributes, found that health claims were a major attribute of interest for EVOO consumers. In terms of importance in selecting EVOO, consumers sampled in their study (n = 179) ranked health claims after information on geographic origin and before organic and a generic "sustainable" attribute. Lastly, Pichierri et al. (2020a; 2020b) tested competitively the four health claims potentially associated with EVOO in a sample of Italian consumers (n = 185) using a framework rooted in the general psychology, namely the Regulatory Focus Theory (Higgins, 2002). Such theory postulates that persons have two inner self-regulation systems: one focusing on achieving rewards, or promotion focus, while the other attempting to avoid losses, or prevention focus. Promotion-focused individuals seek opportunities for improvements and they are likely to adopt strategies to achieve their goals. Conversely, prevention-focused individuals tend to implement "avoidance" strategies focused on mitigating losses and risks to their wellbeing. Authors found that health claims increase the perceived healthiness of EVOO and that consumers prefer the risk of disease reduction claim over other claims, especially in the prevention-focused consumer group (2020b). Although Pichierri et al. (2020a; 2020b) pointed out that individual psychological traits affect consumer preferences for health claims, authors do not inform to what extent health claims are preferred when presented to consumers with many other product attributes. The same shortcomings affect Boncinelli et al.'s (2016) findings. Also, Pichierri et al.'s (2020a; 2020b) findings may have limited generalizability due to the small sample size used, analogously to findings from Perito et al.'s (2019) study.

Thus, the present study aims to extend the existing literature on EVOO consumers by assessing the importance of health claims in selecting EVOO products by jointly accounting for consumer preferences for the many search, experience, and credence attributes potentially available on EVOO, as well as by accounting for attitudinal and psychographic individual characteristics which affect consumer decision to prefer products with health claims over conventional ones (i.e. subjective nutritional knowledge, nutritional knowledge, nutritional importance, attitudes towards using food as a medicine, general health interest). The latter characteristics play a pivotal role in individual decisions to consider health claims when purchasing food, as indicated in the general literature on consumers and health claims. Such individual-related characteristics capture the individual attitude and interest in preventing health losses through food choices and diet (see for instance, Roininen et al. (1999) ,Van Trijp & Van der Lans (2007) Dean et al. (2012)).

To achieve our research goal, we employed a best-worst (BW) approach on a representative sample of Italian household members who are responsible for food shopping. Consumers tested competitively the multiple product attributes of EVOO. The share of consumers interested in health claims was detected by a latent class clustering model and characterized based on their socio-demographic, attitudinal, and psychographic features. Thus, this is the first study attempting to identify the features of consumers interested in health claims while purchasing EVOO using a large sample of household responsible of food purchases.

2. Materials and methods

2.1. Data collection and description

The data was collected in 2019 by an online survey administered by a professional marketing agency to a representative sample of Italian household members who are responsible for food shopping (N = 1030), stratified by age, gender, and area of residence. The data collection method complied with national ethical requirements as all subjects gave their informed consent to participation in the study, and all the data was collected anonymously. The data was recorded and managed according to the "Italian Personal Data Protection Code" (Legislative Decree no. 196 of 30 June 2003).

The questionnaire consisted of two parts. The first part concerned respondents' choice associated with the BW experiment described in the next paragraph, aimed at identifying consumer preferences for 13 EVOO attributes selected from the literature and reported in Table 1. The attributes were described to respondents before the BW experiment.

The second part of the questionnaire collected socio-demographic data of respondents (e.g. gender, age, education, children under 12 years in the household and self-declared income), EVOO consumption habits (consumption frequency of EVOO and quantity consumed monthly), health-related information (direct and indirect exposure to chronic diseases and self-declared health status), attitudes and psychographic features (Table 4 and Table 5 in the results and discussion section). The latter two were collected according to the following validated scales:

i) *General Health Interest* (GHI), adapted from Roininen et al. (1999), was implemented to elicit respondents' attitudes to healthy eating. The scale is composed of 8 items measured on a 7-point Likert scale, ranging from strongly disagree (1) to strongly agree (7).

ii) *Attitudes towards using food as a medicine* (AFM), proposed and validated by Dean et al. (2012), measures attitude to using food to improve health status due to an unhealthy diet. It is composed of four items measured on a 7-point Likert scale, ranging from strongly disagree (1) to strongly agree (7).

iii) *Nutritional importance* (NI) is a psychographic scale, adapted from Van Trijp & Van der Lans (2007), measuring the nutritional importance attributed to EVOO by respondent. The scale is composed of two items and uses 7-point scales ranging from never (1) to always (7).

[1] There are four health claims applicable to extra-virgin olive oil included in the EU Register on nutrition and health claims (Regulation (CE) n. 1924/2006): "*Olive oil polyphenols contribute to the protection of blood lipids from oxidative stress*" (Health claim on Olive oil polyphenols); "*Vitamin E contributes to the protection of cells from oxidative stress*" (Health claim on Olive oil Vitamin E); "*Replacing saturated fats in the diet with unsaturated fats contributes to the maintenance of normal blood cholesterol levels*" (Health claim on unsaturated fats); and "*Replacing saturated fats with unsaturated fats in the diet has been shown to lower/reduce blood cholesterol. High cholesterol is a risk factor in the development of coronary heart disease*" (Reduction of disease risk claim on unsaturated fats). However, it should be specified that different regulatory systems in health claims on foods across countries exist. In fact, the European Union regulates the use of health claims according to Regulation (CE) n. 1924/2006 on Nutrition and Health Claims made on foods, while the U.S. regulate the use of health claim via the "The Nutrition Labeling and Education Act" of 1990 (NLEA). In Japan, where products with health claims are largely marketed, a new regulatory system called "Foods with health claims" has been adopted since April 2001. For further details on the scientific and regulatory systems regulating the use of health claims on foodstuffs in the European Union, USA, and Japan, the interested reader can see a review of Lalor & Wall (2011).

Table 1
The 13 EVOO attributes used in the survey *(translated from Italian)*.

EVOO attribute	Description	References
Country of origin	The country or countries where the olives were harvested and pressed (e.g. Italy, Spain, European Union)	Panico et al., 2014; Ballco & Gracia, 2020
Geographical indications	Certification and mark guaranteeing that at least one (protected geographic indication, PGI) or all stages (protected designation of origin, PDO) of EVOO production process took place in a well-defined area (e.g. Tuscan PGI, Terra di Bari PDO)	Del Giudice et al., 2015; Grunert & Aachmann, 2016
Brand	The producer's name or other identifying logos on the label (e.g. Bertolli, Monini, Carapelli)	Del Giudice et al., 2015
Previous experience	Personal experience with a product already purchased in the past	Del Giudice et al., 2015
Organic	Certification and mark guaranteeing that all stages of EVOO production were environmentally friendly (e.g. no synthetic chemicals or genetically modified plants)	Del Giudice et al., 2015; Boncinelli et al., 2016; Perito et al., 2019; Giannoccaro et al., 2019; Tempesta & Vecchiato, 2019
Price	The price (€) paid for the EVOO purchased	Del Giudice et al., 2015
Olive variety	The variety or varieties of olives indicated on the label (e.g. Leccino, Coratina, Frantoio)	Ballco & Gracia, 2020; Roselli et al., 2020
Packaging	EVOO packaging (e.g. material, shape, size)	Muñoz et al., 2015; Bernabéu & Díaz, 2016; Sayadi et al., 2017; Cavallo, & Piqueras-Fiszman, 2017.
Extraction process	The method used to extract the EVOO indicated on the label (e.g. cold extraction, first cold pressing)	Perito et al., 2019
Health claim	Any statement linking EVOO consumption and human health. The European Commission has authorised various health claims for the labelling of EVOO.	Boncinelli et al., 2016; Perito et al., 2019; Pichierri et al., 2020a; 2020b
Acidity	The free acidity of EVOO (e.g. 0.4%)	Valli et al., 2014; Del Giudice et al., 2015.
Colour	The colour of EVOO (e.g. yellow, green)	Muñoz et al., 2015; Bernabéu & Díaz, 2016; Sayadi et al., 2017
Taste	The sensory features of EVOO (e.g. bitter, pungent, fruity, sweet)	Valli et al., 2014; Del Giudice et al., 2015; Cavallo et al., 2019; Vecchio et al., 2019;

iv) *Subjective nutritional knowledge* (SNK) is a psychographic scale adapted from Van Trijp & Van der Lans (2007) that measures subjective perceptions of knowledge about health and nutrition issues. It is composed of two items and measured on a 7-point Likert scale ranging from strongly disagree (1) to strongly agree (7).

v) *Nutritional knowledge* (NK) is an index that measures objective knowledge of food and nutrition. The NK scale is adapted from Paramenter & Wardle (1999) and modified according to Cavallo & Piqueras-Fiszman (2017). The latter used the scale to study consumers' NK of EVOO using 17 questions.

A detailed description of the items included in each scale is reported in Appendix B.

2.2. Best-Worst method and latent class clustering analysis

In order to reveal consumer preferences toward the attributes of EVOO, a BW scaling experiment was performed. The BW technique is a scaling method developed in 1990 (Louviere & Woodworth, 1990) - and first published by Finn & Louviere (1992) - based on the random utility theory of decision making (McFadden, 1974), where the value a respondent derives from an attribute relative to a comparator is proportional to how often she/he chooses it in preference to that attribute. It has the advantage of being free of rating bias (Cohen & Markowitz, 2002; Lusk & Briggeman, 2009), and it has been found to have greater discrimination than rating scales (e.g., Jaeger et al., 2008). It consists in iteratively asking interviewees to choose the most preferred ("best") and the least preferred ("worst") items of a choice set (Louviere et al., 2015). Therefore, forcing respondents to make trade-offs between items, BW scaling overcomes the issue of many attributes having similar importance weights and it provides more information about the ranking of the choice options in each set (Louviere et al., 2013). The number of items in a single choice set and the number of choice sets depend on the total number of items and the experimental design. The BW scaling approach has been widely used to study consumer preferences for food products' attributes (e.g. Finn & Louviere, 1992; Lagerkvist, 2013; DeMagistris et al., 2017) as it is particularly suited to scale distinct attributes, characteristics or items on one dimension such as utility, liking, agreement or importance. In addition, applying a BW method we can construct individual-level scales of preference for each EVOO attribute and accurately compare these scales (Hein et al., 2008; Lusk & Briggeman, 2009).

The current BW scaling experiment had a balanced incomplete block design (13,4,4,1),[2] i.e. 13 items divided into 13 choice sets with four items each, and every attribute appearing 4 times in the choice sets. Balanced indicates that every item appears the same number of times. The 13 items were the EVOO attributes in Table 1. Respondents were asked to choose between EVOO attributes according to which they considered the most (and the least) important in their choice of EVOO. An example of a choice set is given in Table 2.

Brand was included in the list of the selected attributes since the average consumer tends to give a higher liking score, i.e. to prefer, credence attributes supported by a familiar brand which is able to provide an additional guarantee of credence attributes declared on the label (Del Giudice et al., 2015).

The ranking of EVOO attributes was calculated for single respondent and then for the entire sample by assigning + 1 every time an attribute was mentioned as the best and −1 every time it was mentioned as the worst. Adding the + 1 s and the −1s gave a score for each EVOO attribute (BW score) that was used to make the final ranking. The experimental design was such that every attribute had a score from −4 to + 4 for each individual. While the BW score indicates the importance of an attribute, negative scores do not indicate dislike, but below average preference (Peano et al., 2019).

A correlation matrix of average BW scores depicts EVOO attribute preference structure (Table A in Appendix). For example, a significant high correlation means that two attributes vary together. This makes it possible to single out the most important attributes that drive different consumers in choosing EVOO and then to identify different consumer segments, each including individuals who share similar preferences. As

Table 2
Example of choice set.

	Most important	Least Important
Country of origin		
Geographical indication		
Brand		
Previous experience		

[2] 13 are the choice set, 4 is the repetition per level, 4 is the number of items in each choice set, 1 is the pair frequency.

in other studies (e.g., Jaeger et al., 2008; Muller & Rungie, 2009), we used a Latent Class Clustering Model, or Latent Class Analysis (LCA). Clustering the sample by this method further analyses the heterogeneity underlying attribute importance among respondents and unveils patterns that may be used for market analysis (Muller & Rungie, 2009). Hence, clusters were generated using attribute BW scores as dependent variables. The assumption of LCA is that data is generated by a probability distribution which defines a certain number of latent clusters. The sub-samples generated by LCA can be characterized in terms of demographic, attitudinal and psychographic characteristics, to identify market segments and improve the understanding of the complete range of preferences expressed by respondents. The list of variables and the coding used for LCA is reported in Table 3.

3. Results and discussion

3.1. Sample description

Summary statistics of sample collected in Table 4 pointed out that respondents were almost equally composed of men and women (49% vs 51%), half of the respondents in the sample was between 36 and 55 years old, and one out of three had a high level of education. A child under 12 years old was present in one out of three households and the majority of the respondents declared an average household income under 1800€. In terms of the geographical distribution of respondents, 31.84% was located in the South of Italy, 26.80% in the North-West, 22.72% in the Centre, while the remaining 18.64% of respondents was sampled in the North-East of Italy. The EVOO usually consumed by the whole sample, with a share of approximately 90% of respondents who use EVOO more than once a week and a median monthly household consumption of 0.5–1.0 L. Health status across the sample was good, although a small share of respondents ranging from 19% and 33% suffered from chronic diseases directly or indirectly, while only 13% of respondents in the sample followed a special diet.

Lastly, all respondents scored above the average for all the scales capturing attitudinal and psychographic features measuring the individual interest in health, nutrition, and attitudes on using food for ameliorating the health status as reported in Table 5.

Table 3
Variables applied in the Latent Class Model

Variables	Type	Coding
Gender	Dummy	(0 = Female, 1 = Male)
Age	Continuous	18 – 70
Number of household members	Categorical	1 – 10
Children	Dummy	(0 = No, 1 = Yes)
Education	Categorical	1–5 (1 = low level, 5 = high level)
Profession	Categorical	1–6 (1 = Homemaker, 2 = Unemployed, 3 = Employed part time, 4 = Employed full time, 5 = Retired, 6 = Student)
Income	Categorical	1–3 (1 = Below 1.800€, 3 = Over 2.600€)
Body mass index	Continuous	14–58
Family illness	Dummy	(0 = No, 1 = Yes)
Special diet	Dummy	(0 = No, 1 = Yes)
Personal illness	Dummy	(0 = No, 1 = Yes)
Self-declared health status	Categorical	1–7(1 = Bad, 7 = Excellent)
EVOO consumption frequency	Categorical	1–4 (1 = Once a month, 4 = more than once a week)
EVOO quantity montly consumed per household	Categorical	1–14 (1 = Less than one third of a litre, 14 = More than 10 L)
General health Interest (GHI)	Categorical	1–7 (1 = very low, to 7 = very high)
Attitudes towards using food as a medicine (AFM)	Categorical	1–7 (1 = very low, to 7 = very high)
Nutrition importance (NI)	Categorical	1–7(1 = very low, to 7 = very high)
Subjective nutrition knowledge (SNK)	Categorical	1–7 (1 = very low, to 7 = very high)
Nutrition knowledge (NK)	Categorical	1–17 (1 = very low, to 17 = very high)

Table 4
Sample description (N = 1030)

Variable	*Sample*	
	N.	%
Gender:		
Females	528	51
Males	502	49
Age range (years):		
18–35	299	29
36–45	272	26
46–55	247	24
greater than 55	212	21
Education:		
Primary	108	11
Secondary	589	57
Tertiary	333	32
Children in the household (< 12 years):		
Yes	301	29
No	729	71
Self-declared monthly income:		
under €1800	445	43
€1800-2600	361	35
over €2600	224	22
Area of residency		
North-East	192	18
North-West	276	27
Centre	234	23
South	328	32
EVOO consumption frequency		
More than once a week	899	87
Once a week	80	8
Two or three times a month	37	4
Once a month	14	1
EVOO quantity monthly consumed per household		
Half litre or less	219	21
Between half litre and one litre	327	32
Between one litre and two litres	332	32
More than two litres	152	15
Special diet		
Yes	136	13
No	894	87
Personal illness		
Yes	200	19
No	830	81
Family member illness		
Yes	338	33
No	692	67
Self-declared health status		
Very poor	7	1
Poor	17	2
Not so good	43	4
Normal	230	22
Decent	294	28
Good	379	37
Excellent	60	6

Table 5
Attitudes and psychographic characteristics of respondents

Scale/Index	Mean	S.D.	Min	Max
General health interest (GHI)	4.84	1.08	1	7
Attitudes toward using food as a medicine (AFM)	5.04	1.22	1	7
Nutritional importance (NI)	4.90	1.23	1	7
Subjective nutritional knowledge (SNK)	4.46	1.51	1	7
Nutritional knowledge (NK)	9.73	3.38	0	17

3.2. Average Best-Worst score analysis

The number of times each attribute was indicated as best (B), most important, and worst (W), least important, were used to calculate the BW score by subtracting the number of times the attribute was selected

as worst from the number of times it was selected as best. The BW score was divided over the total number of respondents (n) in the sample to compute the average BW score (B–W)/n (see Table 6). Among the 13 attributes tested, the attributes *Taste*, *Country of Origin*, *Geographic Indication* were selected as the most important attributes, preferred in more than 1/4 cases when they appeared in a choice set. The findings suggested the importance of taste in selecting EVOO, as previously documented by Del Giudice et al., (2015), as well as knowing where the EVOO came from and certification of origin, in line with findings in the marketing studies (Panico et al., 2014; Ballco & Gracia, 2020).

The attribute *Organic* scored immediately after *Geographic Indication*, in line with studies showing that consumers value the environmental sustainability dimension of EVOO production once they know the origin of the product (Giannoccaro et al., 2019; Tempesta & Vecchiato, 2019; Perito et al., 2019). The attribute *Health claim* ranked immediately after the *Organic* in term of importance, suggesting that this attribute is of secondary interest for the average EVOO consumer.

The positive, albeit marginal, importance attributed to *Health claim* may be mostly due to the fact that consumers are familiar with EVOO and its health benefits (Santosa & Guinard, 2011; Yubero-Serrano et al., 2019). Thus, consumers likely consider that EVOO is healthy *a priori,* irrespective of whether there are health claims on the label. Alternatively, the marginal importance attributed to health claims may be because consumers are accustomed to purchasing products bearing health claims which are familiar and easily understandable (Ares et al., 2009; Nocella & Kennedy, 2012). Instead, health claims are recently introduced in EVOO European market, thus consumers may not be familiar with them, as well as their wording is rather technical far from being understood by the average consumer (Nocella & Kennedy, 2012). Lastly, among the attributes tested, *Brand* and *Packaging* were considered by far the least important attribute in purchasing EVOO.

3.3. Cluster analysis

To explore respondent heterogeneity, we used the average BW score and latent class cluster analysis to identify homogeneous groups of consumers with similar preferences for EVOO attributes (Table 7). The larger the average BW score for an attribute, the more important the attribute for the respondent group is. Latent class cluster analysis assumes that individuals belong to one of k clusters, the size and number of which are unknown *a priori*. Additionally, Latent class models assume that there are unique segments (latent classes) of consumers, who have similar preferences within segments but significantly differ in their preferences across clusters (see, among others, Jaeger et al., 2008; Loose & Lockshin, 2013).

In the current study, we identified four homogeneous consumer groups using the Bayesian Information Criterion (BIC) and log-likelihoods (LL) to select the optimal number of segments (Table B in Appendix). ANOVA was used to test whether segments significantly differed in the importance of each attribute, using the average BW score as a proxy for attribute-related importance. In particular, ANOVA F-statistics tests the average BW scores across clusters against the null hypothesis that they are statistically equal across clusters. Subsequently, post-hoc Tukey tests investigated the paired statistical significant differences ($p < 0.05$) among the four cluster means. All analyses were performed using Stata14.0 software (Stata Corp, College Station, Texas).

Table 6
Sample-level BW scores and average BW scores

EVOO ATTRIBUTES	BW score	Average BW score
Taste	$1541^{(a)}$	1.50
Country of origin	$1390^{(a,b)}$	1.35
Geographical indications	$1347^{(b)}$	1.31
Organic	$629^{(c)}$	0.61
Health claim	$220^{(d)}$	0.21
Extraction process	$134^{(d)}$	0.13
Previous experience	$-94^{(e)}$	−0.09
Price	$-150^{(e,f)}$	−0.15
Olive variety	$-266^{(e,f)}$	−0.26
Acidity	$-293^{(f)}$	−0.28
Colour	$-990^{(g)}$	−0.96
Brand	$-1046^{(g)}$	−1.02
Packaging	$-2422^{(h)}$	−2.36

Note: BW scores for attributes bearing the same superscript letter do not statistically differ among them according to the T-test p < 0.05) for pairwise comparisons of means.

The information reported in the last column of Table 7 shows that the four consumer groups differ in all attributes' preferences and great variance exist, also among clusters' mean scores assigned to EVOO attributes.

Similarly, in Table 8 F-stat reveals that the four clusters are different in terms of gender, age, family size and number of children in the family, as well as whether respondents or a family member suffer from a chronic disease. The four groups also differed in the share of those follow a special diet, in total monthly consumption of EVOO and in frequency of consumption. Lastly, and most importantly, the four groups differed in general interest in health, attitude to using food as medicine, the nutritional importance of food, nutritional knowledge and subjective knowledge of nutrition. The results showed significant differences for all 13 attributes (Table 7) across consumer groups (Table 8). The four groups of consumers were defined as: *Practicals*, *Agnostics*, *Traditionalists* and *Postmoderns*.

The first consumers group, *Practicals* (20.5% of the sample), valued taste in first place (2.88), followed by price (1.42) and previous experience (1.23), while they were less interested in packaging (-2.97) and brand (-1.40). Consumers in this group were mainly women (58%) and more often directly (0.2) or indirectly (0.37) exposed to illness. Although this consumer group recorded the highest score for nutritional knowledge (10.05) along with *Traditionalists* and *Postmoderns*, they showed the lowest score on the AFM scale (4.64) which may explain their marginal interest in selecting EVOO with health claims. Also, consistently with previous studies, results revealed the existence of a share of consumers whose food choices relied on direct experience with the product as those consumers place importance on search and experience product attributes (e.g., taste and price) (Valli et al., 2014; Del Giudice et al., 2015). Thus, *Practicals* used information already in their minds from product labels to choose their EVOO, presumably to reduce the risk of making a wrong choice. Although this consumer group was more exposed to illness, directly or indirectly, it was more likely to use alternatives (e.g. pills or supplements) than to change its diet by including products with health claims. Similar findings can be found in the general marketing literature on consumer preferences for products with health claims (Hailu et al., 2009).

The second group of consumers were dubbed *Agnostics* (17.6% of the sample). Agnostics did not value any product attribute when purchasing EVOO, because their average BW score was never above (below) 1(-1). *Agnostics* had the most numerous households (3.51) and often with children (0.41). Consumers in this group were less exposed than others to illness, directly (0.10) or indirectly (0.19), less often than others on a special diet (0.06), and scored lowest on GHI (4.24) and nutritional knowledge (7.89). These results confirm the existence of a share of consumers who are not interested in any product attributes, as previously found by Caputo et al. (2016), and in this study it is slightly lower than the 20% of the sample. This consumer group is difficult to detect in studies based on choice experiments where consumers are often forced to select a product with a given attribute profile (Caputo et al., 2016).

The third group, *Traditionalists* (12.0% of the sample), valued the country of origin (2.65) and geographical indication (1.96) of products more than did the other groups, while they also valued other product features such as brand name (1.30) and taste (1.31). *Traditionalists* were slightly older (44.59 years) and recorded higher EVOO consumption (5.48), like *Postmoderns*. *Traditionalists* did not differ in any other individual characteristic. These outcomes are in line with previous results

Table 7
Heterogeneity of preferences for product attributes according to average BW scores

	Practicals (n = 211)	*Agnostics* (n = 181)	*Traditionalists* (n = 124)	*Postmoderns* (n = 514)	F-stat
Country of origin	0.73(a)	0.01(b)	2.65(c)	1.77(d)	83,60(*)
Geographical indications	0.11(a)	0.01(a)	1.96(b)	2.10(b)	174.69(*)
Brand	−1.40(a)	−0.17(b)	1.30(c)	−1.71(d)	178.06(*)
Previous experience	1.23(a)	−0.09(b)	0.57(c)	−0.79(d)	70.70(*)
Organic	−0.64(a)	−0.05(b)	−0.02(b)	1.51(c)	108.72(*)
Price	1.42(a)	0.23(b)	0.79(c)	−1.14(d)	113.51(*)
Olive variety	−0.51(a)	−0.15(a)(b)	−1.02(c)	−0.01(b)	16.51(*)
Packaging	−2.97(a)	0.03(b)	−2.44(c)	−2.92(a)	347.96(*)
Extraction process	0.19(a)(b)	−0.23(a)	−1.02(c)	0.51(b)	31.77(*)
Health claim	−0.58(a)	0.06(b)	−1.32(c)	0.96(d)	92.97(*)
Acidity	0.30(a)	−0.22(b)	−1.64(c)	−0.22(b)	39.93(*)
Colour	−0.76(a)	−0.06(b)	−1.12(a)(c)	−1.32(c)	39.13(*)
Taste	2.88(a)	0.64(b)	1.31(c)	1.28(c)	100.99(*)

Note: The asterisk (*) in the last column indicates an F test p-value < 0.05, rejecting the null hypothesis of equality of mean values across groups. Average BW scores bearing the same letter on the same row were not significantly different according to pairwise Tukey test ($p < 0.05$).

Table 8
Cluster differences in terms of respondent socio-demographics, EVOO consumption habits, health-related information, attitudinal and psychographic features

Variable	*Practicals* (n = 211)	*Agnostics* (n = 181)	*Traditionalists* (n = 124)	*Postmoderns* (n = 514)	F-stat
Gender	0.58(a)	0.45(a) (b)	0.43(b)	0.53(a) (b)	3.44(*)
Age	43.14(a)	37.88(b)	44.59(a) (c)	45.92(c)	18.69(*)
Number of household members	2.99(a)	3.51(b)	3.06(a)	3.11(a)	6.31(*)
Children	0.27(a)	0.41(b)	0.30(a) (b)	0.26(a)	5.12(*)
Education	3.29	3.38	3.30	3.23	1.95
Profession	3.40	3.51	3.58	3.54	0.71
Income	1.74	1.75	1.77	1.82	0.68
Body mass index	24.69	24.07	24.98	24.23	1.75
Family illness	0.37(a)	0.19(b)	0.29(a)(b)	0.37(a)	7.12(*)
Special diet	0.12(a)(b)	0.06(a)	0.11(a) (b)	0.17(b)	5.20(*)
Personal illness	0.20(a)	0.10(b)	0.18(a)(b)	0.23(a)	4.85(*)
Self-declared health status	5.01	4.97	5.10	5.18	2.28
EVOO consumption frequency	3.84(a)	3.61(b)	3.85(a)	3.86(a)	10.04(*)
EVOO quantity consumed	5.13(a)	5.03(a)	5.48(a) (b)	5.64(b)	5.36(*)
GHI	4.65(a)	4.24(b)	4.63(a)	5.19(c)	45.68(*)
AFM	4.64(a)	4.90(a)	4.80(a)	5.30(b)	18.69(*)
NI	4.61(a)	4.80(a)	4.52(a)	5.14(b)	15.50(*)
SNK	4.00(a)	4.66(b)	4.15(a)	4.66(b)	12.74(*)
NK	10.05(a)	7.89(b)	9.74(a)	10.24(a)	23.94(*)

Note: The asterisk (*) in the last column indicates an F test p-value < 0.05. rejecting the null hypothesis of equality of mean values across groups. Average values bearing the same letter on the same row were not significantly different according to pairwise Tukey test ($p < 0.05$). Acronyms used are: General Health Interest (GHI); Attitudes toward using food as a medicine (AFM); Nutritional importance (NI); Subjective nutritional knowledge (SNK); Nutritional knowledge (NK).

from the general marketing literature, which identified older consumers as having a strong interest in and preference for products with geographical indications (Grunert & Aachmann, 2016). Brand familiarity also drove *Traditionalists'* interest in products, indeed for this group, brand can signal the manufacturer's guarantee of the truth of what is declared on labels, as well as the "local" dimension of products with a geographic indication (Deliza & MacFie, 1996; Hassan & Monier-Dilhan, 2006).

The fourth and last group of consumers, *Postmoderns* (49.9% of the sample) was the largest. Respondents in this segment valued geographic indication (2.10) and country of origin (1.77) like *Traditionalists*, and valued organic (1.51) and health claims (0.96) far more than the other groups. *Postmoderns* placed the lowest value on packaging (-2.92) and brand (-1.71) in line with the overall results. These consumers were older than *Practicals* and *Agnostics*, were mostly women (53%), as previously indicated by Perito et al. (2019). Also *Postmoderns* were exposed to illness directly (0.23) or indirectly (0.37), like *Practicals*. Instead, unlike other groups, *Postmoderns* placed the highest importance on health, scoring an average of 5.19 on the GHI scale, and were highly willing to use the food as a medicine, with an average AFM score of 5.30, the highest of all groups. *Postmoderns* recorded the highest values of all psychographic variables, such as nutrition importance (5.14), nutrition knowledge (10.24) and subjective knowledge of nutrition (4.66).

Postmoderns, like *Traditionalists*, valued country of origin and geographic indication, whereas different from *Traditionalists,* preferred sustainable and healthy products. This result can be interpreted as a possible overlap between health and sustainable attributes in the perception of Italian consumers, as previously documented in other studies (Sundar & Kardes, 2015). Indeed, respondents such as *Postmoderns*, who valued health, therefore preferred both organic products and products with health claims. The purchase of organic products presumably indicates that this group, which scored high on the GHI scale, had a healthy holistic lifestyle. Also, their preferences for products with health claims are in line with their willingness to use food to "adjust" their health and increase psychological well-being when needed, as indicated by the highest AFM score of this group. Thus, the selection of organic products and products with health claims is guided by consumer interest in health but with different understandings of health or approach to it. The preference for these product attributes is not exclusive, but correlated (Goetzke et al., 2014).

However, our results are not free of limitations. A shortcoming is related to how the attributes used for BW experiment were described, and then interpreted by different consumers. Also, the BW method employs a not very realistic choice card experiment which may lower the external validity of the results. Lastly, our findings are only referable to Italian consumers and may not be transferred in other geographical contexts since cultural differences may play a role in moderating consumer preferences for health claims.

4. Conclusions

This study used BW analysis on data collected from a representative sample of Italian household responsible for food shopping to assess the relative importance of health claims for consumer choice of EVOO. Consumers interested in health claims were detected by a Latent Class Clustering Model based on socio-demographic and psychographic features and attitudes.

The results showed that health claims were of interest, albeit marginal, to consumers. Indeed, although approximately 1 out of 2 respondents valued health claims in selecting EVOO products, this interest ranked after geographic origin and sustainable production methods. This result is presumably due to the fact that health claims are not yet used by producers. Consumers may therefore not be familiar with health claims or do not link the claims with health benefits. A finding related to this point, in fact, was that consumers who valued health claims on EVOO coincided with those who are exposed directly or indirectly to chronic diseases, more interested in health and more willing to use food as medicine to promote health. This consumer group is probably more aware of as well as more prone to use EVOO for its health benefits and, thus, to value health claims on it.

These findings have practical implications for producers interested to target the different consumer segments, as well as for policymakers. On one hand, producers may use the organic logo jointly with health claims in order to capture consumers who are more interested in using EVOO for health reasons, since the two groups overlap. Also, producers may inform consumers via advertising about the bio-components of EVOO and relative health benefits, thus increasing consumer awareness of the link between EVOO consumption, bio-components and health. This will allow health claims to become a tool for product differentiation. On the other hand, policymakers may offer financial support to producers to develop communication and marketing activities aimed at increasing consumer awareness of the importance of EVOO for individual well-being. Policymakers may also provide guidance to companies on the use of health claims on EVOO labels. For instance, the health claim for "olive oil polyphenols" (Reg. EC 432/2012) which states that "Olive oil polyphenols contribute to the protection of blood lipids from oxidative stress" can be used for olive oil that contains at least 5 mg of hydroxytyrosol and its derivatives (e.g. oleuropein complex and tyrosol) per 20 g of olive oil. Regarding the use of this claim, there is no standardized analytical method for the quantitative determination and unequivocal identification of phenols. This has an impact on the reliability of the lower limit (5 mg/20 g oil) set for the health claim, introducing uncertainty regarding use of the claim in compliance with Reg. EC 432/2012 and ultimately hindering companies from using the claim.

The need for a standardized analytical method for the an accurate quantification of such chemicals is a widespread call among scientists and policymakers as indicated in several studies. Quantification methods proposed by Bellumori et al. (2019) and Reboredo-Rodríguez et al. (2016) represent simple, cheap, and suitable methods, among the many used, that can guarantee a proper determination and quantification of the phenolic content of EVOOs to satisfy the requirements of the specific health claim (EU Reg. 432/2012). Thus, policymakers need to formally indicate a standardized method to quantify phenols and foster companies in using this health claim by lowering the uncertainty around its use.

Future research needs to be undertaken in several directions. In an attempt to address one of the core limitations of the current study, it would be worth analysing consumer attitudes and preferences for selected EVOO attributes defined in more detail. A more realistic research design for an higher external validity of results is needed. This could be obtained for instance by virtual shelf techniques which more closely simulate the complexity of a "real" food choice environment, with respect to survey-based choice, and capture consumer variety seeking behaviour (van Herpen et al., 2016). Lastly, results from our study may not be transferred in other geographical contexts, and thus future studies will investigate on the consumers' acceptance of, and preferences for health claims on EVOO in other countries to have a more comprehensive view on the subject.

Research founds

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CRediT authorship contribution statement

Bernardo Corrado De Gennaro: Conceptualization, Supervision, Funding acquisition. **Luigi Roselli:** Conceptualization, Writing - original draft, Writing - review & editing. **Francesco Bimbo:** Conceptualization, Writing - original draft, Writing - review & editing. **Domenico Carlucci:** Conceptualization, Visualization, Validation. **Carla Cavallo:** Conceptualization, Visualization, Validation. **Gianni Cicia:** Conceptualization, Supervision, Funding acquisition. **Teresa Del Giudice:** Conceptualization, Visualization, Validation. **Alessia Lombardi:** Conceptualization, Visualization, Validation. **Antonio Paparella:** Data curation, Formal analysis. **Riccardo Vecchio:** Conceptualization, Methodology, Writing - review & editing, Supervision.

Declaration of Competing Interest

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

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Appendix A

Table A - Correlation between average BW attribute scoresCoefficient with a significance level greater than 0.05 are reported

	Country of origin												
Geographical indications	0.26	*Geographical indication*											
Brand	-0.06	-0.10	*Brand*										
Previous experience	-0.08	-0.20		*Previous experience*									
Organic		0.15	-0.22	-0.26	*Organic*								
Price	-0.16	-0.29	0.08	0.10	-0.28	*Price*							
Olive variety			-0.11	-0.24	-0.08	-0.25	*Olive variety*						
Packaging	-0.22	-0.26	0.17	-0.02	-0.18		-0.04	*Packaging*					
Extraction process			-0.23	-0.16		-0.24	0.09	-0.13	*Extraction process*				
Health claim	-0.22		-0.22	-0.26	0.29	-0.21		-0.15		*Health claim*			
Acidity	-0.17	-0.15	-0.23	-0.12	-0.09	-0.14		-0.08	0.11		*Acidity*		
Colour	-0.14	-0.22			-0.20			0.16	-0.17	-0.12		*Colour*	
Taste	-0.16	-0.17	-0.08	0.15	-0.21	0.11	-0.15	-0.17	-0.16	-0.11			*Taste*

Table B – Summary of latent class cluster models

Model solution	LL	AIC	BIC
Two cluster	−26043.12	52166.24	52363.73
Three cluster	−25860.51	51829.01	52095.63
Four cluster	−25749.67	51635.34	51971.07

LL = log likelihood; BIC = Bayesian information criterion; AIC = Akaike information criterion

Appendix B

Scales and related-items used in our study:

General health interest (adapted from** Roininen et al., 1999**)

7-point Likert scale, ranging from strongly disagree (1) to strongly agree (7)

1. The healthiness of food has little impact on my food choices
2. I am very particular about the healthiness of food I eat.
3. I eat what I like and I do not worry much about the healthiness of food.
4. It is important for me that my diet is low in fat.
5. I always follow a healthy and balanced diet.
6. It is important for me that my daily diet contains a lot of vitamins and minerals.
7. The healthiness of snacks makes no difference to me
8. I do not avoid foods, even if they may raise my cholesterol

Attitude towards using food as medicine (**Dean et al., 2012**)

7-point Likert scale, ranging from strongly disagree (1) to strongly agree (7)

1. I can prevent diseases by regularly eating foods with health claims
2. Foods with health claims can repair the damage caused by an unhealthy diet
3. Foods with health claims make it easier to follow a healthy lifestyle
4. Eating foods with health claims will help me to not get some diseases

Psychographic characteristics

***Nutrition importance (adapted from** Van Trijp & Van der Lans (2007)*

7-point scale with end points ranging from never (1) to always (7)

1. How often do you select food for reasons of health?
2. How often do you eat healthy food?

Subjective nutrition knowledge (adapted from Van Trijp & Van der Lans (2007)

7-point scale with end points ranging from strongly disagree (1) to strongly agree (7)

1. I am knowledgeable about health and nutrition issues.
2. My friends ask me for nutritional/health advice or information

Nutrition knowledge (adapted from Parmenter & Wardle, 1999)

1) Which fat do experts say is most important for people to cut down on? (tick one)

(a) monounsaturated fat
(b) polyunsaturated fat
(c) saturated fat
(d) not sure

2) Do you think these are high or low in added sugar? (tick one box per food: high; low; not sure)

(a) Bananas
(b) Unflavoured yoghurt
(c) Ice-cream
(d) Orange squash
(e) Tomato ketchup
(f) Tinned fruit in natural juice

3) Do you think these are high or low in salt? (tick one box per food: high; low; not sure)

(a) Sausages
(b) Pasta
(c) Kippers
(d) Red meat
(e) Frozen vegetables
(f) Cheese

4) Some foods contain a lot of fat but no cholesterol
o Agree
o Disagree
o Not sure
5) Saturated fats are mainly found in: (tick one)

(a) vegetable oils
(b) dairy products
(c) both (a) and (b)
(d) not sure

6) Harder fats contain more: (tick one)

(a) Monounsaturated
(b) polyunsaturated
(c) saturates
(d) not sure

7) Polyunsaturated fats are mainly found in: (tick one)

(a) vegetable oils
(b) dairy products
(c) both (a) and (b)
(d) not sure

Appendix C. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jff.2021.104461.

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