Food Safety Perceptions of Fresh Fruits and Vegetables Consumers

Özge Can NIYAZ¹  Nevin DEMİRBAŞ²

¹Canakkale Onsekiz Mart University, Faculty of Agriculture, Department of Agricultural Economics, Canakkale-Turkey 
²Ege University, Faculty of Agriculture, Department of Agricultural Economics, İzmir-Turkey.

Correspondence author: E-mail: ozgecanniyaz@comu.edu.tr

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The objective of this study was to determine the perceptions regarding food safety of the fresh fruits and vegetable consumers in Canakkale. Face to face interviews were carried out with 166 consumers who were determined via Proportional Sampling Method. A Five-Point Likert Scale was used to define the perceptions consumer and Multidimensional Scaling Analysis was used for determining the perception dimensions. Survey results show that half of the all the consumers were women. About half of consumers have more than 11 years of education. About 89.2 % of fresh fruits and vegetable consumers have monthly food expenses of 250 Euros or less and 69 % spend 50 Euros or less on fresh fruits and vegetables. As a result of study; consumers are of the opinion that fresh fruits and vegetables include hormones, pesticides, fertilizer remains and Genetically Modified Organisms.

Keywords: Consumer perceptions, food safety, fresh fruits, fresh vegetables.

Yaş Meyve ve Sebze Tüketicilerinin Gıda Güvenliği Algıları

Bu çalışmanın amacı Çanakkale’deki yaş meyve ve sebze tüketicilerinin, yaş meyve ve sebzelerdeki gıda güvenliği algılarının ölçülmesidir. Oransal Örnekleme Formülü ile belirlenen 166 tüketici ile yüz yüze anketler yürütmüştür. Tüketicilerin algılarının ölçümesi için 5’li Likert Ölçekli yargılardan, algı boyutlarının ölçülmesi için ise Çok Boyutlu Ölçekleme Analizinden yararlanılmıştır. Anket sonuçlarına göre tüketicilerin yarısı kadındır. Tüketicilerin yaklaşık yarısı 11 yıldan fazla eğitim almıştır. Taze meyve ve sebze tüketicilerinin % 89.2’si aylık 250 Euro veya daha az ve % 69’u ise taze meyve ve sebzelede 50 Euro veya daha az harcama yapmaktadır. Çalışma sonuçlarına göre; tüketiciler yaş meyve ve sebzelerin hormon, pestisit, gübre kalıntısi içerdikleri ve Genetiği Değiştirilmiş Organizmalar kullanımını düşündüktedir.

Anahtar kelimeler: Tüketicisi algısı, gıda güvenliği, yaş meyve, yaş sebze.

Introduction

The concept of food safety can be expressed as the degree of confidence that food will not cause any sickness or harm to the consumer when prepared, served and eaten based on its intended use (FAO/WHO, 2003). It is also defined as the conditions and measures required for production, processing, storage, distribution and preparation of food in order to assure that it is safe, sound, wholesome, and fit for human consumption (Badrie et al., 2006). The last decade has pushed forward the concept of food safety as a significant quality of food (Grunert, 2005; Röhrl et al., 2005). Consciousness related with health is on the rise nowadays in addition to flourishing predispositions for improvements in well-being and health as a result of food choices (Ragaert et al., 2004). Health risks related with food consumption have started to cause more concern among consumers during the past decade (Lobb et al., 2007). Preventive behaviors are triggered due to impressions related with personal vulnerability to disease (Redmond and Griffith, 2004). Therefore, it is expected that interest in safe foods will increase as a result of this social and political environment (Roitner-Schobesberger et al., 2008).

Food safety influences the perceptions of consumers with regard to food as well as with the decisions related with food preferences (Rijswijk and Frewer, 2008). Personal responsibility related with food safety should be well noticed as a mandatory factor for putting appropriate food safety behaviors into practice (Redmond and Griffith, 2004). As much, physiological, behavioral and cognitive factors related with consumer experience are all influenced by sensory properties of food products thereby applying pressure on
consumer perceptions (Imram, 1999; Costell et al., 2010; Vabo and Hansen, 2014). Thus, inconsistencies related with to attitudes and behaviors of consumers are especially important (Rimal et al., 2001).

Psychological factors related with foods influence the selection of food greatly in comparison with the physical attributes of food products. Awareness of risks related with food safety have significant effects on both the behavior and attitude of consumers during the decision making process for purchasing (Yeung and Morris, 2001).

Consumers use their senses for experiencing the appearance, taste, scent and texture of the product (Schifferstein and Cleiren, 2005). Consumer satisfaction in developed countries has transformed into a more daunting task for producers due to increasing critical and varied demands of consumers regarding food selection thus resulting in both vertical and horizontal quality differentiation (Grunert, 2005).

Fresh fruits and vegetables are rich sources of vitamins and are thus very important for consumer health (HU, 2015). They are also part of a group of products with the highest amount of chemical residue due to flawed applications during production (UM, 2010). Thus, studies on food safety using fresh fruits and vegetables are significant for public health.

According to 2011 data, Turkey is ranked eighth among fresh fruit vegetable exporting countries with regard to export value (EUROSTAT, 2015). It is a self-sufficient country in the sense of fresh fruits and vegetables consumption of the country’s population excluding exotic products. Both sustainability of export and environment and public health issues within the country make food safety a priority in this food group which interests broad consumer mass.

The averages of 2011/2013 indicate that, Canakkale province meets 2.16 % of the fruit production and 2.87 % of Turkey’s vegetable production (TSI, 2015). The city has important contributions on crop production and export value especially in relation with the sense of specific fruit and vegetable species. Fresh fruits and vegetables consumption level is important since the city is an important center of tourism. The number of studies in literature carried out on food safety perceptions of consumers has increased during the last decade (Rimal et al., 2001; Yeung and Morris, 2001; Redmon and Griffith, 2004; Grunert, 2005; Röhr et al., 2005; Badrie et al., 2006; Lobb et al., 2007; Rijswijk and Frewer, 2008). There are also studies on consumer perceptions related with fresh fruits and vegetables (Fillion and Kilcast, 2002; Ragaert et al., 2004; Peneau et al., 2006; Peneau et al., 2009). Some of these studies cover organic products (Harper and Makatouni, 2002; Roitner-Schobesberger et al., 2008; Hoefkens et al., 2009; Naspetti and Rafaele, 2009; Oraman and Unakıtan, 2010).

Studies have been carried out recently in Turkey on food safety perceptions of consumers (Ergönül, 2013; Oraman and Unakıtan, 2010) and their knowledge levels (Bal et al., 2006; Unusan, 2007; Onurlubaş and Gürler, 2016). However, no study was observed in both international and national literature on the fresh fruits and vegetables food safety perceptions of consumers which make up one of the food groups with the highest amount of pesticide residue regardless of any organic and conventional distinction. Hence, it is thought that the study will fill an important gap in the relevant literature. The objective of the study was to put forth food safety perceptions of consumers for fresh fruits and vegetables in Canakkale. Variables related with food safety perceived differently by fresh fruits and vegetables consumers have been put forth in two dimensions.

**Material and Methods**

Results of surveys carried out in 2015 among consumers from the center of Canakkale province comprised the main material for the current study. Sample size was determined via proportional sampling method, based on fruits and vegetables consumers, using the formula below (1):

\[
    n = \frac{z^2 \cdot p (1-p)}{d^2}
\]  

(1)
n = sample size
z² = confidence factor of the desired confidence level (2.58 for 99%)
p = population ratio
d = margin for error
\[2.58^2 \times (0.5) (0.5) = 166\]
\[(0.10)^2\]
n is the sample size, z is the table value of confidence level (assumed to be 99%), p is the probability of the examined situation occurring (p = 0.5 is used due to the absence of preliminary information concerning consumers’ food safety awareness levels about fruits and vegetables), q is the probability of the situation not occurring (q = 1 - p), and d is the margin for error (assumed to be 10%). Estimated sample size was calculated as 166 and was distributed proportionally based on the population.

There are seven districts in the center of Canakkale province. These districts are divided into five groups according to income (1 = Highest income group, 5 = Lowest income group). A total of 166 surveys were carried out in seven districts in compliance with the income groups by means of face-to-face meetings with fresh fruits and vegetables consumers living in these districts.

Items prepared by means of the Five-Point Likert Scale were used in measuring the perceptions of fresh fruits and vegetables consumers in terms of food safety one stands for “Strongly Disagree” and five for “Strongly Agree”. The common rating format for surveys is Likert Scale. They vary between a group of categories-least to most-asking people to put forth how much they agree or disagree, approve or disapprove or believe to be true or false. Likert Scale cannot be generated erroneously. Care should be given to including at least five response categories (Allen and Seaman, 2007). Multidimensional Scaling (MDS) Analysis was used in turn to analyze the data. MDS is a technique for analyzing similarity and dissimilarity data on a set of objects. MDS attempts to model such data as distances among points in a geometric space. The main reason for doing this is that one wants a graphical display of the structure of the data, one that is much displays the essential information in the data, smoothing out noise (Cox and Cox, 2001; Borg and Groenen, 2005). MDS has three different applications. These are known as; full-metric MDS with intervals between the proportional input and output data, non full-metric MDS with ordinal input and ordinal output data and non-metric MDS with ordinal input and metric output data (Özdamar, 2013). Full-metric MDS method was used in the study since the data and results obtained via Five-Point Likert Scale were interval scale. The acquired data were transformed into distance matrix between observations using the Alternating Least Square (ALSCAL) and were interpreted as such. ALSCAL enables grouping for making binary comparisons when the acquired data do not have a weight of preference (Kalaycı, 2010). ALSCAL method was preferred since there was no weight of preference for the data used in the study. Euclid distance was selected as a means of acquiring distance since the data in the study had an interval scale. The variables used in MDS analysis and their definitions are given in Table 1.

**Food safety perceptions of the fresh fruits and vegetables consumers**

Survey results show that 50% of all the consumers were women. About 51 and 20.5% of the consumers underwent fewer than nine and more than 11 years of education, respectively. The percentage of families consisting of less than five members was detected to be 66. Approximately 57.2% of fresh fruits and vegetables consumers have monthly household incomes of 625 Euros or less. About 89.2% of fresh fruits and vegetable consumers have monthly food expenses of 250 Euros or less, and 69% spend 50 Euros or less on fresh fruits and vegetables.

A total of 13 questions prepared via Five-Point Likert Scale were asked to the consumers in order to measure their perceptions on fresh fruits and vegetables food safety.
The scale averages calculated in accordance with the responses of the consumers to these questions have been given in Table 2. Accordingly, consumers accept the judgment that fruits-vegetables are freshly presented to the market (4.43). Consumer choice of fruits and vegetables depends significantly on freshness (Ragaert et al., 2004; Bond et al., 2009; Peneau et al., 2009). Consumers agree that the physical appearance of fresh fruits-vegetables is important in purchasing decisions (4.19 and 4.03). The appearance of fresh fruits and vegetables is a primary criterion in making purchasing decisions (Kays, 1999; Resnicow et al., 2001; Whitehead et al. 2012). Consumers also agree with the judgment that hormone (4.07) and GMO (4.03) are used in fruits-vegetables sold and that fruits-vegetables contain pesticide (3.89) and fertilizer (3.86) remains. Consumers neither agree nor disagree with the judgments that the required care is provided to the cold chain for fruits-vegetables being sold (3.06), that the products are of low quality (3.05) and that standardization (2.96) and traceability (2.51) are attained. Finally, consumers have also put forth that they do not agree with audit during sales (2.20) and audit during production (2.17). Stress value is a criteria used for deciding on the accordance of the solution in MDS. Low stress value is desired. Accordingly, the table published by Kruskal in 1964 for the interpretation of the stress value is shown in Table 3. Two dimensions were used in the study for an easier understanding of MDS analysis as is the case in many other studies (Gündüz, 2011). Two dimensions optimize the object locations and facilitating interpretation. Because of this reason, two dimensions are used in this study too.

The stress value calculated according to the MDS results carried out on the two-dimensional plane continued until the fourth iteration. Iteration was stopped when the stress value was lower than 0.001 for k=2.

<table>
<thead>
<tr>
<th>Variable Names</th>
<th>Variable Definitions</th>
<th>Scales</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standardization</td>
<td>Thinking that there is standardization for issues like length, color for fruits and vegetables (Berdegue et al., 2005)</td>
<td>1= I certainly do not agree</td>
</tr>
<tr>
<td>Freshness</td>
<td>Paying attention to consuming fruits and vegetables in their fresh form (Bond et al, 2009)</td>
<td>2= I do not agree</td>
</tr>
<tr>
<td>Physical appearance-(1)</td>
<td>Crushed fruits and vegetables having adverse effects on the purchasing decision (Kays, 1999; Oraman and Unakitan, 2010)</td>
<td>3= I neither agree nor do not agree</td>
</tr>
<tr>
<td>Physical appearance-(2)</td>
<td>Worm, bug etc. on the fruits and vegetables having adverse effects on the purchasing decision (Kays, 1999; Oraman and Unakitan, 2010)</td>
<td>4= I agree</td>
</tr>
<tr>
<td>Cold chain</td>
<td>Thinking that cold chain is given importance in the production and marketing of fruits and vegetables (FAO, 2004)</td>
<td>5= I certainly agree</td>
</tr>
<tr>
<td>Traceability</td>
<td>Not being able to ensure traceability during the production and marketing of fruits and vegetables (Liao et al., 2011)</td>
<td></td>
</tr>
<tr>
<td>Audit during production</td>
<td>Consumers thinking that the audits at the farms are sufficient (Safefood, 2007)</td>
<td>1= I certainly do not agree</td>
</tr>
<tr>
<td>Audit during sales</td>
<td>Consumers thinking that the audits during sales are sufficient (Bal et al., 2006; Safefood, 2007)</td>
<td>2= I do not agree</td>
</tr>
<tr>
<td>Hormone</td>
<td>Consumer opinion regarding the use of hormones by farmers</td>
<td>3= I neither agree nor do not agree</td>
</tr>
<tr>
<td>Pesticide residue</td>
<td>Consumer opinion that there is pesticide residue on the fruits and vegetables (Safefood, 2007; Oraman and Unakitan, 2010)</td>
<td>4= I agree</td>
</tr>
<tr>
<td>Fertilizer residue</td>
<td>Consumer opinion that there is chemical fertilizer residue on fruits and vegetables (Yilmaz et al., 2010)</td>
<td>5= I certainly agree</td>
</tr>
<tr>
<td>Genetically Modified Organism (GMO)</td>
<td>Consumer opinion that the fruits and vegetables contain GMO (Rodriguez-Lazaro et al., 2007; Oraman and Unakitan, 2010)</td>
<td></td>
</tr>
<tr>
<td>Quality</td>
<td>Thinking that the fruits and vegetables are of low quality</td>
<td>1= I certainly do not agree</td>
</tr>
<tr>
<td></td>
<td>(Harker et al., 2003)</td>
<td>2= I do not agree</td>
</tr>
<tr>
<td></td>
<td>(Yılmaz et al., 2010)</td>
<td>3= I neither agree nor do not agree</td>
</tr>
<tr>
<td></td>
<td>(Rodriguez-Lazaro et al., 2007; Oraman and Unakitan, 2010)</td>
<td>4= I agree</td>
</tr>
<tr>
<td></td>
<td>(Safefood, 2007; Oraman and Unakitan, 2010)</td>
<td>5= I certainly agree</td>
</tr>
</tbody>
</table>
Table 2. 5 Point-Likert Scale averages of the variables used in the study

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standardization</td>
<td>2.96</td>
<td>1.09</td>
<td>166</td>
</tr>
<tr>
<td>Freshness</td>
<td>4.43</td>
<td>0.84</td>
<td>166</td>
</tr>
<tr>
<td>Physical appearance-(1)</td>
<td>4.19</td>
<td>1.08</td>
<td>166</td>
</tr>
<tr>
<td>Physical appearance-(2)</td>
<td>4.03</td>
<td>1.09</td>
<td>166</td>
</tr>
<tr>
<td>Cold chain</td>
<td>3.06</td>
<td>1.08</td>
<td>166</td>
</tr>
<tr>
<td>Traceability</td>
<td>2.51</td>
<td>1.03</td>
<td>166</td>
</tr>
<tr>
<td>Audit during production</td>
<td>2.17</td>
<td>1.01</td>
<td>166</td>
</tr>
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<td>Audit during sales</td>
<td>2.20</td>
<td>1.05</td>
<td>166</td>
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<td>4.07</td>
<td>0.91</td>
<td>166</td>
</tr>
<tr>
<td>Pesticide residue</td>
<td>3.96</td>
<td>0.79</td>
<td>166</td>
</tr>
<tr>
<td>Fertilizer residue</td>
<td>3.86</td>
<td>0.85</td>
<td>166</td>
</tr>
<tr>
<td>Genetically Modified Organism (GMO)</td>
<td>4.03</td>
<td>0.92</td>
<td>166</td>
</tr>
<tr>
<td>Quality</td>
<td>3.05</td>
<td>1.16</td>
<td>166</td>
</tr>
</tbody>
</table>

Accordingly, the value of 0.00028 obtained for the study corresponds to the full accordance interval. There was full accordance between the variables used in the study and the MDS model. Square of the correlation index ($R^2$) is evaluated for understanding how good the current data in the MDS model represent the model. A value greater than 0.60 is desired for this variable. The $R^2$ value was calculated as 0.95 for this study. Accordingly, data used in the study explain a significant ratio of the model as high as 95%. This indicates the strength of the model.

The relationships between the examined variables have been given in Graph 1. Accordingly, the distances and differences between the variables have a linear relationship as should be the case. Graph 2 is related with the projection of the distances and closeness between the examined variables in two dimensional space. Accordingly, pesticide residue, fertilizer residue, hormone and GMO variables are those that are perceived as similar by the consumers if the variables are to be grouped based on their appearance in space. Whereas the second group consists of physical appearance-(1) and physical appearance-(2) variables. Standardization and cold chain variables are in another group. Production and sales audit which are perceived by the consumers as similar seem close to each other with regard to position.

Whereas the variables of quality, freshness and traceability are perceived by the consumers differently than all other variables and do not form a group. Based on this, it is possible to say that the 13 variables present in the beginning are collected under seven different groups thus decreasing the number of variables. These seven groups can be listed as: variables that have physiological effects on fresh fruits and vegetables, variables that have physical effects on fresh fruits and vegetables, standardization and cold chain, audit, quality, freshness and traceability.

The exact distances between variables related with food safety are included in the matrix table for variables (Table 4). The three relationships in the table with the highest similarity were between pesticide residue and fertilizer residue (0.000), between audit during production and audit during sales (0.336) and between pesticide residue and hormone (0.547).

Accordingly, consumers perceive these variables as very close to each other with respect to food safety in fresh fruits and vegetables. Whereas the relationship with the largest difference for the examined variables can be listed respectively as; audit during production and freshness (3.571), audit during sales and freshness (3.565), audit during sales and physical appearance-(1) (3.502).
Graph 1. Scatterplot of linear fit

![Scatterplot of Linear Fit](image)

Graph 2. Derived stimulus configuration

![Derived Stimulus Configuration](image)
Consumers perceive these variables very differently in comparison with one another with regard to food safety for fresh fruits and vegetables. Consumers establish a close relationship between taking care to consume fresh products and audits. Turkey is an important producer of fruits and vegetables which enables finding fresh fruits and vegetables in all seasons. Whereas taking care to consumer fresh products depends on the consumer, carrying out proper audits is independent of the consumer. Hence, the variables that were perceived by the consumers to be farthest apart from each other were these two. They also perceived sales audit and physical appearance as distant from each other. Since fresh fruits and vegetables can be found in all seasons in Turkey due to the climate conditions, it is not common to buy crushed fruits and vegetables. These products, especially fruits, are used in the fruit processing industry (TUGEM, 2016). Products with good physical appearance are generally sold as table-top items.

**Conclusions and Suggestions**

MDS results indicate that consumers perceive hormone, pesticide residue, fertilizer residue and GMO criteria as similar. According to consumers, applications that cause changes in the genetic and chemical structures of fresh fruits and vegetables have similar adverse effects on human health. It was observed that consumers perceive the audits carried out during production and sales to be similar as factors that are important for food safety. Audits are necessary to ensure food safety. Consumers perceive all attributes related with the physical appearances of fresh fruits and vegetables as comparable. In addition, providing standardization and cold chain comprise another variable group that is perceived to be similar with respect to the consumers. Quality, freshness and traceability are variables that are perceived by the consumers as different from all other variables and among themselves. Consumers think that these factors are different from the others.

There was no study in literature about food safety perceptions of fresh fruit and vegetable consumers by MDS. There are few study about consumer perception of fruit and vegetables with different statistical analysis methods (Fillion and Kilcast, 2002; Ragaert et al. 2004; Peneau et al. 2006; Peneau et al. 2009). Similar to this study, Ragaert et al. 2004 found that freshness and appearance variables were also under different factors. Peneau et al. 2006 and Peneau et al. 2009 could not find significant at the high level the appearance variable on the freshness. Baker (1999), Harker et al. (2003) and Yahaya et al. (2015) put forth that reduced pesticide and safer products are quite effective on the purchasing decisions of consumers too.

In this context, allowed pesticide types and maximum permissible amounts have been strictly determined via legal frameworks in the European Union (EU). Pesticides which are considered as highly dangerous are not permitted. In addition, products that are on sale in the market are collected via sampling method and are subject to analyses. Farmers are directed towards alternative agriculture methods... It is suggested to put these applications into practice in Turkey as well. Fresh fruits and vegetables producers should be
informed by extension programme about the means with which they can use less chemicals as well as the reasons why they should do so. Consumers should increase their awareness. The consumers should start gaining awareness at an early age by way of education provided during the primary school years. The increase of the number and activities of Non-governmental Organizations related with health and nutrition is also very important for increasing the awareness of consumers. EU has put into effect the Rapid Alert System for Food and Feed (RASSF) Consumers’ Portal in order to inform consumers about the use of pesticides (EC, 2017). It is suggested that the consumers should demand the putting into effect of this system in Turkey as well.

References


