

Traceability and Labelling of Food Products from the Consumer Perspective

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Traceability of food products plays an important role in improving value chain processes of businesses and their reputation in the marketplace. In the past few years, consumers' concerns about food quality and personal health have been closely related to a continuous improvement of traceability systems and government regulation. Labeling of food products is a very important tool for consumers to acquire information about the quality of food, particularly at the purchase decision stage of the buying process. The objective of this research is to know consumers' preferences in regards to information contained in food labels. More particularly, this study focuses on what information is required by consumers on labels of food, highlighting groups of similar preferences. The interviews were carried out by telephone in two cities of north and south Italy (Milan and Palermo) on a sample of consumers extracted by stratified sampling. Cluster Analysis was performed. Results show a number of levels of information required by consumers that corresponds to different attributes of food product shown in the label. Consumers' preferences revealed a hierarchy of information required on labels. Particularly, with the increase of the amount of information required by the consumer, and contained in the foodstuffs label, the interest in information about the origin of the product and the processing increases as well. Moreover, results provide a measure of existing hierarchies among elements of information that describe food and that assess its quality. This findings show that consumers have more awareness about the relation between food production and quality, and they know that these elements are strictly related to attention of businesses in regards to safe management of agricultural systems. Furthermore, this study confirms previous literature that demonstrated how traceability is a method to reduce information asymmetry between producers and the consumer.

1. Introduction

Discussions about new technologies applied in the food sector, especially with regards to genetic modification, have brought into focus the consumers' newly awakened interest in food productions and the general lack of knowledge about it (Grunert, 2002). The several food hazards encountered since the beginning of the 90s, have shaken consumers and drew their attention to the importance of food's traceability. Food safety issues often result from the asymmetric information between consumers and suppliers, with regards to product-specific attributes (Ortega et al. 2011). Consumers seek for high quality food products and they infer this quality on the basis of a certain group of indicators, or attributes, that are classified according to the degree of visibility, namely: search, experience, and credence attributes. More particularly, credence attributes are those that consumers can't ever evaluate with confidence, but basing on consumers' opinions with regards to the product itself or the producer, even after consumption (Verbeke et al., 2006). Nowadays, to define food products' quality, consumers evaluate both intrinsic features of the product and external features, such as traceability, origin (COO), geographical indications and certification (Mascarello et al., 2015; Jover et al., 2004), and then choose foodstuffs according to elements that may characterize the product itself. The food label encloses a set of information that conveys to consumers the product's characteristics, this information can influence consumer' purchase behavior. Several studies point to the existence of a strong relationship between the food label and consumer reactions (Hoogland et al., 2007). The evolution of society, over the last forty years, has led to a radical change of needs and consumer behaviors. Through the purchase and the

consumption, individuals express their own culture, they relate to the society, define their identity and also show more and more attention to social and environmental aspects linked to agriculture. The consumption processes evolve, and food products are evaluated both for their material values and for their symbolic and communicative value; the food product becomes a mean of communication and socialization. Generally speaking, the majority of consumers say they are willing to pay more for a product they perceive as respectful of health, environment, innovation, quality, or considered ethically superior (Bialkova and Van Trijp, 2010; Grunert, 2011). Some details, therefore, may be sufficient to increase the perceived value of the product, such as new technologies for product traceability or product innovations. Under this scenario, the label is the most powerful tool for suppliers to convey information to the consumer (Banterle et al., 2013). The will to protect and promote food production, in the European Union, has allowed the development of an efficient traceability system. With this system of rules it is possible to improve food safety and enhance consumer confidence, in addition to giving a higher value to foods, through the label which provides search, experience and credence information (Louriero et al., 2007). However, the copious legislation in the Union, has not simplified the consumer ability to understand, easily, the quality credence attributes of foodstuffs. In addition, it is now ascertained that consumers perceive traceability as a further quality attribute to be considered at the time of purchase. It seems clear that traceability of food products falls among credence attributes. The Grunert's Total Food Quality Model (Grunert, 2002), considers food quality as a multidimensional construction characterized by four fundamental interrelated dimensions that are: hedonic characteristics of food, health, convenience and production process. Particularly, the dimension that relates to production processes uses food attributes that are typically credence attributes, because it is impossible for the consumer be aware of all the production process, through the agro-food production chain. Nevertheless, so far, what consumers look behind the word traceability was little investigated. The asymmetry between the comprehension of traceability by consumers and producers may need the adoption of certifications that easily communicate to the consumer information on agricultural practices beneficial for the climate and the environment. Indeed, the consumer has increasingly used the criterion of personal trust to a specific certification. For example, in Italy, the quality features of a product are often connected to local productions or local foodstuffs (Aprile et al., 2016). Local food is perceived as characterized by a large variety of benefits, that range from the satisfaction of enjoying a homemade authentic food product, to the local-food intrinsic ability to enhance the sustainability of the food system, reducing the carbon footprint and providing new market opportunities for local farms (Guerrero et al., 2009). The labeling of food products, therefore, becomes more and more a strategic element for product differentiation in the entire supply chain, since it affects the strategic behavior of producers, of those who become part of the supply chain and the label's evolution itself. This, compared to the past, relates to agricultural firms and also to agro-food industries: the label role is crucial to provide correct information about food products, and do not incur in conflicts of interest among different stakeholders (i.e. researchers, manufacturers, public authorities, and others). Since no studies, so far, in Italy, about consumer insight, with regard to their preferences about information provided on foodstuffs labeling, and the meaning that they give to the concept of traceability, consumers' preferences were studied about a set of quality attributes of food products. In order to ascertain the existence of the asymmetric information between producers and consumers, with regards to traceability, the objective of this study is to gain insight in how the consumer recognizes the traceability and the links among food attributes shown in the label, when he/she evaluates the quality of foodstuffs.

2. Materials and Methods

For this study the reference Population was the residents in two large cities of north and south of Italy (Milan and Palermo) that can represent Italian consumers, having differences in consumption habits connected to socio-economic and cultural differences of population. A Stratified proportional sampling schema was used, wherein each Stratum is one of the selected cities. Because of the diverse Population size (number of residents) in each city, we calculated each sub-sample size proportional to the referred Stratum size, following previous works (Bacarella et al., 2015) and calculated a sample of $n = 267$ respondents, with $p = 95\%$ and $\epsilon = 6\%$. The respondents were selected by random procedure with random extraction of units from each strata (Cochran, 2007). According to literature, consumers' preferences for food quality attributes may be significantly influenced by age, gender and education, therefore, for the purposes of this study, it was appropriate to select a sample inhomogeneous and with balanced heterogeneity for each socio-economic feature (i.e. equal number of units for each feature), that are: gender (female, male), age (from 20 to 65 years old), education level (low, medium, high), in order to observe a representative and complex set of preferences and not an "a priori" uniform segment of consumers (Ingrassia et al., 2016). For the interviews a questionnaire was structured with a general part for information such as, age, gender, education level and work position (data not shown), and a second part provided with response options on a 10-point scale (10 = max score: very

high preference; 1 = min score: very low preference). In the second part of the interview, consumers were asked to evaluate 30 quality attributes of foodstuff, provided by the label, basing on the question: "how do you rate, according to your personal preference, the following quality attributes provided by the labels of foodstuff?". Interviews were made by telephone. According literature, the Cluster Analysis is a useful tool to perform exploratory data analysis and set multivariate objects within a simplified configuration of classes or types without losing too much information. It allows revealing characteristics not directly measurable or evolutionary dynamics not 'a priori' acknowledged. In this case the Hierarchical Cluster Analysis was applied, in order to discover natural groups of similar attributes, based on consumers preferences in the Italian sociocultural context. The Dendrogram performed is the visual representation of the hierarchical clusters structure, and in this study, it was used to help in the selection of the most appropriate cluster solution. Among the agglomerative methods known in literature, for this study the Average Linkage appeared the most appropriated because, according to the cited literature (Rencher, 2002), it is particularly robust against outliers. The distance between the points that describe the coordinates of a couple of objects was computed by the Euclidean Distance method. Data were processed using SPSS v. 21.

3. Results and Discussion

The Exploratory HCA, aggregated, hierarchically, groups with the greatest similarities. The Dendrogram, which is the graphical representation of hierarchical clusterization (Figure 1), shows the most appropriate cluster solution (best cut-off point along the shaft), according to the agglomeration coefficients (data not shown), which explain numerically the cut-off choice. Results highlight two big groups as separate entities, basing on consumers' preferences, these clusters have been defined as *Cluster 1 - "Standard attributes"* and *Cluster 2 - "Additional attributes"* basing on the types of attributes that characterize them. Analyzing firstly *Cluster 1*, we observe the majority of *search* and *experience* attributes, which are evaluated with the highest preferences (having obtained mean values from 9.70 to 6.06) and therefore are considered fundamental quality attributes to find in food labels (Table 1 and 2). More particularly, the attributes composing the cluster named "*Standard attributes*" highlight that Italian consumers believe the most important features to be displayed in the labeling are the food basic characteristics, such as, ingredients to infer taste, brand to infer price, or expiration date to infer freshness. These results confirm the intention to buy described by the Total Food Quality Model (Grunert, 2002) and connections existing between *search* and *expected* quality attributes.

Table 1: Quality attributes of foodstuffs (Search/Experience and Credence) inside the Cluster 1 and 2

Quality attributes of foodstuffs displayed in food labels	
Cluster 1 – Standard attributes	Cluster 2 – Additional attributes
Search / Experience attributes	
¹² Ingredients ¹¹ Expiration date ⁴ Place of provenance ¹⁴ Country of origin ¹ Price ² Brand ³ Nutritional properties ¹³ Nutritional values	⁹ Easy meal preparation ²⁶ Regional product ⁸ Traditional food ¹⁹ Home storage and preparation information ²⁰ Kilocalories content ¹⁰ Promotions
Credence attributes	
²⁹ Type of rearing ³⁰ Animal feed ²⁷ Ethical company policies ²⁸ Production Methods	²³ Recyclable packaging ²⁴ Environment friendly techniques ¹⁷ Fair trade product ⁶ Organic certification ⁷ PDO and GPI certification ²⁵ Short chain ²¹ Carbon footprint ²² Water footprint ¹⁸ Probiotic product ¹⁶ Organic production ¹⁵ GMO content ⁵ Traceability

Contrariwise, the *Cluster 2 - "Additional attributes"* is composed of a greater number of *credence* attributes than that of the Cluster 1, and the average means of the attributes in this cluster range from 6.03 to 1.3, demonstrating a secondary level of interest for these features and cues, according to Italian consumers. Finally, it should be noted that the different degrees of priority and importance of the two clusters recall, also, the Maslow's theory of human motivation (Maslow, 1943) in the fact that, in the cluster "Standard attributes"

consumers prioritized the satisfaction of physiological and safety needs, however, in the cluster "Additional attributes" consumers evaluated similarly product attributes that satisfy social, esteem and self-actualization needs, having clustered together the majority of credence attributes (Table 1), such as, traditional food, organic certification, short chain, recyclable packaging etc.. Another interesting finding to point out is that the attribute *traceability* is linked with 'traditional food', 'home storage and preparation information', 'organic certification', 'kilocalories content', 'easy meal preparation', 'promotions' and 'price', which is the attribute whereby the two clusters are connected at the final agglomeration stage (data not shown). This is a very interesting result, because it highlights that, ultimately, another element for consumers to infer traceability of a product is the 'price'. More precisely, this result shows that consumers believe that traceability requires more costs for producers, and thus higher prices. To conclude, two sub-clusters of attributes may be observed from results in the Cluster "Standard attributes", that are composed of: (1) Type of rearing, animal feed and ingredients; and (2) ethical company policies, production methods and expiration date (Figure 1). Similarly, in the Cluster "Additional attributes" we observed the following sub-clusters: first composed of recyclable packaging and environment friendly techniques; and second composed by short chain and regional product (Figure 1).

Table 2: Mean values, standard error and standard deviation of food attributes

Food attributes	Mean	St. Err.	St. Dev.
Search / Experience			
¹ Price	7.83	.142	.323
² Brand	7.45	.148	.412
³ Nutritional properties	6.38	.152	.485
⁴ Place of provenance	7.87	.123	.003
¹⁹ Home storage and preparation information	4.02	.143	.334
⁸ Traditional food	3.93	.120	.967
⁹ Easy meal preparation	2.91	.121	.985
¹⁰ Promotions	4.41	.172	.806
¹¹ Expiration date	9.60	.076	.244
¹² Ingredients	8.12	.102	.664
¹³ Nutritional values	6.06	.140	.280
¹⁴ Country of origin	7.03	.111	.816
²⁰ Kilocalories content	4.33	.149	.428
²⁶ Regional product	3.02	.143	2.333
Credence			
¹⁵ GMO content	4.62	.134	2.188
¹⁶ Organic production	4.52	.128	2.089
¹⁷ Fair trade product	3.03	.125	2.047
¹⁸ Probiotic product	3.70	.123	2.008
⁷ PDO and GPI certification	5.46	.137	2.233
⁶ Organic certification	4.87	.154	2.510
⁵ Traceability	3.89	.142	2.314
²¹ Carbon footprint	6.03	.111	1.816
²² Water footprint	5.01	.103	1.665
²³ Recyclable packaging	1.56	.137	2.133
²⁴ Environment friendly techniques	1.99	.086	1.243
²⁵ Short chain	4.03	.144	2.335
²⁷ Ethical company policies	9.04	.007	2.288
²⁸ Production Methods	9.70	.138	2.003
²⁹ Type of rearing	8.03	.111	1.813
³⁰ Animal feed	6.99	.075	1.243

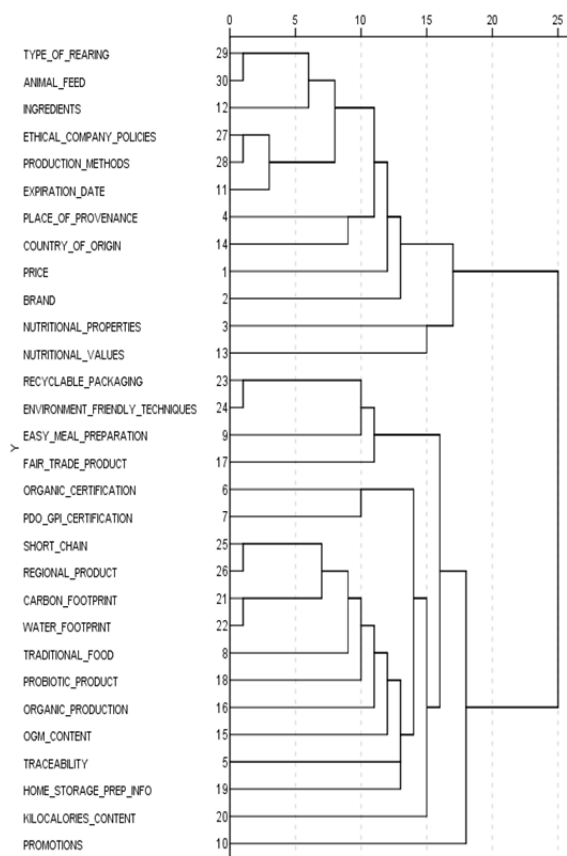


Figure 1: Graphical representation of Clusters (Dendrogram)

These results reflect consumers' concerns about the connection between quality of foods and issues related to health of animals bred, environmental protection, production methods used, short chain and local production. In accordance to previous studies, our findings reveal that (Table 2) consumer interest is generally low for traceability, mean 3.89 (Verbake et al., 2006), moderate for GMO content (mean 4.62), organic production (mean 4.52) and relatively high for PDO-GPI certifications and Carbon footprint. Contrarily to other study, Italian consumers are interested in country of origin and place of provenance, which is probably due to

the strong identity of a country with high qualitative standards for food. It is notable that, also in this case, the interest is high also for direct indications of quality, i.e. brand, price or expiration date. Information about type of rearing and animal welfare, together with ethical policies and production methods considered safe for human health, were also very important in determining Italian consumers' preferences and willingness to pay higher prices for food products; this is another case wherein search attributes infer credence characteristics. Another aspect to be stressed is that, the association between food and territory is particularly strong, this confirms findings of previous studies on consumer preferences in regards to local and traditional food (Sortino et al., 2016). In our results traditional food is linked with water footprint, carbon footprint, regional product and short chain. While consumers are facing more and more claims, when choosing food products, what is not known, today, is the extent to which all these claims and attributes compete in consumers' mind or present complementarities that would add value to the food offering. Therefore there is a need for label certification (Sirieix et al., 2013). The success of a certification scheme depends, also, greatly on the ability of stakeholders to gain a premium price to offset the incurred costs (Rival et al., 2016). The labeling can support consumers in making choices connected to their preferences in terms of qualitative features by reducing the asymmetric information and, thus, improving economic efficiency (Verbake et al., 2006; Banterle et al., 2013). The results highlighted a moderately low preference for the attribute of traceability. Traceability systems are an important tool for tracking, monitoring and managing product flows through food supply chains, potentially verifying the presence of credence attributes in consumer food purchases. Sustainable production practices, particularly at the farm level, are credence attributes that are growing in importance and might require traceability for verification purposes. This study confirms that traceability systems can be useful both in food safety recalls, and also in verifying production credence attributes, including environmentally sustainable production. This is quite in accordance with information economics: once one believes that information can be trusted, information becomes more useful and will be in higher demand (Maute et al., 1991). The technology used in food production is mostly an example of a credence characteristic, since the average consumer has no way of ascertaining that a product is, for example, 'guaranteed GMO-free.' It is well known that Italian consumers have been very skeptical towards the application of genetic modification in food production. As pointed out by several studies on EU consumers, the Italian respondents connected a considerable risk with the new technology in agriculture, being GMO content and organic production two attributes considered moderately important in our results, even though most literature dismisses the possibility of serious risks arising from the application of genetic modification. Other critical aspects observed are general issues about the industrialization of food production because the more risks perceived, the harder it becomes to see any benefits. More particularly, perceived benefits and, especially, perceived risks are linked to more general and underlying attitudes such as the 'Attitude to nature', i.e. a basic belief that humans are part of nature with which they should live in harmony. Therefore this attitude has a strong link to the risks perceived with regards to industrial agriculture (Figure1). Brands are a special quality cue, because they allow consumers to draw on their previous experience with the product. Results show that in Italy there is a higher consumer awareness about PDO and GPI certifications, that recognize foodstuffs local foods of quality, these products are often produced with traditional local methods, and for this reason consumers perceive them even more as good quality products. Given these results, it is not surprising that when food products are marketed basing on characteristics that are unascertainable, quality perception becomes, almost exclusively a question of communication. Communication makes a key contribution to building, sustaining and enhancing over time the reputation and appreciation of a food product and of the processes, services and other features that consumers look for and seek assurances on. The results are in line with previous studies that claim credibility of information from sources with vested interests in the topic of the message is generally low, and advertising information is therefore a priori a source with low credibility. Another central aspect shown by the study, however, is the importance of the production processes and place of production of food products. It is, thus, essential, for the various stages of the food production chain, to be efficiently coordinated in order to create, maintain and enhance the elements of differentiation on which the consumers' perception of quality is based. An understanding of the expected quality of a product is also important for the institutions in charge of public policy on food safety and consumer protection. Therefore, it is crucial for agro-food producers to provide the consumer of clear and correct information on applied agricultural techniques, and use systems of traceability in order to increase consumers' confidence on quality products, through credence attributes associated to them. Nowadays, Italian consumers are more informed and thus aware of some connections between production methods and healthy food, but not so much about traceability in general. These results highlight that consumers understand traceability as a wide concept that means, generally, food quality with a wide variety of meanings and underlying concepts. Food labels are, therefore, a powerful tool to communicate this information correctly, by reconciling information about innovative cultivation techniques, aimed to be environmentally friendly and healthy quality food. Therefore, information misalignments may be reduced and consumers' perception of product's value may be enhanced.

4. Conclusions

This paper has highlighted some important trends in Italian consumers' definition of food quality and has helped to give a further contribution to the ongoing research with respect to consumer behavior towards the food labels and the meaning that Italian consumers give to the concept of traceability. The study demonstrates that labels play an important role in delivering information about the quality of food products to consumers. Moreover, results highlighted that labels may reduce information misalignments between consumers and producers, with regards to traceability. Communication plays a crucial role in respect to credence attributes, aimed at reducing uncertainty and increase confidence by improving consumers ability to understand the quality of foodstuff. Collaborative and multidisciplinary research in order to provide certification standards with science-based evidence and this strengthen their reliability is hoped. The goal of the institutions concerned with public health protection is to provide consumers with the appropriate tools to be able to assess the safety and quality of food products and the risks associated. Future studies will carried out on consumers' needs with regards to information about foodstuffs and innovative techniques of cultivation and food processing.

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