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An Econometric Analysis of Factors Affecting Fish Consumption: The Case of Tekirdag, Turkey

Derya İlkay ABDİKOĞLU[1], Mecit Ömer AZABAĞAOĞLU[2], Gökhan UNAKITAN[3]
Tekirdağ Namık Kemal University, Faculty of Agriculture, Agricultural Economics Department, Tekirdağ, Turkey
[1]https://orcid.org/0000-0003-0273-3323, [2]https://orcid.org/0000-0002-7745-0574, [3]https://orcid.org/0000-0002-9824-5975
✉: deryailkay@nku.edu.tr

ABSTRACT

The aim of this study was to determine the factors affecting the fish consumption in Tekirdag province. The data were obtained from 270 consumers selected by using random sampling method from 48000 households living in Tekirdag province. Consumers' demographic characteristics were analyzed and responses for preferences about fish consumption habits were discussed. In this study, Factor Analysis was performed to analyze the purchasing behavior of consumers about fish consumption. Factor groups were named as "attitude towards processed and canned products", "conscious purchasing", "opinion about aquaculture", "health benefits", "impact on consumption amount". Factors affecting the amount of fish consumption per capita were explained with Tobit model. Consumer's income, education level and factor groups derived from factor analysis were used as explanatory variables in the model. According to the results conscious purchasing factor, health benefits factor, consumer income and education level have positive effect on fish consumption. As a result of the study, it was observed that the increases in income level and conscious level would increase fish consumption. Based on the result of the Tobit model, in order to increase fish consumption, consumers should be informed about the health benefits of fish.

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Balık Tüketimini Etkileyen Faktörlerin Ekonometrik Analizi: Tekirdağ İli Örneği

ÖZET

Bu çalışmanın amacı Tekirdağ ilindeki tüketicilerin balık tüketim miktarlarına etki eden faktörlerin belirlenmesidir. Tekirdağ ilinde yaşayan 48000 haneden tesadüfi örnekleme yöntemi kullanılarak seçilen 270 tüketici ile anket uygulaması yapılarak tüketicilerin demografik özellikleri ve balık tüketim alışkanlıkları ile ilgili yargılara verdikleri cevaplar ele alınmıştır. Çalışmada tüketicilerin balık tüketimi ile ilgili satın alma davranışlarını analiz etmek üzere faktör analizi kullanılmıştır. Faktör analizi sonunda elde edilen faktör grupları "işlenmiş ve konserve ürünlere karşı tutum", "bilinçli satın alma", "yetiştiriciliğe bakış", "sağlığa fayda" ve "tüketim miktarına etki" olarak belirlenmiştir. Kişi başı balık tüketim miktarını etkileyen faktörler Tobit model yardımı ile açıklanmıştır. Modelde açıklayıcı değişken olarak tüketici geliri, eğitim durumu ve faktör analizinden elde edilen faktör grupları kullanılmıştır. Analiz sonucuna göre bilinçli satın alma faktörü, sağlığa fayda faktörü, tüketici geliri ve eğitim düzeyi anlamlı bulunmuştur. Çalışma sonucunda, gelir seviyesi ve bilinç düzeyindeki artışın balık tüketimini artıracağı tespit edilmiştir. Tobit modelinin sonuçlarına göre, balık tüketimini artırmak için tüketicilere balıkların sağlığa faydaları hakkında bilgi verilmelidir.

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INTRODUCTION

Since seafood is a healthy protein source, it has an important place in human nutrition. Fish meat contains high protein and minerals, less oil than other

meats. Because of this, its importance and consumption have been increasing (Sayılı et al., 1999). Worldwide, there is a growing trend from the consumption of red meat to white meat, especially to the fish. Although rapidly increasing population and lack of a balanced diet, seafood, especially fish is not consumed enough in Turkey. This situation about fish consumption should be reviewed and possible solutions should be discussed.

Fish consumption in many countries is seen more important as compared to Turkey. The average fish consumption per capita is 16.89 kg/year in European Union countries and 14.19 kg/year in the world. Despite the known benefits of fish consumption on human health, fish consumption is still not at the desired sufficient level in Turkey. The average fish consumption per capita is 5.58 kg/year in Turkey (FAO, 2018). Referring to the current situation in Turkey, fish consumption is not sufficiently widespread and it is lower than the world average. This situation highlights the fact that the generalization of fish consumption will be very important in terms of healthy and balanced nutrition.

There are numerous studies in the literature related consumers' fish preference according to the characteristics of fish (Sarı et al., 2000; Jaffry et al., 2004; Çolaklıoğlu et al., 2006; Şen et al., 2008; Adıgüzel et al., 2009; Brécard et al., 2009; Oğuzhan et al., 2009; Claret et al., 2012; Yeşilsu et al., 2019) and the effects of socioeconomic factors on the fish consumption (Şenol and Saygı, 2001; Olsen, 2003; Arvanitoyannis et al., 2004; Erdal and Esengün, 2008; Burger and Gochfeld, 2009; Aydın et al., 2011; Cosmina et al., 2012; Iton and Hutchinson, 2017; Uzundumlu, 2017; Korir et al., 2018; Terin, 2019). There are also plenty of studies about the factors that are effective on fish consumption preferences by using factor analysis (Honkanen et al., 2005; Verbeke and Vackier, 2005; Pieniak et al., 2010; Altintzoglou et al., 2011; Hall and Amberg, 2013; Birch and Lawley, 2014; Temel and Uzundumlu, 2015; Tomic et al., 2016). Koç and Şahin (2018) discussed the Tobit model in detail and applied the model to fish consumption in Kahramanmaraş, Turkey.

This study is important in terms of determining fish consumption behaviors of consumers living in Tekirdag and determining the reasons affecting fish consumption.

MATERIAL AND METHODS

Material

In this study, data was obtained from consumers living in Tekirdag province. Also, macro data was obtained from Turkish Statistical Institute, Food and Agriculture Organization of the United Nations, Ministry of Agriculture and Forestry, local and international studies, projects and reports.

$$n=\frac{Npq}{(N-1)\sigma_p^2+pq}$$

According to the sampling calculated from limited population formula (90% confidence interval, 5% margin of error and p=q=0.5 to achieve maximum sample size), face to face surveys were applied to the randomly selected consumers representing 270 different households. The number of households included in the sample were proportional to the number of households in the neighborhoods.

In this study, preferences about fish consumption of the consumers in Tekirdag were grouped by factor analysis and the effects of the factor groups and socioeconomic characteristics of households were determined with the Tobit model.

Method

Factor analysis

Factor analysis is a technique that is used to reduce a large number of variables into fewer numbers of factors. This technique extracts maximum common variance from all variables and puts them into a common score. In factor analysis, since the observed number of variables is tried to be explained by a smaller number of factors, firstly, correlations between variables are taken into account. While factor analysis aims to reduce dimension and to eliminate dependence structure, it aims to find a few number of new (common) unrelated variables by bringing related variables together in an event with p variables (Tatlıdil, 2002).

Factor analysis is performed in four basic steps. The first step is to examine the suitability of the data for factor analysis. The three methods used for this purpose are the creation of the correlation matrix, Kaiser-Meyer-Olkin (KMO) and Barlett's tests. In the calculation of the correlation matrix, there should be a high correlation between the variables. Variables with very strong correlation between them will usually be within the same factor (Nakip, 2003).

The Kaiser-Meyer-Olkin (KMO) Test is calculated by comparing the simple correlation coefficients with the partial correlation coefficients as shown in the formula below. The value of the test ranges from 0 to 1 (SPSS, 1994).

$$KMO=\frac{\Sigma_{i\neq j}\Sigma r_{ij}^2}{\Sigma_{i\neq j}\Sigma r_{ij}^2+\Sigma_{i\neq j}\Sigma a_{ij}^2} \quad (1)$$

In formula 1,

r_{ij} : the correlation coefficient between the *i.* and *j.* variable,

a_{ij} : the partial correlation coefficient between *i.* and *j.* variable.

KMO values higher than 0.90 indicate the sampling is adequate. KMO values between 0.89 and 0.80 indicate the sampling is meritorious and between 0.79 and 0.60 indicate the sampling is middling. KMO values less than 0.6 indicate the sampling is not adequate. (Sharma, 1996).

The second step is to determine the number of factors. The goal is to obtain a small number of factors that represent the relationships between variables at the highest level. In the third step, rotation of the factors, the aim is to obtain the factors that can be named and interpreted. After determining how many factors the model consists, the number of variables to be included in each factor and the distribution of the variables to these factors are determined. Then the fourth step is to name the factors (Tavşancıl, 2002; Nakip, 2003; Çokluk et al., 2010).

Tobit model

The models where limited dependent variables are examined are called Tobit models (Tobin, 1958). These models are also called censored or discrete regression models (Gujarati, 2001). In the regression models with a limit of the variable range of the dependent variable, if the observations outside of a certain range are completely lost, the model is called a "truncated model" and if independent variables can be observed the model is called "censored model" (McDonald and Moffitt, 1980).

It is known that the estimation methods, such as the ordinary least square (OLS) for sample subsets of individuals above the censored threshold, are invalid. Therefore, researchers generally use the Tobit estimation method for censored dependent variables. An important feature of the Tobit estimators is that they are based on two important information for each individual.

The effect of an individual on the dependent variable depends on the probability of over censored threshold value

The effect of individuals on the censored threshold value depends on the intensity of the dependent variable.

When combined these two information in probability functions, Tobit model estimators give consistent results. Many researchers use this model to study with normal random variables because of its features such as consistency and asymptotic efficiency of the Tobit estimators.

In Logit and Probit models, the dependent variable takes the values 0 and 1. In this study, fish consumption is dependent variable and it is discrete variable. Tobit model is used since the dependent variable is fish consumption amount (kg/year), not fish consumption status (consume=1, not consume=0).

In this study, it is assumed that all households are consume fish. It is accepted that non-consumers do not consume fish due to income, habit and psychological reasons. The Tobit model is defined as follows under the stated acceptances:

$$Q_i = \propto +\beta_1 F_{1i} + \beta_2 F_{2i} + \beta_3 F_{3i} + \beta_4 F_{4i} + \beta_5 F_{5i} + \beta_6 E_i + \beta_7 I_i + \mu_i \quad (2)$$

In equation 2,

Q_i: annual fish consumption per capita of *i.* household,
F_{1i}: attitude towards processed and canned products of *i.* household,
F_{2i} : attitude towards conscious purchasing of *i.* household,
F_{3i}: opinion about aquaculture of *i.* household,
F_{4i}: attitude towards health benefits of *i.* household,
F_{5i} : attitude towards effect on consumption amount of *i.* household,
E_i : educational level of *i.* household,
I_i : income level of *i.* household.

RESULTS

The research was conducted with 270 consumers in Tekirdag. Overall, 43.70% of the consumers were female and 56.30% were male. Majority of consumers, about 59% were at the age of between 26 to 40 years old. Education level and income level results of consumers are shown in the Table 1. Majority of the consumers around 42% have bachelor's degree. Majority of the consumers, around 34% have an average income of 2001-3500 TL.

Table 1. Demographic characteristics of consumers
Çizelge 1. Tüketicilerin demografik özellikleri

		No	Ratio (%)
Educational Level	Primary school	15	5.56
	Middle school	5	1.85
	High school	57	21.11
	Associate degree	23	8.52
	Bachelor's degree	113	41.85
	Postgraduate	57	21.11
Income Level	<1000	8	2.96
	1000 - 2000	35	12.96
	2001 - 3500	92	34.08
	3501 - 5000	73	27.04
	5001 < 8000	60	22.22
	8000 <	2	0.74

Approximately 98% of the consumers indicated that they consume fish (Table 2). Fish consumption per capita in Tekirdag province was 14.69 kg.year^{-1}. While sea fish consumption per capita was14.16 kg/year, freshwater fish consumption per capita was 0.53 kg/year.

The data obtained with the Likert scale from 270 consumers were used in factor analysis,. The total number of variables was reduced from 23 to 15 by elimination.

Table 2.Consumers' fish consumption
Çizelge 2. Tüketicilerin balık tüketimleri

Fish Consumption	Frequency	Ratio (%)
Yes	264	97.80
No	6	2.20
Total	270	100.00

Bartlett's Test of Sphericity was 0.000 (p <0.005). Thus, it shows that the correlation between items was sufficient to run the factor analysis. The standard Cronbach's alpha statistic, which indicates the reliability of the variables,was 0.565. This value indicates that the variables were low reliability. The KMO value was 0.630 and this means the sample size was middling level.

The initial eigenvalues and the sum of the squares of the factor loads after rotation are shown in Table 3. Five factors were determined whose eigenvalueswere higher than 1. The first factor explains about 18.41% of the total variance. The variance explained by the second factor was 11,43% and the third factor explains 11.24% of total variance. The total variance explanation percentage of the first 5 factors with eigenvalues higher than 1 was 63.29%.

According to the results of the rotated factor matrix, the scale consists of 15 items and 5 factors. The dimensions were named by taking into account rotated factor load and the meaning of the factors. The names of dimensions were "attitude towards processed and canned products", "conscious purchasing", "opinion about aquaculture", "health benefits", "impact on consumption amount" (Table 4).

The factors affecting the fish consumption of the households were explained with the Tobit model. In the model, total income of households, educational level of consumers and factors groups were explanatory variables. As a result of the analysis, conscious purchasing factor and income were significant at 99% significance level. The education level of the consumers was significant at 95% significance level, while the health benefits factor was significant at 90% significance level (Table 5).

In regard to Tobit model results, variables were consistent with expectations. When income and education level increases, fish consumption would increase. Also, conscious purchasing and health benefit factors effects the fish consumption positively.

DISCUSSION

Fish consumption per capita in Tekirdag province was 14.69 kg/year. Although this amount was higher than the average of Turkey (5.58 kg / year), it is lower than the EU average (16.89 kg / year) and the world average (14.19 kg / year).

In regard to factor analysis results, the most effective factor in fish purchase decision was attitude towards processed and canned products. Other factors were conscious purchasing, opinion about aquaculture, health benefits and effect on consumption amount respectively.

According to the Tobit model, developed from factor analysis results, income and education level had a positive effect on fish consumption per capita. It was observed that increase of the education level and of the knowledge about fish would increase the amount of fish consumption per capita. Sayılı et al. (1999), Hatırlı et al. (2004), Orhan & Yüksel (2010), Yüksel et al. (2011), Wan & Hu (2012), Nalinci (2013), Koc & Sahin (2018) indicated that when the level of income and education increased, fish consumption amount increased.

Table 3. Total variance explained
Çizelge 3. Açıklanan toplam varyans

Factors	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.840	18.933	18.933	2.761	18.406	18.406
2	2.313	15.420	34.353	1.714	11.426	29.831
3	1.567	10.445	44.799	1.687	11.244	41.076
4	1.525	10.168	54.967	1.676	11.172	52.248
5	1.248	8.321	63.288	1.656	11.040	63.288
6	0.988	6.589	69.877			
7	0.824	5.496	75.373			
8	0.810	5.399	80.772			
9	0.641	4.275	85.047			
10	0.548	3.655	88.702			
11	0.446	2.973	91.675			
12	0.373	2.484	94.159			
13	0.319	2.128	96.288			
14	0.295	1.964	98.252			
15	0.262	1.748	100.000			

Bartlett's Test of Sphericity = 0.000, KMO=0.630

Table 4. Denomination of factor groups
Çizelge 4. Faktör gruplarının adlandırılması

	Factor Load	% of Variance
Factor 1 - Attitude towards processed and canned products		18.406
My consumption will increase if canned products in the market diversify	0.801	
I like to consume canned seafood	0.797	
I like to consume canned fish (tons, pickled, etc.)	0.717	
My consumption will increase if canned products become widespread.	0.700	
I like to consume processed fish (fish finger, nugget etc.)	0.637	
Factor 2 - Conscious purchasing		11.426
I am experienced in purchasing fish	0.899	
I know seasonal fishes	0.898	
Factor 3 - Opinion about aquaculture		11.244
Cultured fish is cleaner than marine fish	0.810	
Cultured fish is more nutritious than marine fish	0.796	
Aquaculture is essential to increase consumption	0.579	
Factor 4 - Health benefits		11.172
Fish consumption has positive effects on child development	0.913	
I know the health benefits of fish	0.865	
Factor 5 - Impact on consumption amount		11.040
If my income increases, my fish consumption increases	0.801	
If my health problem arises, my fish consumption increases	0.726	
The decrease in fish prices does not affect my consumption	0.671	

Table 5. Results of Tobit model
Çizelge 5. Tobit model sonuçları

Variable	Coefficient	Probability
Fish consumption per capita (dependent variable)		
Factor 1 (Attitude towards processed and canned products)	-0.574269	0.5612
Factor 2 (Conscious purchasing)	5.132694	***0.0000
Factor 3 (Opinion about aquaculture)	0.320052	0.7523
Factor 4 (Health benefits)	1.804754	*0.0642
Factor 5 (Impact on consumption amount)	-0.221948	0.8286
Income	4.454390	***0.0000
Education level	1.203463	**0.0314
Log likelihood		-991.8161

* P <0.10, ** P <0.05 and *** P <0.01

There was a positive relationship between the increase in consciousness level and fish consumption. In other words, when consumers' experience of purchasing fish and their knowledge about fish season according to fish kind increases, fish consumption per capita will increase. Hatırlı et al. (2004) suggested that to raise awareness of families by explaining the importance of the fish. Temel & Uzundumlu (2015), determined health and nutrition motivation and effect of advertising on consumption among the factors that increase fish consumption. Olsen (2003) found a positive relationship between seafood consumption and health. Trondsen et al. (2004), indicated that with the increase in knowledge about health, seafood consumption would increase.

Fish consumption per capita would increase as a result of consumers' awareness of its health benefits and positive effects on child development.

Due to the preferences of consumers about processed and canned seafood, Factor 1 group had a negative effect on fish consumption. According to consumers, due to the fact that there was no difference between cultured fish and marine fish, Factor 3 group has a positive effect on fish consumption.

When the meat consumption habit of consumers was examined, it was seen that red meat is outweighed as compared to fish consumption in Turkey. However, chicken meat had a price advantage as compared to fish prices. For these reasons, fish consumption per capita is lower than red meat and chicken meat consumption. As a result of the study, it was observed that the increases in income level increases fish consumption. Model results support the fish purchase behavior of consumers in Turkey. Furthermore, according to model results, it was understood that consumption would increase as a result of increasing

conscious level. In order to increase fish consumption, consumers should be informed about the health benefits of fish. Campaigns and training activities should be organized by public institutions and non-governmental organizations, in particular educational institutions, to inform consumers.

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