Factors Affecting Consumers' Awareness of Food Safety:
A Case Study in the Urban Area of Samsun Province in Turkey

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Abstract: The objective of this research is to determine what factors affect the food safety awareness of consumers in Samsun Province, an urban area in Turkey. In this study, food safety awareness levels were divided into three types: low, medium and high. Survey data from 384 consumers was analyzed with the Ordered Probit Model. The results indicate that socioeconomic variables (gender, education level and household income) and behavioral variables (consumption of organic food versus genetically modified food) have a considerable effect on consumers' awareness of food safety. The results indicate that the probability of having a high level of awareness increases by about 26% with a 1 year increase in the length of consumers' education. Moreover, it was found that women were more cognizant of food safety issues than men. Consequently, for firms developing marketing strategies and for public institutions increasing awareness-raising efforts, targeting male consumers who typically have lower conscious levels is critically important.

Key words: Food safety, awareness level, consumer, Samsun, Turkey

INTRODUCTION

Human health depends on adequate and balanced nourishment. Such nourishment improves individual cognitive development and research efficiency as well as increases average lifespan by reducing health risks. As individuals mature and cognitive development takes place, consumers gradually develop a sense of balanced consumption and they begin to eat more discriminately (Topuzoglu *et al.*, 2007).

Global agriculture produces enough food for all people to have enough to eat. However, global food distribution is imbalanced (Dolekoglu, 2003). While, some countries cannot access enough food to sustain life, others consume more than their necessity. Similarly, food safety problems affect the whole world but they disproportionately impact underdeveloped and developing countries. The imbalance in world food distribution causes the growth of physically, mentally and socially unhealthy generations and it has also become a major problem that threatens world peace.

Food consumption is especially important for human life because it is among the first physiological needs. Today, the safety of consumed food in terms of taste, quality and health has become important, particularly in countries that have solved more basic food safety problems. Attainment of adequate food is the first step toward nutrition. However, obtained food must also be safe. Healthy and sustainable life is possible only with the simultaneous improvement of food security and food safety.

The emergence of diseases originating through food in the recent years such as avian flu has called food safety into question. At the same time, social and economic developments have increased consumer interest in consuming safe food. Thoughtful consumers take many features of a given product into consideration besides its ability to satisfy their hunger. For instance, consumers' interest in environmentally friendly products has increased. Changing consumer expectations combined with unfavorable events in terms of health have increased the importance of studies concerning food safety. Several studies have examined levels of food safety awareness among people in Turkey and in other parts of the world (Jevsnik *et al.*, 2008; Uzunoz *et al.*, 2008; Gozener and Buyukbay, 2009; Sanlier, 2009).

The objective of this research is to determine what factors affect consumers' levels of food safety awareness in the urban area of Samsun province. These research results will primarily serve as a guide for consumers but they will also be of interest to people and institutions involved in food production, storage and transportation. The results may also shed light on the policies of public institutions responsible for food inspection.

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MATERIALS AND METHODS

The main material of the study is questionnaire data collected from consumers in the Atakum, Canik and Ilkadim districts of Samsun Province. The consumers were surveyed in January and February 2011. The sample size was determined by ungrouped one stage random likelihood sampling method based on households (Collins, 1986):

$$n = \left(\frac{Z_{\alpha/2}}{d}\right)^2 \times p \times q$$

Where:
n   =   The sample size
$Z_{\alpha/2}$ =   The significance level (assumed to be 95%)
p   =   The probability of the examined situation occuring (p = 0.5 is used to the absence of preliminary information concerning consumers' food safety awareness levels)
q   =   Probability of the situation not occuring (q = 1-p)
d   =   The margin of error (assumed to be 5%)

Estimated sample size was calculated as 384 and distributed proportionally according to the population resident in the various districts. The number of consumers surveyed was 84, 55 and 245 in the districts of Atakum, Canik and Ilkadim, respectively.

Consumers were classified into 3 groups according to their food safety awareness levels. To determine these levels, consumers were asked twenty questions in order to assess their behaviours concerning examining label information and purchasing, storing and consuming food. For these questions, the consumers were limited to five answers (never: 1, rarely: 2, sometimes: 3, generally: 4 and always: 5). The total number of points was considered to represent the consumer's level of food safety awareness. Consumers who had one standard deviation point lower than the average number of points were labeled as low-level awareness consumers. Consumers with one standard deviation point either lower or higher than the average score were regarded as consumers with a medium level of awareness. Consumers with one standard deviation point higher than the average score were termed consumers with a high level of awareness (Table 1).

The Ordered Probit Model was used to estimate the effect of consumers' socioeconomic and behavioral characteristics on their levels of food safety awareness.

Table 1: The distribution of consumers according to awareness levels

Awareness levels	Frequency	Percentage
Low	73	19.01
Medium	248	64.58
High	63	16.41
Total	384	100.00

When the dependent variables had more than two values and were qualitative, they were ordered according to their magnitudes. The Ordered Probit Model is one of the recommended consecutive response models for data sets with these types of variables (Maddala, 1983).

It is assumed that one term, an irregularly observable variable, exists behind the intermittent and consecutive categories in the Ordered Probit Model. An unobservable confidential variable is explained with the error term and an explanatory variable vector as shown (Greene, 1997):

$$y^* = \beta x + \varepsilon \quad \varepsilon \sim N[0, 1]$$

Where:
x   =   A vector of the independent variable
y^* =   An unobserved perception held by individual independent variable
β =   A vector of parameters
ε =   The vector of stochastic error term

As the awareness levels are classified into three levels in the research, the dependent variable (y) is ranged according to their values (y = 0, 1, 2) in such a way that it has three different values (Chen *et al.*, 2002; Mutlu and Yurdakul, 2006):

$$y = 0; y^* \leq 0$$

$$y = 1; 0 < y^* \leq \mu 1$$

$$y = 2; \mu L \leq y^*$$

Where:
y   =   The observed equivalent of y^*
$\mu 1$ =   The threshold value appraised with β in the model that is determining the lower and upper bounds of the expected values of y

The probability of consumers having one of the three awareness levels is stated. These probabilities are required to be positive for $\mu 1 > 0$:

$$P(y = 0) = \phi(-\beta' x)$$

$$P(y = 1) = \phi(\mu 1 - \beta' x) - \phi(-\beta' x)$$

$$P(y = 2) = 1 - \phi(\mu 1 - \beta' x)$$

where, ϕ is the cumulative normal range function. This model is solved by the Logarithmic Maximum Likelihood Method but directly interpreting the coefficients' variables to be estimated that belong to the Ordered Probit Model by using this method is problematic

(Akbay *et al.*, 2007). Because they depend on the values of these variables and the effects of explanatory variables on the probabilities, the parameter (β) estimations are not the same. Due to this, the marginal effects of the explanatory variables must be estimated in order to determine their effect on the possibilities. The variables' marginal effects were calculated as follows (Greene, 1997).

$$\frac{\partial P(y=0)}{\partial x} = -\phi(\beta'x)\beta$$

$$\frac{\partial P(y=1)}{\partial x} = \left[\phi(-\beta'x) - j(\mu 1 - \beta'x)\right]\beta$$

$$\frac{\partial P(y=2)}{\partial x} = \phi(\mu 1 - \beta'x)\beta$$

The marginal effect of the shadow variables is calculated separately for 0 and 1 and then these values are subtracted. The sum of the marginal effects of an explanatory variable in different probabilities is equal to zero (Greene, 1997). If the coefficient of the explanatory variable is positive, this indicates that the probability of consumers having that level of awareness increases whereas, the likelihood of consumer not having that level of awareness decreases.

RESULTS AND DISCUSSION

According to the survey results, 64% of the consumers polled were women. About 41% of consumers were educated 8 years or less and 19% of consumers were educated 14 years or more. Housewives who earned no income constituted 34% of the consumers surveyed. Families with a household size of three individuals or less made up 52% of surveyed families while the remaining 48% of families had households of three individuals or more. Of the families surveyed, 25% had children under 6 years old. About 57% of the consumers were aware of at least one certificate relevant to food safety, quality or environmental management (ISO 9001, ISO 22000, ISO 14001, HACCP ve GLOBALGAP). In the study, only 8% of consumers reported purchasing organic food. Moreover, 27% of consumers stated that they prefered Genetically Modified (GM) food if its price was lower than the standard price.

A consumer's food safety awareness level, the dependent variable of the model was classified as low awareness level (0), medium awareness level (1) or high awareness level (2). Socioeconomic characterisitcs of consumers (age and education level, household income,

household size and number of children) and the consumer's consumption behaviours (awareness of at least one certificate about food safety, organic food consumption, purchasing GM food at low prices) constituted the independent variables of the model. The dependent and independent variables used in the model are shown in Table 2.

The results of the Ordered Probit Model for variables affecting consumers' levels of food safety awareness are shown in Table 3. The threshold ($\mu 1$) value in the model was found to be positive and statistically significant at the 0.01 level. This means that the consumer characteristics included in the model significantly affected food safety awareness levels.

The marginal effects of consumers' socioeconomic and behavioural characterisitics on food safety conscousness levels are shown in Table 4. Coefficients in Table 3 and marginal effects in Table 4 were evaluated together in order to pay attention to marginal effects. Based on the results, coefficients related to consumers' gender were positively correlated and statistically significant ($p<0.01$). When a given consumer was a woman, the probability of a low level of awareness decreased by 7% whereas the possibility of a medium or high level of awareness increased 2 and 6%, respectively.

Variables related to the ages of consumers (AGE2 and AGE3) affected consumers' food safety conscousness levels negatively. However, AGE2 and AGE3 variables were not found to be statistically significant. It was also determined that the education levels of consumers affected food safety awareness levels positively and some variables (EDU2 and EDU3) relating to education level were found to be statistically significant.

When marginal effects were taken into consideration, a one-unit increase in EDU2 or EDU3 variables decreased the probability of a consumer having a low food safety awareness level decrease of 14 and 32%, respectively. Similarly, the probability of a medium level of awareness increased 3 and 7% and that of a high awareness level increased 11 and 26%, respectively. Variables regarding the income of consumers (INC2, INC3 and INC4) were determined to be positively correlated with food safety awareness levels and statistically significant. The positive sign of the variables' coefficients indicates that when the household income was more than 450 TL per month, an increase in the INC2, INC3 and INC4 variables increased consumers' food safety awareness. A one-unit increase in INC2 and INC3 variables decreased the probability of a low awareness level by 8% while the probabilities of being in a medium or high awareness level increased by 2 and 6%, respectively. Similarly, a one-unit increase in INC4

Table 2: Definition of variables and explanatory statistics of the sample

Explanatory variables	Definition of variables	Variable name	Mean	SD
Gender	Male = 1; female = 0	GENDER	-	-
Age (year)	<35 = 1; otherwise = 0	AGE1[b]	0.25	0.43
	35-49 = 1; otherwise = 0	AGE2	0.46	0.50
	>49 = 1; otherwise = 0	AGE3	0.29	0.46
Education (year)	<9 = 1; otherwise = 0	EDU1[b]	0.41	0.49
	9-13 = 1; otherwise = 0	EDU2	0.40	0.49
	>13 = 1; otherwise = 0	EGDU3	0.19	0.39
Consumer income (TL*/month)	<450 = 1; otherwise = 0	INC1[b]	0.34	0.47
	450-1000 = 1; otherwise = 0	INC2	0.31	0.46
	1001-2000 =1; otherwise = 0	INC3	0.29	0.45
	>2000 = 1; otherwise = 0	INC4	0.07	0.25
Household size (individual)	1-3 =1; otherwise = 0	HSIZE1[b]	0.52	0.50
	>3 = 1; otherwise = 0	HSIZE2	0.48	0.50
Children between ages 0-6	Yes = 1; otherwise = 0	CHILD	0.25	0.56
Awareness of certificates	Awareness = 1; otherwise = 0	CERTIFICATE	0.57	0.50
Organic food consumption	Yes = 1; otherwise = 0	OFC	0.08	0.27
Preference for low-priced GM food	Yes = 1; otherwise = 0	GMO	0.27	0.44
Dependent variable[a] y = 0, y = 1 and y = 2	-		0.97	0.60

[a]0 refers to a low awareness level, 1 refers to a medium awareness level and 2 refers to a high awareness level; [b]Indicates base variables omitted from models to avoid multicollinearity; *TL: Turkish Lira

Table 3: Estimates Ordered Probit Model's for food safety awareness levels

Variables	Estimated coefficients	SE	t-ratios	p-values
Constant	-0.134	0.351	-0.383	0.702
GENDER	0.504*	0.189	2.655	0.008
AGE2	-0.083	0.219	-0.379	0.705
AGE3	-0.118	0.253	-0.468	0.640
EDU2	1.017*	0.229	4.448	0.000
EDU3	2.353*	0.336	7.000	0.000
INC2	0.588*	0.217	2.708	0.007
INC3	0.598**	0.301	1.986	0.047
INC4	1.027**	0.435	2.365	0.018
HSIZE2	-0.173	0.153	-1.127	0.259
CHILD	0.094	0.155	0.605	0.545
CERTIFICATE	0.241	0.159	1.515	0.129
OFC	1.162*	0.308	3.772	0.000
GMO	-0.402**	0.169	-2.372	0.018
$\mu1$	3.070*	0.213	14.405	0.000

*Statistically significant at the 0.01 level; **at the 0.05 level

Table 4: The marginal effects of factors on the probability of relative frequencies for food safety awareness levels

Variables	Probability[a] (y = 0)	Probability[b] (y = 1)	Probability[c] (y = 2)
Constant	0.019	-0.004	-0.015
GENDER	-0.069	0.015	0.055
AGE2	0.011	-0.002	-0.009
AGE3	0.016	-0.003	-0.013
EDU2	-0.140	0.029	0.111
EDU3	-0.324	0.068	0.256
INC2	-0.081	0.017	0.064
INC3	-0.082	0.017	0.065
INC4	-0.142	0.029	0.112
HSIZE2	0.024	-0.005	-0.019
CHILD	-0.013	0.003	0.010
CERTIFICATE	-0.033	0.007	0.026
OFC	-0.160	0.034	0.127
GMO	0.055	-0.012	-0.044

[a]y = 0 refers to low awareness level; [b]y = 1 refers to medium awareness level and [c]y = 2 refers to high awareness level

decreased the probability of a low awareness level by 14% and increased the probabilities of being in a medium or high awareness level by 3 and 11%, respectively.

The HSIZE2 variable in the model affected consumers' food safety awareness levels negatively while the CHILD variable affected them positively. Neither variable however was found to be statistically significant. The CERTIFICATE variable regarding consumers' awareness of at least one food safety certificate affected consumers' food safety awareness levels positively. However, the CERTIFICATE variable was also not statistically significant.

Consumers' organic food consumption coefficient was positively correlated with food safety awareness levels and statistically significant. Consumers' consumption of organic food decreased the probability of being at a low food safety awareness level by 16% while it increased the probability of being at a medium or high food safety awareness level by 3 and 13%, respectively.

Consumers' consumption of Genetically Modified (GM) food affected their food safety awareness levels negatively and the coefficient of GM food consumption was statistically significant. When consumers consumed these foods, the probability of being in a low awareness level increased by 6% and the probability of being in a medium or high awareness level decreased by 1 and 4%, respectively.

CONCLUSION

In recent years, the appearance of foodborne diseases affecting human health has made consumers more interested in safe food products. This interest has caused them to ask what factors might contribute to food safety from the production process to the moment of consumption. There are various people and institutions serving different roles in regulating food consumption. The most active elements among them are the consumers demanding the products. For that reason, consumers' food safety awareness levels must be determined. Assessing the factors affecting safe food consumption

and presenting consumers' relevant socioeconomic factors and behavioral characteristics are of great importance for manufacturers and the food sector more broadly.

The Ordered Probit Model results used in this study have shown that gender and educational status of consumers, household income, organic food consumption and low-priced GM food consumption have significant effects on consumers' awareness of food safety. The gender and education of consumers, their household income and organic food consumption affected consumers' food safety awareness levels positively while low-priced GM food consumption affected awareness levels negatively. All were found to be statistically significant. In other words, consumers' consumption of low-priced GM food decreases their probability of being at a high-awareness level while the other variables increase this probability. In the research, 16% of surveyed consumers were at a high awareness level while the remaining consumers were at medium or low awareness levels. Because of the importance of food safety in terms of human health, this ratio must be increased. Since, education is a variable that increases consumers' awareness level significantly, individuals at young ages must develop this awareness in the home environment and subsequently while at school.

The food safety awareness levels of the consumers varied according to their genders. Woman consumers were also more aware of food safety than men. Therefore, new products developed by food companies and studies concerning existing products' reliability must be devoted to gaining the confidence of women. Yet changes in Turkey's sociocultural structure in recent years have increased men's role in purchasing and preparing food. Consequently, it is important to give weight to awareness raising research directed at male consumers as men generally have lower awareness levels than woman consumers.

It was determined that only 8% of surveyed consumers consume organic food. It is necessary to popularize studies concerning organic food consumption because of its importance for health. Yet its cost affects its purchase by consumers. Unit costs should decrease as organic food production increases, meaning that organic food will be able to be sold at lower prices. On the other side, GM foods are of great importance among the subjects remaining on the food safety agenda and also among the much debated questions in terms of health. In the research, 27% of consumers had a tendency to prefer GM foods if they were available at lower prices. Consumers do not yet know the adverse effects of GM foods on human health. Therefore, consumers must be informed about these risky foods prior to consumption.

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