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# The olive oil sector: a comparison between consumers and "experts" choices by the sensory analysis.

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**Abstract**

The analysis is focused on olive oil, given its importance in the present competitive scenario and also for the renewed and growing interest that this product has in nutrition, health and wellbeing. It is in the interests of the different categories of olive oil producers to highlight the value of the specific attributes of their products, through the certification systems, geographical indications or organic farming. We have analysed consumer liking in order to understand what sensory attributes guide the choice, because this can help managers to develop marketing strategies focused on consumers' demands. This study was conducted to identify and define sensory characteristics of five Italian olive oils and to link these differences to consumer and "experts" (the chefs) preferences through the application of preference mapping. This study confirms the hypothesis that experts give more importance to intrinsic attributes than "novices", and also that the chefs are more aware than consumers on the EU certification systems and geographical indications or organic farming.


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*Keywords*: olive oil; competitiveness; preference mapping; sensory analysis; region of origin; perceived quality.

## 1. Introduction

The globalization process has led to a standardization of food products but, on the other hand, cultural differences in food habits and practices still remain (Askegaard & Madsen, 1995). In the EU, olive oil is an important production in Spain, Italy, Greece, Portugal, France, Cyprus, Slovenia and Malta. The available data for 2010 show

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that olive groves are concentrated in Spain (50%), Italy (26%) and Greece (22%) (European Commission, 2012). Average olive oil productions in the EU in recent years represent around 73% of world production. Two thirds of the EU production is traded internationally (within and outside the EU). Trade within the EU in 2010/11 was about 45% of EU production. Spain is the biggest supplier, while Italy is the biggest buyer. EU exports represent approximately 66% of world exports. In 2010/11, exports to third countries amounted to 447,000 t, of which Spain sold 225,000 t and Italy 160,000 t. The biggest markets are the USA, Brazil, Japan, Australia, Russia and China (European Commission, 2012).

The EU is the world's biggest consumer (66% share). Spain, Italy and Greece account for around 80% of EU consumption. Consumption seems to be stable in the producer countries, whereas it is increasing in France and in the non-producer Member States. The main consuming countries are also the main olive oil producers: Spain, Italy, Greece, Tunisia, Turkey, and Syria produce 88.5% of the world's production (Achabou et al., 2010). Consumption models differ in the EU's three main producer countries. In Italy and Greece, the majority of oil consumed is extra virgin, whereas in Spain this category represents less than half of consumption. The general trend is towards the increasing consumption of extra virgin oils. Olive oil nutritional and health qualities are some of the sector's strengths. It is in the interests of the different categories of olive oil producers to highlight the value of the specific attributes of their products, notably through the EU certification systems and geographical indications or organic farming.

The implemented marketing strategy and the related profitability for protected designations of origin/protected geographical indication (PDO/PGI) vary across the board: some PDOs opt for strategies that allow for high market prices and volumes, whereas others place only a small volume of PDO oil on the market at prices comparable to standard oils. Understanding the importance of olive oil attributes can help managers and marketers to develop marketing strategies focused on consumers' cultural expectations and demands. In fact, olive oil is an example of a product for which consumption is marked by local culture; it is emblematic of the diet and culture of the Mediterranean region (Dekhili et al., 2011). In a contest of increasing competition the strategy aimed at the improvement of product's intrinsic and perceived quality assumes a great importance in order to obtain a competitive advantage in the markets internationalization (Grunert, 2005). This paper's aim is to analyze and compare consumers' and chefs' preferences for five Italian olive oils with the objective to eventually identify differences in choice behaviors. According to Maheswaran (1994) ''experts'' give more importance to intrinsic attributes than ''novices''.

The paper is organized as follows. In the next section the main trends in production and world consumption and the importance of "perceived quality" were investigated. In the third section, a description of the methodology used in the analysis as well as the data collection and survey design is considered. The main results are reported in section four, while the final considerations and conclusions are highlighted in the last part of this paper.

## 2. The olive oil sector in Italy: main trends in production and world consumption and importance of "perceived quality".

### *2.1. Evolution of the olive oil market in Italy.*

In accordance with the estimations of the Italian Institute for Services to the Agricultural and Food Market (ISMEA, 2012) in 2013 Italy will produce 550,000 tons of olive oil, 6% above last years 518,000 tons and states that the decline in production is due to the subsidy structure known as the "single payment scheme" where growers are subsidized for keeping up their groves, whether they harvest their olives or not. ISMEA also reports that olive growers, confronted with the continuing low prices for olive oil and increasing costs for cultivation, often forego harvesting, depressing total olive oil production. Considering the average of the last ten years the decrease is even more significant. As a result of these trends, the import of olive oil has tripled in the last 20 years saturating domestic and international markets with products fraudulently labelled as "Made in Italy." Fraud and adulteration of Italian oil cost the industry around 100 million euro per year, with the risk of the environmental heritage being threatened.

Producer prices vary depending on supply and demand: therefore they are higher in markets such as Italy characterized by a product deficit than in those with a surplus like Spain or Greece. Prices vary as well depending on the quality of olive oil (European Commission, 2012). From the qualitative point of view, in 2009, 35% of Spanish

oil was Extra Virgin olive oil, 32% was Virgin olive oil and 33% was lampante olive oil, while in Italy the same categories were represented respectively at 59%, 18% and 24% (Scarpato et al. 2013).

According to the main historical trends and the foreseeable evolution of the sector over the next years the European Commission has established, in 2012, the prospects for the olive oil sector until 2020 on the basis of a detailed statistical analysis. For Italy, since the evolution of total area over the last decade has not shown any significant trend, the projections assume that total area devoted to olive oil production would remain constant until 2020 at around 1.14 mio ha, which corresponds to the average value of the period 2000-2010. In particular, as regards Italy, a gradual drop in production to 477,000 tons for 2020 is expected. In addition, Italy is expected to import 493,000 tons per year in 2020 while exporting 358,000 tons. Thus, in 2020 Italy will be configured as a net importer of olive oil (European Commission, 2012) (Fig. 1).

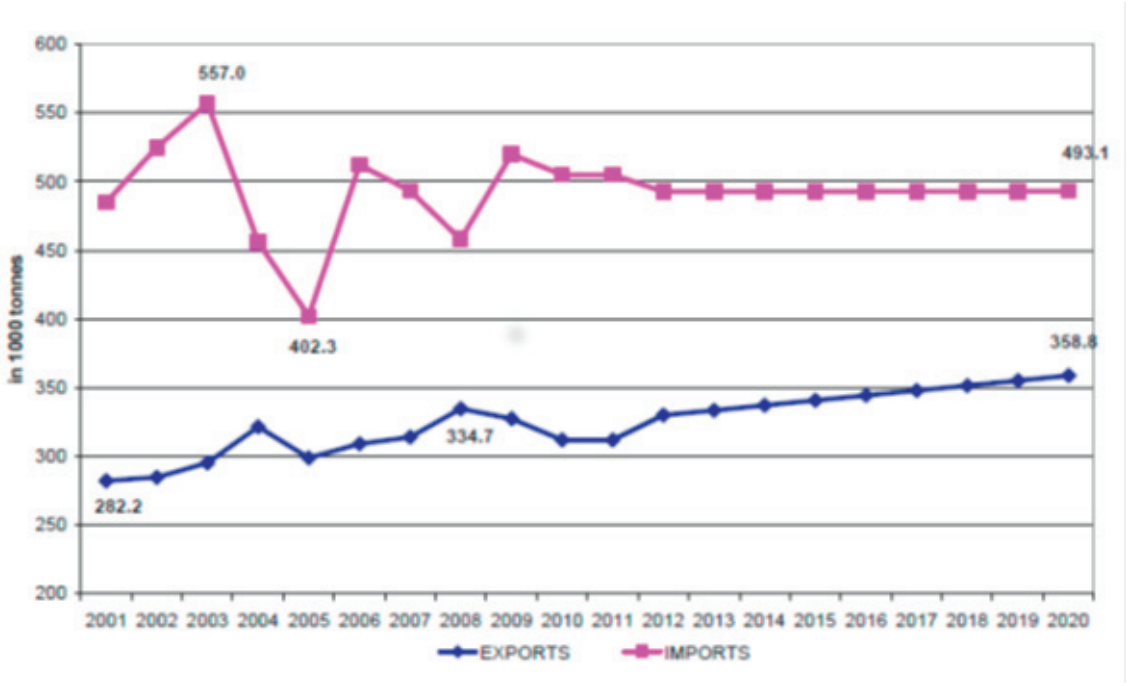


Figure 1. Projections for the imports and exports of olive oil in Italy - Source: European Commission, (2012).

The opening of new markets could offer new horizons to Italian companies which will have to be ready to face the challenge, given the already important trust in the "Made in Italy" products. The critical factor related to the consumption is connected to the possibility of creating an additional medium-term marketing segment able to promote productions with highest quality standards and adequate price differentials.

This is an important factor that should be developed not only in the overseas markets, but also in the internal market where product knowledge is not always as good as expected.

### *2.1. Main features of the olive oil production in Italy and perceived quality*

The Italian olive-mill system is characterised by a great biodiversity with a propensity for quality that has made it unique in the world panorama. There are about 250 million plants (Italian olive groves), that provide manpower for more than 50 million working days per year and a turnover of 2 billion euros. Many of them are centuries old, located in areas where they contribute to the landscape and the environment. Italy is the second largest producer of olive oil of which two thirds of the production is Extra Virgin olive oil. There are many types of trees under cultivation in Italy. It is estimated that there are more than 500 varieties (cultivars) each of them with different

characteristics that vary from region to region, but more precisely, from place to place, capable of producing an infinite number of olives of excellence. In other countries such as Spain and France a reduced variety is observable: 50-70 at most, of which only 6-10 are the most common.

The demand for oils with well-defined organoleptic, nutritional and commercial characteristics has recently reassessed the role of the cultivar as an element that contributes to the qualification of olive productions. The protection of certain qualitative characteristics of oil passes through the conservation and promotion of heritage varieties of a given territory. This makes it possible to preserve those oils' organoleptic characteristics that define the "typicality" (Protected Designations of Origin/Protected Geographical Indication (PDO/PGI). There are 43 Italian oils with denomination of origin recognized by the European Union (Van Der Lans Ivo et al., 2001). The growing trend of world consumption and the increase of global competition highlight the importance of making the excellent Italian products recognizable in order compete with the rest of the world (Obermiller and Spangenberg, 1989). The recovery of competitive positions on domestic and foreign markets requires a strong commitment regarding consumer information about the characteristics of different oils, (e.g. types of goods, olive oil, extra-virgin etc.).

In a previous research, we tried to analyze whether consumers have an adequate knowledge of the specific qualities of olive oil and also the perceived quality linked to its origin (Pagliuca and Scarpato, 2011). The investigation showed firstly, that a significant proportion of consumers who would buy an oil that is characterized as being 100% Italian, is not able to recognize it. This highlights the strong information asymmetry that characterise this sector (Akerlof, 1970). In addition, this investigation showed a very weak link of the consumer with the territory in the choice of consumption of olive oil. In particular, only a low percentage of consumers have tried the oils from the Campania region that are recognized by the European Protected Designation of Origin, because the consumer does not know of its existence or can not find it in stores frequented. Only a small percentage does not buy it because they believe that the price is high. This shows, once again, that consumer information about olive oil is particularly lacking.

In this context, the approval of the Regulation 261/2011 by the European Union, is crucial especially for the protection of the "Made in Italy". This regulation fights the importation and sale of poor quality oil labelled as extra virgin olive oil, often sold at a lower price, creating a doubly negative consequence: first, it is oil in competition with oil produced in Italy and second, the poor quality is in contrast with the interests of consumers. Additionally, on 19 December 2012, the Agriculture Committee passed a bill, approved by the Senate, and defined "saving oil law", establishing strict rules regarding labelling and traceability of the olives used for PDO extra virgin olive oil production. This is an important measure in the direction of transparency and the fight against fraud in extra virgin olive oils to protect producers and citizens.

## 3. Materials and methods

### *3.1. Experimental plan and consumers' testing*

Two separate surveys were performed: one survey was developed for consumers and the other for chefs in Naples and Salerno. We chose these two cities because in these areas there are important productions of oils that are recognized by the European Protected Designation of Origin (PDO) certification and this suggests a higher knowledge of both consumers and chefs about the characteristics of this product. The same questionnaire was administered through CAPI to the sample of 400 consumers selected voluntarily and recruited among people who buy olive oil regularly and 35 chefs. Each respondent was asked to fill in the questionnaire concerning information considered relevant for consumer description and for the explanation of their choices. The questionnaire was divided into three blocks. The first block included questions about olive oil consumption and purchase frequency, olive oil uses, place of purchase and important criteria for choosing olive oil. The second block is composed by the analysis of the preferences, whereas the third block includes respondents' socio-demographic characteristics. The olive oils were firstly analysed in terms of chemical composition parameters and secondly they were assessed by the samples in terms of overall liking. The physicochemical composition parameter and sensory attributes, recognized as significant factors of olive oil acceptance and quality, are presented in Table 1.

The choice of these attributes was based on the results of a preliminary focus group with same consumers and chefs. Based on the findings of this pretest and the fact that it was very difficult to submit an excessive number of

products to be judge, we have analysed the most widespread commercial Italian olive oils and fairly comparable regarding their sensory profiles. For all five products, we have considered the classic line.

Table 1. Products, and selected physicochemical composition parameter and sensory olive oil attributes.

| Products | Physicochemical parameter | Sensory attributes | Protected Denomination of Origin (DOP) |
|---|---|---|---|
| Bertolli | Energy value | Flavour | No |
| Carapelli | Saturated fats | Aftertaste | No |
| De Cecco | Monounsaturated fats | Digestibility | Yes |
| Monini | Polyunsaturated fats | Aroma | Yes |
| Sapio | | | No |

For each product, consumers expressed an overall liking using a five-point scale (where 1 means no preference and 5 means high preference). All sensory attribute were scored using a five-point scale (where 1 means not important and 5 means very important).

### *3.2. Experimental plan and consumers' testing*

The aim of this work was to compare consumers' and chefs' preferences for 5 Italian olive oils in order to see if there are different choice behaviors. The analysis of consumers' preferences has assumed an extreme importance in business nowadays in order to improve quality of products and to obtain a competitive advantage. Learning about chefs' preferences was important to investigate whether experts give more importance to intrinsic attributes than novices (Maheswaran, 1994). Sensory analysis is a powerful and indispensable tool for describing and quantifying perception and preference and for understanding the intrinsic quality of the foods in order to translate customer needs in products (Meilgaard et al., 1987; Stone and Sidel, 1993). Sensory analysis is an integral part in the control of olive oil quality: the chemical-physical and microbiological characteristics are important, but if the product does not have appropriate characteristics perceptible to the senses, these have only a relative value. Sensory analysis is the examination of a product through the evaluation of the attributes perceptible by the five sense organs, such as color, odor, taste, touch, texture and noise.

The use of senses in judging food quality is part of our daily actions in the consumption. Sensory science is used to understand consumer preferences and to predict eating quality with instrumental measurements. Sensory evaluation defined as the "systematic study of human response to physico-chemical properties" of products can be used in very different contexts from the production line to the research laboratory and for a wide range of applications. Obviously, perception plays a major role in the science of sensory analysis. Sensory analysis comprises a variety of powerful and sensitive tools to measure human responses to foods and other products. Sensory methods have been used to determine sensory attributes using descriptive analysis and consumer evaluation methods. It is well known that the investigation of the existing relationship between sensory instrumental and preference data is fundamental in developing new products and quality evaluations. In order to determine meaningful drivers of liking in terms of sensory attributes, defined and measured by consumer perceptions and physicochemical characteristics, the relationship between homogeneous consumers' groups overall preference and liking of specific sensory and physical inputs was analyzed by the preference mapping (Risvik et al. 1994; Greenhoff and MacFie, 1994).

Generally, there are two approaches: internal and external preference mapping. Internal preference mapping is a principal component analysis (PCA) of the matrix of hedonic scores across the products (the observations) and the consumer (the variables), which is carried out on a covariance matrix to allow for differences in the strength of the consumer preferences to be expressed (Guinard, 1998). Internal preference mapping (Carroll, 1972) refers to the analysis of preference data only, and provides a summary of the main preference directions and the associated consumer segments (Dekhili and D'Hauteville, 2009). External preference mapping aims to understand the descriptive sensory attributes that influence consumer preferences (Schlich, 1995; MacFie and Thomson, 1988; McEwan, 1996) in order to identify the particular attributes that move their acceptance. It relates consumer

preferences in a multidimensional representation of products obtained from descriptive sensory data (Schiffman et al., 1981). In external preference mapping, the dimensions of the descriptive analysis space are the predictor variables, whereas consumer acceptability is the response variable (Schlich, 1995). Using a number of regression models, external preference mapping regresses the preferences of each consumer onto the first two principal components of a principal component analysis of the products' sensory characteristics. The different models used to regress the hedonic ratings onto the first two PCs are the vectorial, circular, elliptical (with maximum or saddle point) and quadratic models. The equation relating Y for a consumer to first ($x_1$) and second ($x_2$) principal component may therefore range from a simple, linear one, e.g.:

$$Y = b_0 + b_1 x_1 + b_2 x_2 \tag{1}$$

to a complex, second-order one with quadratic and cross-product effects, e.g.:

$$Y = b_0 + b_1 x_1 + b_2 x_2 + b_3 x_1^2 + b_3 x_2^2 + b_4 x_1 x_2 \tag{2}$$

Were Y is the liking, $b_0$ is the intercept and $b_1$,$b_2$, $b_3$, and $b_4$ are the regression coefficients.
As a result, a graphical representation was derived, showing consumers with opposite preference judgments for the oil allocated onto vectors in opposite directions through the map.

## 4. Results and discussion

Selected socio-demographic characteristics of both samples were summarized in table 2. The majority of the consumers were females, in the class 31-50 with a low educational level, indicating that women are relatively more interested in consumption of olive oil than men. The majority was married and was employees. The chefs were all men, in the class 31-50. They were married and had a high educational level.

Table 2 - Selected sample characteristics

| Socio-demographic characteristics | | **Consumers (%)** | **Chefs (%)** |
|---|---|---|---|
| **Gender** | | | |
| | Female | 54 | |
| | Male | 46 | 100 |
| **Civil status** | | | |
| | Single | 29 | 17 |
| | Married | 41 | 83 |
| | Divorces, Widow/er | 30 | |
| **Age** | | | |
| | 18-30 | 30 | 23 |
| | 31-50 | 53 | 66 |
| | > 50 | 11 | 11 |
| **Education level** | | | |
| | Low | 70 | 20 |
| | High | 30 | 80 |
| **Profession** | | | |
| | Employee | 37 | |
| | Housewives | 33 | |
| | Students | 19 | |
| | Professionals | 11 | |

Since the number of consumers is significant, we have decided to group them into homogeneous classes according to their liking in order to make the preferences' analysis results easier to interpret. Five clusters are identified applying, firstly, an agglomerative hierarchical clustering to select the number of clusters, and secondly, the k-means cluster. Clusters 1, 2, 3, 4 and 5 represented, respectively, 28, 20, 17, 19 and 15 per cent of the judges. The consumer clusters differed only in preference scores ($p<.05$); in contrast, the socio-demographic characteristics

were not different (p>.05). We analyzed the mean ratings of both chefs and consumer participants to determine if the two groups had similar perception about the olive oil intrinsic attributes. Consumers liked the flavor more than chefs for all olive oil (Table 3). But few mean ratings were significantly different between the two groups. The aftertaste attribute was rated significantly higher by consumers, with the exception of Bertolli and Carapelli. In contrast, all mean ratings for Digestibility and Aroma were significantly different between the two groups.

Table 3. Mean rating of consumer vs. chef acceptability of five olive oil samples on sensory attributes.

| Sensory attributes | Bertolli | | Carapelli | | De Cecco | | Monini | | Sapio | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Consumer | Chef | Consumer | Chef | Consumer | Chef | Consumer | Chef | Consumer | Chef |
| Flavour | 2.44 | 2.23 | 2.96* | 2.57 | 3.02* | 2.06 | 2.21 | 2.14 | 2.16 | 1.91 |
| Aftertaste | 2.66* | 3.14 | 2.52 | 2.69 | 2.71* | 2.26 | 2.90* | 1.97 | 2.47* | 1.69 |
| Digestibility | 3.27* | 3.97 | 2.71* | 3.54 | 2.38* | 3.06 | 3.07* | 3.60 | 2.97* | 2.51 |
| Aroma | 2.22* | 1.00 | 2.43* | 1.34 | 2.50* | 1.74 | 2.42* | 1.20 | 2.71* | 2.20 |

*Mean differences of attributes within categories (consumer vs. chef) significant at $P \leq 0.05$.

Consumers and chefs appear to have different ratings about attributes for the five types of olive oil. To evaluate whether there are similar preferences between two groups, we have used External Preference Mapping and the most intuitive criterion is the visual comparison of factorial maps. Firstly we have created two maps for both groups by running a PCA on the matrix of standardized mean ratings for the 8 attributes across the 5 olive oils: the map of the sensory and physicochemical characteristics and the map of the products (Fig. 2).

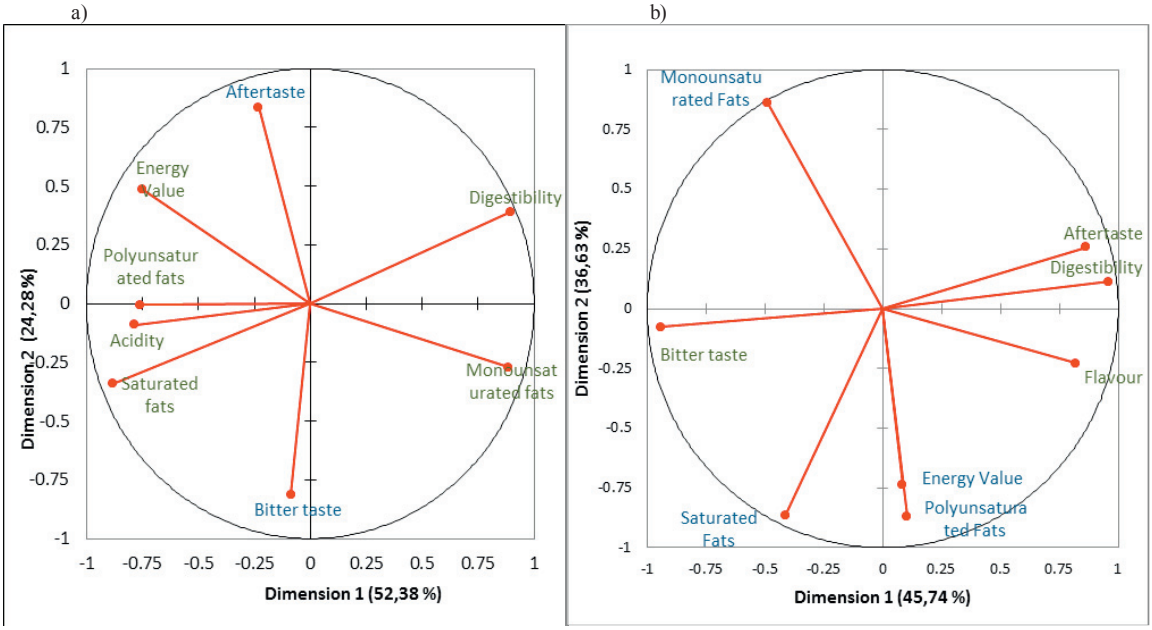


Figure 2. Map of the sensory and physicochemical characteristics for consumers (a) and chefs (b)

There are no differences between consumers' and chefs' judgements about physicochemical characteristics. For the respondents the difference between "good" fats and "bad" fats is quite clear. Monounsaturated fats which are characterized by having one double bond, saturated fats have only one single bond and polyunsaturated fats which instead have many double bonds. There are some differences about the sensory characteristics. The consumers opposed flavour to digestibility, and aroma against aftertaste. While the chefs opposed aroma to digestibility, flavour, and aftertaste.

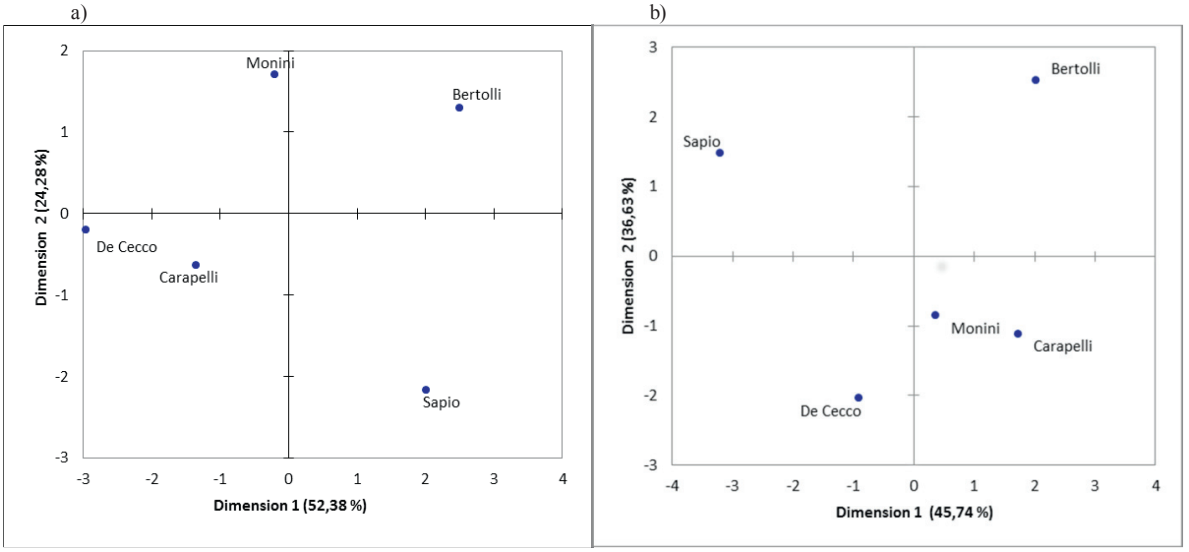


Figure 3. Map of five olive oil products for consumers (a) and chefs (b).

The contrast between the De Cecco and Carapelli oils and the Bertolli and Sapio oils is the same for the two group of respondents. This contrast can be explained by the fact that the judges had perceived more flavour for the De Cecco and Carapelli products than for the Bertolli and Sapio oils. The judges associate these products with a more digestibility. Also, De Cecco and Carapelli oils have an increased amount of polyunsaturated fats, while Bertolli and Sapio have a larger amount of monounsaturated fat, the top two brands have an energy value higher than the second. The contrast among Monini and Bertolli oils on the one hand and Sapio oil on the other was the same for consumers and chefs. It depended on two sensory attributes: aftertaste and aroma. The consumers who valued the aftertaste of an oil chose Monini, while the consumers who given importance to the aroma chose Sapio. The difference was Carapelli: for the consumers it was similar to De Cecco and Sapio, while for the chefs it was similar to Bertolli and Monini. Only the chefs have separated oils PDO to oils non PDO.

The second step of the external preference mapping was to regress preference data for each respondent on to the principal components descriptive space derived from PCA. The analysis of the preferences of the five consumer groups and of the chefs on the eight characteristics (sensory and physicochemical variables) of the five products leads to the map showed in Figure 4. The overall preferred oils for consumers in group one, in the top right portion of the plot on the left, were the Bertolli and Monini, characterized primarily by digestibility and aftertaste. Bertolli was the most preferred oil also for the majority of chefs from Salerno. The consumers in groups two and three, and chefs from Naples preferred the aroma of oil and they liked Sapio oil. The groups four and five preferred De Cecco and Carapelli oils, which were characterized by flavour. Some olive oils have a similar pattern of preference, most notably Carapelli and De Cecco, as were Bertolli and Monini.

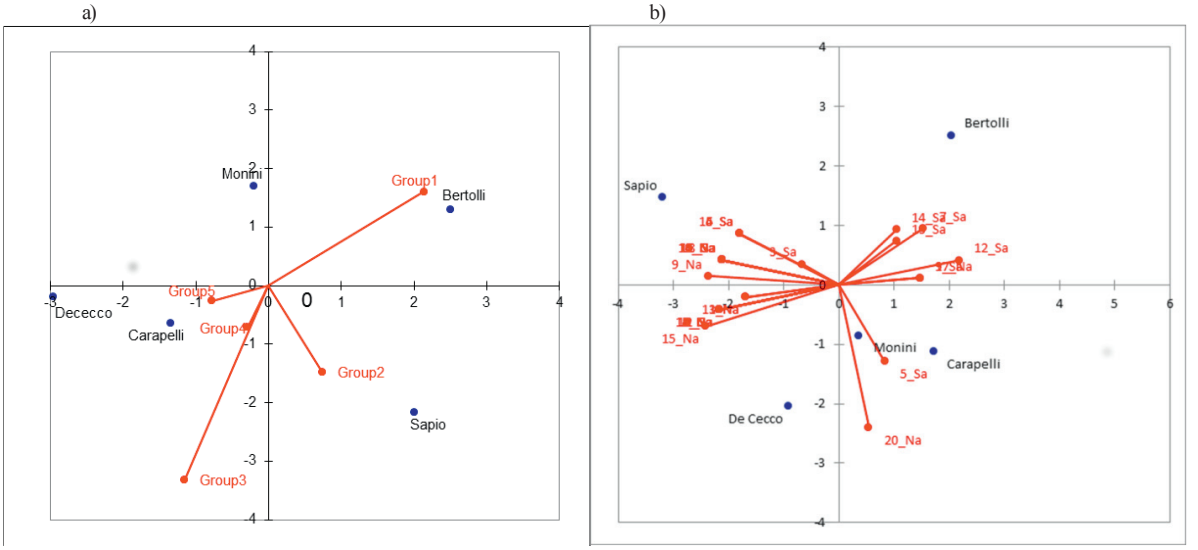


Figure 4. Preference map for consumers (a) and chefs (b).

## 5. Conclusion

The aim of this study was to employ sensory analysis in order to describe and analyze the preferences of both expert (chefs) and consumer groups for five most widespread commercial Italian olive oils. The main results obtained have shown that sensory and physicochemical characteristics can be discriminating factors. In fact there were sensory differences among the five olive oil varieties. For the dissimilar physicochemical characteristics, there were no differences between consumers' and chefs' judgements. For the respondents the diversity between "good" fats and "bad" fats is quite clear. In fact, concerning the sensory attributes, the consumers opposed flavour to digestibility, and aroma against aftertaste. In particular, the sensory attributes which guided the consumers' overall choice preference in oils were: digestibility and aftertaste for consumers who liked the Bertolli and Monini oils, aroma of oil for the consumers who liked Sapio oil and flavor for the consumers who preferred De Cecco and Carapelli oils. While the chefs opposed aroma to digestibility, flavour, and aftertaste. The sensory attributes which guided the chefs' overall preference in oils were: digestibility and aftertaste for chefs who liked the Bertolli oil, aroma of oil for the chefs who liked Sapio oil, and flavor for the chefs who preferred Carapelli, De Cecco and Monini oils. Lastly, only the chefs recognized oils PDO to oils non PDO. A possible explanation may be that the chefs are more aware than consumers of the EU certification systems and geographical indications or organic farming (Van Ittersum, 2001). This confirms the hypothesis that experts give more importance to intrinsic attributes than novices. Implementation of sensory analysis and its corresponding findings validate the managerial objective of the present study. The identification of different olive oil quality attributes should constitute a clear incentive for the highly competitive, market-oriented firms to satisfy the needs of quality-conscious olive oil consumers. This highlights to policy makers the importance of measures that aim to reduce the strong information asymmetry between production and consumption. In the Italian perspective, as seen above, measures in the direction of transparency and the fight against fraud in extra virgin olive oils play an important role to protect not only citizens, but in the contest of global competition, also "quality oriented" producers.

Only by reducing the information asymmetry regarding consumer information on the characteristics of different oils it will be possible to make the Italian excellent products recognizable and to compete with the rest of the world. Nonetheless, the choice for a specific research design and approach, with its corresponding selection of specific research methods, implies some limitations on this study. A first limitation pertains to the nature of data collection, i.e. the selection procedure, as well as people selected. A last limitation concerns the sensory evaluations which

were performed outside controlled testing environment and without using standardised and uniform sample preparation and presentation procedures. However, more research with larger numbers of olive oil samples is needed to confirm the ability of sensory and physicochemical characteristics for olive oil discrimination.

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Acknowledgements and Reference heading should be left justified, bold, with the first letter capitalized but have no numbers. Text below continues as normal.

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**References**

Achabou, M. A., Blanc, P., Dekhili, S., Emlinger, C., Madignier, A., Strohl, J., 2010. Plant Products–Mediterranean Specialities. Atlas Mediterra (Mediterranean Agriculture, Food Fisheries and The rural World), 68–77.

Akerlof G., 1970. The market for Lemons: Qualitative Uncertainty and the Market Mechanism. Quarterly Journal of Economics, 84 .

Askegaard, S., Madsen, T. K., 1995. Homogeneity and Heterogeneousness in European Food Cultures: An Exploratory Analysis, in European Marketing Academy Conference Proceeding. Gergy-Pontoise. France, 25–47.

Carroll, J. D., 1972. Individual Differences and Multidimensional Scaling, in "*Multidimensional Scaling: Theory And Applications in The Behavioural Science"*. In Shepard, R.N., Romney, A.K., Nerlove, S.B. (Ed.). Seminar Press, New York, 1, 105-155.

Dekhili, S., D'Hauteville, F., 2009. Effect of the Region of Origin on the Perceived Quality of Olive Oil: An Experimental Approach Using a Control Group. Food Quality and Preference, 20, 525-532.

Dekhili S., Sirieix L., Cohen E., 2011. How Consumers Choose Olive Oil: The Importance of Origin Cues. Food Quality and Preference, 22, 757–762.

European Commission, 2012. Prospects For The Olive Oil Sector In Spain, Italy And Greece 2012-2020. European Union press, Bruxelles.

Greenhoff, K., MacFie, H.J.H., 1994. Preference Mapping in Practice, in *"Measurement of Food Preferences"*. In MacFie, H.J.H., Thompson D.M.H. (Ed.). Blackie Academic & Professional, 137-66.

Grunert, K. G., 2005. Food Quality and Safety: Consumer Perception and Demand. European Review of Agricultural Economics, 32 , 369–391.

Guinard, J. X., 1998. Data Collection and Analysis Methods for Consumer Testing. Third International Food Science and Technology Conference. Davis, CA.

ISMEA, 2012. Il mercato internazionale e nazionale dell'olio di oliva, Studi di settore, marzo 2012.

McEwan, J., 1996. Preference Mapping for Product Optimization. Multivariate Analysis of Data in Sensory Science, 16, 71-102

MacFie, H. J. H., Thomson D. M. H., 1988. Preference Mapping and Multidimensional Scaling, in *"Sensory Analysis of Foods"*. In Piggot, J.R. (Ed.). Elsevier Applied Science, London, 380-409.

Maheswaran, D., 1994. Country of Origin as a Stereotype: Effects of Consumer Expertise and Attribute Strength on Product Evaluations. Journal of Consumer Research, 21, 354–365.

Meilgaard, M., Civille G. V., Carr, B. T., 1987. Sensory Evaluation Techniques, I and II. CRC Press, Florida.

Obermiller, C., Spangenberg, E., 1989. Exploring the Effects of Country of Origin Labels: an Information Processing Framework. Advances in Consumer Research, 16, 454-459.

Pagliuca M.M., Scarpato D., 2011. Food Quality, Consumer Perception and Preferences. Electronic Journal of Applied Statistical Analysis, 4, 215-226

Risvik, E., McEwan, J. A., Colwill, J. S., Rogers, R., Lyon, D. H., 1994. Projective Mapping: a Tool for Sensory Analysis and Consumer Research. Food Quality and Preference, 5, 263-269.

Scarpato D, Borrelli IP, Ardeleanu MP., 2013. Competitiveness and Environmental Performance in the Olive Oil Sector: an Analysis of The Campania Region. Quality - Access to Success (Supplement), 14.

Schiffman, S. S., Reynolds, M. L., Young, F.W., 1981. Introduction to Multidimensional Scaling. In Theory, Methods and Applications. Academic Press, New York.

Schlich, P., 1995. Preference Mapping: Relating Consumer Preferences to Sensory or Instrumental Measurements, Bioflavour '95. In Analysis/Precursor Studies/Biotechnology, P. Etivant and P. Schreier, Versailles: INRA Editions.

Stone, H., Sidel J. L, 1993. Sensory Evaluation Practices. Academic Press, New York.

Van der Lans, I. A., Van Ittersum, K., De Cicco, A., Loseby, M., 2001. The Role of the Region of Origin and EU Certificates of Origin in Consumer Evaluation of Food Products. European Review of Agricultural Economics, 28, 451-477.

Van Ittersum, K., 2001. The Role of Region of Origin in Consumer Decision-Making and Choice. Social Sciences, 185.