The quality attributes for organic food: exploratory factor analysis

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Abstract
The aim of this study is to identify the sensory attributes and organic food packaging characteristics that are relevant to the consumers of those products: the sensory attributes, essential information contained in the package, organic certification according to food taste and the presence of the word organic on the package.

Keywords: quality attributes, organic food, exploratory factor analysis

Background
The increased complexity of product development is, in general, a consequence to the increasing multiplicity of factors that influence it. These elements, both internal (production process characteristics) and external source (market segments characteristics that the product is targeted to), regarding the business, constrain, impact and influence the definitions dynamics that are intended to build the product. Different reasons imply the peculiarities of the new products. They derive from unprecedented demands; the necessity or convenience of meeting specific market segments; incorporating various technologies; integration with other products and uses or the imperative of the products to fit new patterns, new habits, new behaviors or even new legal requirements (Toledo et al. 2008).

This context is no different within food production. In fact, the dynamics of the global market also affects the food sector. The development of new products in food segment has experienced the influence of increasing interest for new demands, as the search for foods that meet the consumers’ emerging needs regarding their own health and the environment condition (Chen, 2009). One of the trends in the food industry today is the production of organic foods, which is confirmed by the growing demand for these products in recent years (Cicek and Kartalkanat 2010; Crinnion 2010).

Companies that produce organic foods have the challenge of ensuring the safety and quality attributes demanded by consumers throughout the whole food chain, since these products are still in introduction stage and are not prevalent (Chen 2007; Lindh and Olsson 2010). In addition to ensuring the required attributes of quality and safety, the producers of these foods
should focus their efforts to meet the additional requirements of their customers. Consumers are increasingly demanding quality and harmlessness of food products they purchase. From that fact, they seek more information about new products (Francisco et al. 2007). A usual way to extend the quality compliance to the market which the product is targeted to is associated with market segmentation and the encouragement to the increased consumption. This compliance begins at organic food development process (Achilleas and Anastasios 2008).

Under these considerations, the aim of this study is to identify the sensory attributes and organic food packaging characteristics that are relevant to the consumers of those products. The definition of these items, as can be seen, is a determining factor for the increase in consumption of these foods. To reach that goal, we carried out a survey-type research with organic food consumers. Then we performed data processing by using factorial analysis as a tool. We found that some specific factors related to the product packaging and sensorial attributes can influence the purchasing decision for organic food.

This study is justified by the fact that organic foods are in consolidation process in the market. Thus, defining the sensory attributes and packaging characteristics of those products relevant to the consumer is a critical action of the producers, who begin to prioritize the control of these in the production process. The achievement of satisfactory levels in these aspects can be determined during the development of organic food, in the case of the processed food. The remaining organic food should be assigned standards for each variable identified as relevant here. This paper is divided into five sections. The first is the introduction in which the context and study aims are presented. The theoretical background is presented in the second section. The description of the methodological steps is shown in the third section. The fourth section presents the results, and finally, conclusions are discussed in the fifth section.

**Organic food**

In the past decade, organic food accounted for only a small segment of the market. A small number of consumers were willing to pay higher prices for these products in this market in order to have quality and product safety guaranteed (Pellegrini and Farinello 2009). Thus, the production of organic food is a trend in the food industry initially limited to some regions of the planet, which mainly reflected the opposition to the consumption of industrialized food (Guthman 2003; Lin et al. 2010).

In subsequent years, the greater acceptance of organic foods has been fueled by the widespread acceptance of its quality characteristics, which has significantly increased the number of customers, retailers or processors (Rosin and Campbell 2009). Conceptually, organic food is that produced in compliance with certain standards for their production, handling, their stages of processing and marketing. The product must be properly certified by a body or specific authority to this end (Ramesh et al. 2005). As a general rule, the organic food definition is based on its production process (Anderson et al. 2006). Some authors, however, state that the subject is a hallmark of labeling (Kouba 2002; Ramesh et al. 2005), which does not seem to be entirely correct.

It should be clear for the consumers that "organic" is not related to safe food (Magkos et al. 2006). The label "organic" provides assurance to consumers that no food ingredient has been subject to irradiation and genetically modified organisms are excluded from its production (Kouba 2002). Organic foods differ as to the variety and origin (Siderer et al. 2005). Moreover,
they are products with reduced durability compared to conventional foods (Campbell 2007). The organic production proposal is to combat the environmental and social impacts of food production, in addition to promote better quality of life to people who consume industrialized food (Pussemier et al. 2006).

In spite of the projected high growth in consumption of organic products, the customer characteristics that contribute to its growth are not well understood (Zhang et al. 2008). Understanding customer behavior on organic foods may help producers to understand the consumption values and in turn, to develop a production mode and a marketing approach that combines these values, in addition to develop new products and improve the existing ones and to formulate guidelines for their companies’ quality management (Chang and Zepeda 2005; Berlin et al. 2009). There is a general consensus in the literature about the reasons by which people will purchase organic food. It is observed in the literature, for example, that there are differences between the consumers’ attitude (usually positive) for organic food and the relatively low level of actual purchases.

More generally, one can consider that the organic product has market differentiation due to their intangible characteristics. These characteristics have given large and rapidly growing consumer market. However, there are challenges with research on the consumers of these foods due to the discrepancy between their perception on the issue of its elements that promote health, on the one hand, and scientific evidence of this fact on the other. Thus, there is no clear answer to the question: are organic foods healthier or not (Pearson et al. 2011)? Consumers seem to think so, as pointed out by the research of Gibbon et al. 2009.

**Packaging characteristics and food sensorial attributes**

The selection and consumption of food are complex phenomena influenced by several factors. The sensory properties have usually been considered as determinants in the selection of this type of product by the customer. However, it is clear that other aspects also play an important role in this process (Guerrero et al. 2000). In this context, the study of the food package is configured as extremely important, since it represents the customer’s first contact with the product, which is essential for defining the object of choice and purchase (Soares et al. 2009).

The effect of the information provided on the packaging of food products has been widely studied (Carneiro 2002) showing its role in the customers’ expectations, as well as in the product’s hedonic evaluation. For food, the customer can use the appearance, an intrinsic factor, as a quality parameter (Jaeger and Macfie 2001). In this context, the label and packaging play a key role in the customer purchase intent, since they act as a means to draw attention and provide information about the content and thereby affect the perception of quality (Sloan 2003). The constant search for the upgrade, modernization and standardization of the information contained in food packaging will prevent the consumer to develop misconceptions and/or improperly use a particular food in your daily diet (Castro 2000).

Through the package, the company can express its concern about the customer’s health by placing clear and objective information for the understanding of your target audience (the customer). The food package triggers a great part of the product marketing impact on the customer (Sloan 2003). In addition, the package has also basic functions related to physical protection of the contents during the phases that include the storage, transport and handling of the product, the physical supply of consumer units, enabling the sales process, as well as those
geared specifically to the exchange and sale system (Castro 2000).

Under current conditions, with multinational and competitive markets, the success of a food is not only dependent on efficiency and economic viability aspects, but also on the flavor and customer expectations satisfaction. Therefore, considering these factors is essential in the development, optimization and improvement of product quality and, therefore, sensory evaluation has become an important tool (Camargo et al. 2007). The sensory properties are the food characteristics perceived by the senses. In its perception, the senses act with greater or lesser impact (Osorio et al. 2005).

On the other hand, researches on sensory analysis with organic products are quite recent; little is known about the sensory characteristics of organic food, they even are presented as different characteristics compared to conventional product. Studies involving the consumer attitude, reflected in its choice mechanism, purchase, consumption and acceptance of organic products are even rarer (Pearson, 2011). Then the research method is presented and then the results are found in field research.

**Research Method**

To collect the data was chosen a structured questionnaire, constructed on the basis of guidelines Synodinos (2003) and Powell et al. (2011). The questionnaire was divided into two parts. The first one is the characterization of organic food consumers in terms of age, education, gender and income, similar to the work of Aertsens et al. (2011) and Zakowska-Biemans (2011). This part consists of four multiple-choice questions. In the second part, information about the sensory attributes and packaging characteristics were presented to the consumer in a multiple choice format (in this case, a question for each construct). Focus groups were conducted prior to identify the 12 variables that are investigated in this study. Based on Osorio et al. (2005) six attributes were presented as an option: color, shape, consistency, aroma, texture and flavor. The options on the characteristics of the packaging were based on Soares et al. (2009): shelf life, chemical composition, packaging shaping, presence of the name organic on the package, seal of organic certification, and nutrition facts.

This study was conducted in the last five months of 2013 in three supermarkets belonging to the local network and nationally known of the state capitals of southern and southeastern Brazil. All these stores sell organic foods and give these products a prominent place in the area of horticultural products. These two regions (south and southeast) were chosen because, according to the IFOAM (International Federation for Organic Agriculture Movement), a leading international federation of organic agriculture, are the regions that consume more organic foods in Brazil (Lin et al. 2010).

Interviews were performed on different days and several times over one week. The number of interviews was estimated in proportion to the average number of people attending the supermarket that day, according to data provided by the stores themselves. In general, the number of people addressed for the research is around 10%, percentage adopted based on historical data the number of consumers served daily by supermarkets, according to their own records and based on Synodinos (2003). At the end of three months as a result of the samples used, 845 questionnaires composed the final sample. This paper considers other studies which investigated consumer on smaller samples of people to support field trials that were published and considered valid. There may be mentioned, for example, surveys of Barnes et al. (2009),
Berlin et al. (2009), Brown et al. (2009), Chen (2009) and Yin (2009).

After questionnaires answered, we proceeded to variables’ cross-tabulation and data analysis using descriptive statistics. To this end, we used the software LISREL 8.8 (Scientific Software International 2011). The quantitative approach predominates at this research stage. Data from the first part of the questionnaire were expressed as percentages. To identify which of the twelve variables are relevant to the organic foods consumption, we used the statistical procedure of factor analysis. Factor analysis is a generic name that denotes a class of procedures primarily used for reducing and summarizing the data. Research can occur where there is a large number of variables, most of them correlated, which should be reduced to a manageable level. Thus, we study the relationships between many interrelated variables set by representing them in terms of some key factors (Malhotra 2006).

As a multivariate statistical procedure, factor analysis is the basic purpose of grouping highly correlated variables. An advantage of this method is that it allows you to analyze, for example, instead of 26 variables, a smaller set of factors that are composed by these variables and thus bring their statistical characteristics (Lehmann et al. 1998). The main results of factorial analysis are: (1) the percentage of variance explained by all the factorial solution and for each factor; and (2) the factor loadings of each variable in the respective factor, representing the correlation of that variable with the factor (Hair et al. 1998).

According to the same reference the factorial analysis was made with orthogonal rotation VARIMAX that simplifies the interpretation of the not-clear factors. In particular, it is common that some variables are related to the first factor only moderately or even if they are related to more than one factor. Rotation adjusts the factor loadings to the components so that it becomes clearer for which factor a given variable has higher load (Lehmann et al. 1998). The cutoff criterion for retention of factors was the eigenvalue greater than or equal to 1. This criterion assumes that variables grouped in one factor are able to explain the variance better than a single variable, on average. Thus, all axes are retained for which the eigenvalue is equal to or greater than 1 (Hair et al. 1998).

**Results**

Out of the 280 people who participated in this study, 36% (305 people) said to be non-consumer of organic foods while most, 64% (540 people) reported to be consumer. Then, the following carried out analysis are made based on the sample of 540 organic foods consumers. Approximately 85% of consumers of organic foods are between 15 and 35 years old. The age group of organic food consumers is concentrated in the range between 21 and 28 years, nearly 50% of the sample. This result shows that the biggest part of organic food consumers is young. Regarding education, more than half (73.3%) of consumers of organic food research participants have completed the third degree and postgraduate full. More than half of the consulted organic food consumer is composed by women, specifically 66.1%, what is expected, since they usually perform grocery shopping for their households.

The problem that the factor analysis seeks to solve is: what are the sensory attributes and packaging characteristics that the organic food consumers consider important in the process of acquisition and analysis of the product? Then consumers were asked to indicate whether they agreed or disagreed with the presentation, in organic foods, of the variables shown in Table 2. According to Bartholomew and Knott (1999) there should be at least four to five times as many
observations (sample size) than variables to validate the results.

Table 2 – Variables researched in the study

<table>
<thead>
<tr>
<th>Sensorial Attributes</th>
<th>Packaging Characteristics</th>
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<tbody>
<tr>
<td>V1 – Color</td>
<td>V7 – Shelf life</td>
</tr>
<tr>
<td>V2 – Shaping</td>
<td>V8 – Chemical Composition</td>
</tr>
<tr>
<td>V3 – Consistency</td>
<td>V9 – Packaging type</td>
</tr>
<tr>
<td>V4 – Aroma</td>
<td>V10 – The name organic in the package</td>
</tr>
<tr>
<td>V5 – Texture</td>
<td>V11 – Organic seal in the package</td>
</tr>
<tr>
<td>V6 – Flavor</td>
<td>V12 – Nutrition facts</td>
</tr>
</tbody>
</table>

For the factor analysis to be appropriate, these variables must be correlated. To test this correlation the Bartlett's test of sphericity (Hair et al. 1998) was applied. This test verifies whether the correlation matrix is an identity matrix, which would indicate no correlation between the data. The null hypothesis that the variables are not correlated in the sample observed was rejected by this test. The approximate chi-square statistic is 278.42 with 66 degrees of freedom, significant at the 0.05 level. The statistical value of 0.698 Kaiser-Meyer-Olkin (KMO - Hair et al. 1998) is also great, greater than 0.5. Thus, the factorial analysis can be considered an appropriate technique to analyze the correlation coefficients between the variables.

The technique used to analyze the data was the principal component analysis, which takes into account the total variance of the data. In this analysis, the factors are called principal components. For this study the number of factors was determined in a way that it will summarize the variables in the eigenvalue-based approach. In this approach only the factors with eigenvalues less than 1.0 are retained. An eigenvalue represents the amount of variance associated with the factor. The components 1, 2, 3 and 4 have eigenvalues greater than 1.0. About 60% of the total variance of consulted sample data can be attributed to a combination of four factors. In addition, factor 1 shows a variance greater than the other. This shows that the variables related to this factor are highlighted in the consumption of organic foods and should be prioritized in the development of these products.

Using the matrix of rotated components one can interpret the relationship between the factors and variables. We used the criteria described by Hair et al. (1998) for the selection of items members of each factor. According to these criteria, for a sample size of 150, items with loading factor above 0.45 are considered significant. The Factor 1 is composed by the variables: V1 (color), V2 (shaping), V3 (consistency), V4 (aroma), and V5 (texture). This factor will be interpreted as the sensorial attributes set that motivate the purchase the organic food. Factor 2 is related to the variables V7 (shelf life), V8 (chemical composition) and V12 (nutrition facts). This can be understood as the label basic information. Third factor is related to the variables: flavor (V6) and organic seal (V11). Thus, factor 3 is labeled as organic certification and flavor guarantee. The variable 9 (packaging) has cross-load on the factors 2 and 3. Thus, it is not included in any factor. The fourth factor is related to the variable "name organic" (V10) interpreted as "name organic on the packaging." For the operationalization of each factor we used scales of the items added components. It was observed that the correlations between factors were zero, which ensures that the factors are distinct. The following section presents a discussion of the findings and recommendations for the development of organic food based on factor
Discussion and recommendations

The profile of the most frequent organic food consumers of the consulted sample, in general, was: women in the age group 22 to 28 years, with educational level no lower than graduation. Therefore, during the product development, it should be planned how the product will be marketed to focus more on this profile. As we do not want to just stick to this market, one must not overlook the other ranges. This is important because organic products cannot be sustained in the market if they are dependent only on this profile.

The four factors identified by factor analysis allow direct efforts at the product development. The first factor explains a greater variation of data in relation to others. This allows us to understand that consumers prioritize the sensory attributes in the purchase of organic food. The changes in these variables can influence the consumption of organic food.

The factor 2 is called the basic information on the label. The shelf life of organic food is reduced compared to conventional foods according to Shepherd et al. (2005). In this case, we recommend an appropriate distribution policy to offer on the shelves of fresh food retailers. Retailers should prioritize a partnership relationship with local food producers, stimulating the conversion from traditional growing to the organic growing. There is no consensus in the literature regarding the existence of nutritional difference between organic and conventional foods (Gibbon et al. 2009; Crinnion, 2010)

Therefore, it is recommended that the retailer establishes a distribution policy based on their own transportation from the production site to the shelves. The proper handling and transport conditions should be guaranteed. An investigation on the optimum moisture index for that variety of organic food to be grown should be performed to ensure the nutrients optimum density. Standard procedures must be developed for ground handling and training of employees of the production site to meet this standard. Organic agriculture in Brazil is regulated by the Ministry of Agriculture, Fisheries and Food Supply (in Portuguese - MAPA). The fertilizers that can be used in this type of cultivation are already standardized. The producer and retailer should investigate which are they and restrict their use in cultures, identifying the optimum amount.

Regarding the chemical composition of organic foods, some authors claim that this is one of the main variable in the quality of these products (Achilles and Anastasios, 2008). Therefore, the packaging for processed and fresh organic foods must have labels with the shelf life, chemical composition and nutrition facts presented in a readable fashion and in a language understood by these products’ consumer.

It can be argued that consumers of these products associate the taste to the seal of organic certification, as shows the grouping of variables V6 and V11 in factor 3. The organic seal, issued by a certifying agency accredited by the Ministry of Agriculture of Brazil guarantees the food provenance, according to the organic production method in the mold of Law No. 10,831 (MAPA, 2010). Thus, it is important that during the product development, those responsible for this process pay attention to the guidelines of organic production legislation of the country where organic food is sold, and disclose this fact. The companies producing these foods should prioritize the certification of its production by a certifier accredited by the MAPA.

It is important to direct the efforts of the food producer towards organic certification. Moreover, it is important that the food is organic in the product packaging as the consumer
considers this an important item for purchase, the factor 4. According to Colom-Gorgues (2009) it is necessary to improve the traceability, indicate the origin of the product in its labels and information about the production methods, aspects that should be the product development guidelines. On the other hand certification aspects should be clarified to the consumer (Chang and Zepeda 2005). Thus, marketing efforts focused on clarifying the benefits of organic food compared to conventional food and the organic certification should also be planned during the product development. It is important to highlight for the consumer that there are different types of certification for organic certification and that only three (TecPar, IBD and EcoCert) are accredited by MAPA to issue certificates of organic production (Mapa 2010). The next section shows the conclusions of this study.

Conclusions

The aim of this study was to determine which sensory attributes and characteristics of the organic food packaging impact on its consumption. Moreover, it was proposed to determine the product consumer profile in terms of four variables: income, gender, education and age. To achieve that goal, a structured questionnaire was constructed in seven multiple choice questions. To define the profile of consumers of organic food, we analyzed the data using descriptive statistics. The other results were achieved through a factor analysis, aiming mainly to the data reduction.

Based on the results, we conclude that consumers are positively influenced to purchase organic food by four basic factors: the sensory attributes, essential information contained in the package, organic certification attesting the taste of the food and the presence of name organic on the package. Thus, producers must provide excellence in these factors to provide a good quality organic food. Moreover, the recommendations proposed in this paper are consequences of these options. In order to identify the perspectives for future work, we suggest further research on this topic, extending the survey of the consumer profile of organic food for a broader sample. Moreover, it is suggested to increase the comparison of the results found in this study with other studies conducted elsewhere in the world. The identification of specific methodologies to improve the development of new organic food products is also required. Another recommendation would be to conduct a study that encompassed the physical presentation of samples of organic food and its packaging.

References


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