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Hedonic Price Model of Table Olive in Turkish Markets: a Case Study of Bursa Province

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Abstract

The overall appearance and size are the most effective factors for quality determination of olives. Moreover, quality classification and pricing of olives are done according to size namely the number of olive fruits per kilogram. The aim of this study was to designate the effects of some quality criteria: number of olive fruit/kg (188-363), width (14.23- 19.23 mm), height (18.23-24.17 mm), flesh/stone weight ratio (4.80-6.96) , total dry matter (41.27-47.19 %), total acidity as lactic acid (0.53-0.74 %), pH (5.10-5.29), total oil (21.70-26.77 %), fatty acid composition of raw *table olive*s on price determination by hedonic model analysis. Statistical analysis of prices was done by using average retail prices of the samples. Lactic acid, flesh/stone weight ratio, total oil and linoleic acid factors had positive coefficients, so they positively affected the price. According to this model, main quality criteria affecting the price of olives were total acidity and flesh/stone weight ratio. Other factors did not significantly affect the *table olive* price. Especially the latter, since for the consumers, paying more would not only mean larger fruits but also a higher flesh ratio. Also, considering the factors having positive coefficients in price determination of *table olive*s for both producers and consumers was important.

Keywords: Gemlik variety olive, olive marketing, quality, price determination factors, consumer preferences, econometric model

Introduction

Olive and olive oil are the basic foods take place in the Mediterranean alimentary model. Beside its economical contribution to national economy, both olive and olive oil are beneficial to the human health. Olive oil is a rich source of essential fatty acids and its fatty acid composition is related with environmental factors and variety (Demirci, 2002; Uylaşer and Karaman, 2005; Savaş and Uylaşer, 2007; Uylaşer *et al*., 2008).

A large number of olive varieties are grown in the Mediterranean countries which produce most of the world's olives (Italy, France, Spain, Greece, Tunisia, Morocco, Turkey, Portugal) and Mexico, South Africa, Australia and, of course, in California (Uylaşer *et al*., 2008). Production for the 2006–07 season amounted to 1.823.500 tons, the majority of which (ca. 41.2%) was located in the European Union (Spain, France, Greece, Italy, Portugal, Slovenia). Other significant non-EU producing countries include Egypt (11.4% of the world production), Turkey (11.2%), Syria (8.7%), The United States (8.1%) and Morocco (7.5%) (IOOC, 2008). Olive has social, ecological and economic importance in these countries.

Production of *table olive*s in Turkey was 1.075.854 tons in 2007. Bursa district,where 94.590 tons of olive were produced in the same year, have significant importance in *table olive* production (***, 2007). There are large number of olive varieties grown in Turkey. Among these, Gemlik variety of olive that is produced in Gemlik - Bursa district is considered as the best quality olives of the world. These olives are private with its thin skin, little stone and high oil content (Vural, 1993). Barut (2000) researched some chemical changes in black fruits of olive cv. Gemlik grown in four different districts of Bursa (Gemlik, Orhangazi, İznik and Mudanya). Ecological factors also affected the chemical composition of the fruit. Gemlik variety olives grown in Gemlik district had higher protein, oil, sugar content and pH value and a lesser acidity than the other samples. For black *table olive* production, low acidity, high protein, oil and sugar content were desired quality characteristics. For that reason, with distinctive quality characteristics, Gemlik variety olive is one of the most suiTab. varieties for *table olive* production (Vural, 1993).

Physical, chemical and microbiological quality characteristics are important parameters for evaluation of food quality. The physical properties of agricultural products like olive, such as the length, width, thickness, arithmetic mean diameter, geometric mean diameter, sphericity, volume, unit mass, bulk density, true density, porosity, projected area, terminal velocity, drag coefficient are used in the harvesting, handling, conveying, separation, mechanical expression of oil, storing, processing, and designing equipment (Kılıçkan and Güner, 2008; Uylaşer *et al*., 2008). Also, physical properties are fundamental quality characteristics used for price determination of both processed and

non processed olives. Also chemical and microbiological properties are geared to nutritional value and health.

Fluctuation of *table olive* prices depends on supply and demand; however quality is the main effect of the differing prices in the sales market. Qualities and prices are distinguished by the characteristics of the final product. However there is no study focused on the relationship between physical properties, quality criteria and pricing of olive.

This research was conducted to determine relationships between selected raw *table olive* characteristics (number of olive fruit/kg, flesh/stone weight ratio, total dry matter, total acidity as lactic acid, pH, total oil, fatty acid composition) and prices, by using "Hedonic Price Model". Result uses of this analysis can estimate appropriate prices of *table olive*s encouraging producer improvements to product quality to meet consumers demand.

The hedonic beginning represents an indirect method of the preference measurement. It is used, in order to evaluate individual characteristics of a good, whose value consists of a bundle of characteristics. For heterogeneous goods a direct comparison of market prices is impossible, because these are difficulty comparable one with another. The theoretical development of the model is based on work of Rosen (1974) converted independently the theoretical bases of Griliches in models, which serve as basis for the estimation of the marginal values of goods characteristics.

Hedonic price models are used for the evaluation of many other heterogeneous goods as, for example, the quality of consumer goods (Rosen, 1974) or to the evaluation of (not-agricultural) real estates for the economic model (Shonkwiler and Reynolds, 1986) (Işgın and Forster, 2006).

Materials and methods

Samples

In this research Gemlik variety olives grown in three different important olive producing districts (Gemlik, Nilüfer and Orhangazi) of Bursa/Turkey were used. Hand picked raw olives collected from three olive orchards of these districts and transferred into laboratory. Samples were classified into 3 different groups according to number of olive fruit per kg (max. 200 fruit/kg, max. 300 fruit/kg, and >300 fruit/kg) then size (width and height), flesh/stone weight ratio, total dry matter, total acidity, pH, total oil and fatty acid composition of olive analysis were applied to these samples. Analyses were carried out in triplicate.

The Physical and Chemical Analysis

In order to proceed to the physical and chemical analysis, the olive samples were, firstly, hand cleaned by sorting from foreign materials.

The number of olive fruit per kg was determined by weighing randomly selected 100 g of samples and after counting them, then multiplying with 10.

For determining the size of the samples, approximately 100 olives were selected and grouped into 5 categories.

Dimensions (width and height) of 20 olive samples for each category were measured by a caliper with 0.1 mm precision.

To determine flesh/stone weight ratio, randomly selected olives (100 g) were weighed and then pitted by hand. Stones of olives were cleaned, dried and weighed. After determination of flesh weight by subtracting stone weight from total weight, stone weight was compared with flesh weight (Çalışır *et al*., 2005).

The dry matter and total acidity of pulp of the olive fruits were determined according to TS 774 olive standard (*** 1997). The pH of pulp of the olive fruits was measured by using a pH meter (Nel Model 890). The total oil content of pulp of the olive fruits was determined by Soxhlet extraction using n-hexane (AOAC, 1990).

Determination of Fatty Acid Composition

Fatty acid methyl esters (FAME) were prepared according to TS 4504 standard using cold extraction method (***, 2002). The fatty acid composition of FAME was analyzed according to TS 4664 standard using Hewlett Packard 6890 gas chromatograph equipped with a flame ionization detector (FID) (***, 1996). The analytical column was Agilent + DB-23 (60 m length, 0.25 mm i.d. and 0.25 μm film thickness). The flow rate of the carrier gases were set at 450 mL/min. for air, 40 mL/min. for hydrogen and 43 mL/min. for helium respectively. Injection quantity was 1μL. Temperatures of injector, column oven and detector were 130-170°C, 215-230°C and 130°C, respectively.

Statistical analysis

The purpose of this study, therefore, is to offer a solution for an econometric model to be use in pricing *table olive* (Rosen, 1974). Price data are taken from the result of fieldwork carried out by the authors.These data were collected from the twenty different olive dealers in Bursa region at the olive harvesting period. Average values of these prices were used for statistical analysis.

A hedonic price model is suiTab. for the empirical analysis of the food market. The hedonic beginning represents an indirect method of the preference measurement. It is used in order to evaluate individual characteristics of a good, whose value consists of a bundle of characteristics. The hedonic beginning assumes the prices are characterized by the function P(Zi). In the hypothesis test, it is examined whether the characteristic is significantly for an additional unit of a characteristic different from 0.

P(Zi)=P(Z number of olive fruit/kg Zdry matter Ztotal acidity Zflesh/stone weight ratio Ztotal oil Zoleic acid Zlinoleic acid) (1)

Results and discussion

The results of the physical and chemical analyses of Gemlik variety olives and fatty acid composition of the oils of the samples were given in Tab. 1 and Tab. 2 respectively. The results of correlation analysis aimed to determine the relationships between the main factors affecting *table olive* prices were given in Tab. 3.

According to the Tab. 3, correlation coefficient between total dry matter - total oil and also oleic acid- linoleic acid were very high. Other relationships were not so significant.

Hedonic model analysis was used for to search relationships between the price and the factors which affect the *table olive* price. All factors were used in this model since it had not been found high correlation among them according to the results of correlation analyses. Model was reliable statistically as F value (Tab. 4).

Conclusions

Lactic acid, flesh/stone weight ratio, total oil and linoleic acid factors had positive coefficients, so they positively affected the price. However, the main factors increased the *table olive* price were total acidity (as lactic acid) and flesh/stone weight ratio. Other factors did not significantly affect the *table olive* price. Generally other factors had smaller coefficients. The main cause of this situation could be explained as the price determination on the market was

Tab. 1. The Results of the Physical and Chemical Analysis of Gemlik variety olives

Olive samples grown in different districts	Number of olive fruit/kg	Width (mm)	Height (mm)	Flesh/stone weight ratio	Total dry matter (%) (w/w)	Total acidity (as lactic acid) (%) (w/w)	pH	Total oil (%) (w/w)
G-1	199	18.60	23.10	5.93	44.08	0.74	5.17	25.08
G-2	262	16.50	21.40	5.45	44.24	0.58	5.29	25.17
G-3	356	14.93	19.60	5.29	46.58	0.53	5.24	25.24
N-1	188	19.07	23.33	6.26	41.96	0.66	5.16	22.69
N-2	234	17.90	21.20	5.61	46.14	0.72	5.15	24.28
N-3	314	15.97	18.70	4.80	47.19	0.72	5.19	26.77
O-1	190	19.23	24.17	6.96	37.81	0.71	5.10	21.70
O-2	259	16.80	21.63	6.03	41.27	0.63	5.16	24.23
O-3	363	14.23	18.23	4.91	45.90	0.65	5.18	25.95

G: Gemlik, N: Nilüfer, O: Orhangazi
1: max. 200 fruits/kg, 2: max. 300 fruits/kg, 3: >300 fruits/kg

Tab. 2. Fatty Acid Composition of Oils of Gemlik Variety Olives (%)

Fatty Acids	G-1	G-2	G-3	N-1	N-2	N-3	O-1	O-2	O-3
Palmitic (C16)	12.91	12.81	12.81	13.61	13.44	13.32	16.91	15.45	16.69
Palmitoleic (C16:1)	1.32	1.14	1.15	1.19	1.18	1.13	1.25	1.24	1.10
Heptadecanoic (C17:1)	0.11	0.10	0.12	0.12	0.12	0.14	0.14	0.13	0.16
Stearic (C18)	3.11	3.19	3.24	2.89	3.06	3.05	3.63	3.64	3.99
Oleic (18:1)	72.65	74.28	74.36	71.94	72.61	71.71	69.20	71.58	68.63
Linoleic (18:2)	8.40	6.99	6.75	8.73	8.16	9.09	0.61	1.30	0.30
Linolenic (18:3)	0.54	0.54	0.55	0.60	0.54	0.56	-	-	-
Arachidic (C20)	0.40	0.40	0.41	0.36	0.37	0.39	0.50	0.48	0.52
Eicosenic (C20:1)	0.23	0.25	0.25	0.24	0.23	0.23	0.23	0.22	0.20
Behenic (C22)	0.09	0.11	0.10	0.09	0.05	0.09	0.12	0.12	0.13
Lignoseric (C24)	0.03	-	0.04	-	0.05	0.05	0.72	0.61	1.18

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Tab. 3. Correlation coefficients of the main factors affecting table olive prices

	Number of olive fruit/kg	Total dry matter (%) (w/w)	Total acidity (as lactic acid) (%) (w/w)	Flesh/ stone weight ratio	Total oil (%) (w/w)	Oleic acid (18:1)	Linoleic acid (18:2)
Number of olive fruit/kg	1.00	0.43	-0.14	-0.62	0.51	-0.21	-0.20
Total dry matter (%)(w/w)	0.43	1.00	-0.14	-0.92	0.78	0.40	0.50
Total acidity (as lactic acid) (%)(w/w)	-0.14	-0.14	1.00	0.23	-0.17	-0.43	0.12
Flesh/stone weight ratio	-0.62	-0.92	0.23	1.00	-0.87	-0.21	-0.26
Total oil (%) (w/w)	0.51	0.78	-0.17	-0.87	1.00	0.23	0.25
Oleic acid (%) (18:1)	-0.21	0.40	-0.43	-0.21	0.23	1.00	0.71
Linoleic acid (%) (18:2)	-0.20	0.50	0.12	-0.26	0.25	0.71	1.00

Tab. 4. Estimates of hedonic price models of table olive

	B	Beta	Std. Error	Statistic	Significance
(Constant)	-4.208		8.268	-0.509	0.617
Number of olive fruit/kg	-0.001	-0.063	0.001	-0.547	0.591
Total dry matter (%) (w/w)	-0.062	-0.211	0.090	-0.691	0.497
Total acidity (%) (w/w)	2.711	0.222	1.617	1.677	0.110
Flesh/stone weight ratio	1.049	0.791	0.503	2.087	0.051
Total oil (%) (w/w)	0.503	0.155	0.090	0.918	0.370
Oleic acid (%) (18:1)	-0.006	-0.014	0.084	-0.078	0.939
Linoleic acid (%) (18:2)	0.057	0.236	0.041	1.401	0.177
		$R^2 = 0.89$	Adj.R^2=0.85	F = 21.45	Durbin-Watson = 1.46

Independent variable: Price of table olive

done according to the number of olive fruit per kg. In consequence, flesh/stone weight ratio and total acidity were determined as principal factors affecting the price. Also, considering the factors having positive coefficients in price determination of *table olive*s for both producers and consumers was important.

References

*** (1996). TS (4664) Yağ asitleri metil esterlerinin gaz kromatografisi ile analizi. Türk Standartları Enstitüsü, Ankara, 11 p.

*** (1997). TS (774) Yemeklik zeytinler. Türk Standartları Enstitüsü, Sayı: 23153, Ankara, 6-19.

*** (2002). TS (4504) Hayvansal ve bitkisel katı ve sıvı yağlar - yağ asitleri metil esterlerinin hazırlanması. Türk Standartları Enstitüsü, Ankara, 25 p.

*** (2007). T.C. Başbakanlık Türkiye İstatistik Kurumu (TUIK) Göstergeleri. http://www.tuik.gov.tr/VeriBilgi.do?tb_id=45&ust_id=13.

Çalışır, S., M. Özcan, H. Hacıseferoğulları and M. U. Yıldız (2005). A study on some physico-chemical properties of Turkey okra (Hibiscus esculenta L.) seeds. Journal of Food Engineering 68:73-78.

AOAC (1990). Official Methods of Analysis, Association of Official Analytical Chemists. Arlington.VA, edn. 15.

Barut, E. (2000). Bursa ilinin değişik yörelerinde yetiştirilen "Gemlik" zeytin çeşidinde meyvelerin kimyasal bileşimleri üzerine bir araştırma, Türkiye 1. Zeytincilik Sempozyumu. 6-9 Haziran 2000, Bursa. p. 361-365.

Demirci, M. (2002). Beslenme, 1. Baskı, Rebel Yayıncılık, Tekirdağ, 286 p.

***, IOOC (2008). International Olive Oil Council. http://www.internationaloliveoil.org/noticias

Işgın, T. and F.L. Forster (2006). A hedonic price analysis of farmland option premiums under urban influenced. Canadian Journal of Agricultural Economics. No.54, 327-340.

Kılıçkan, A. and M. Güner (2008). Physical properties and mechanical behavior of olive fruits (Olea europaea L.) under compression loading. Journal of Food Engineering, 87(2): 222-228.

Rosen, S. (1974). Hedonic price and implication marketer:

Production differentiation in pure competition. Journal of Political Economics. 82(1):34-55.

Savaş, E. and V. Uylaşer (2007). Zeytinin besin bileşenleri ve insan sağlığı üzerine etkileri, Dünya Gıda. 8:77-82.

14. Shonkwiler, J. S. and J. E. Reynolds (1986). A note on the use of hedonic price models in the analysis of land prices at the urban fringe. Land Economics. 62(1):58-63.

Uylaşer, V. and B. Karaman (2005). Zeytin ve zeytinyağının beslenmedeki önemi. Dünya Gıda. 2:68-70.

Uylaşer, V., C. E. Tamer, B. İncedayı, H. Vural and Ö.U. Çopur (2008). The quantitative analysis of some quality criteria of Gemlik variety olives. Journal of Food, Agriculture & Environment. Vol.6 (3&4):26-30.

Vural, H. (1993). Bursa ilinde sofralık zeytin üretim ve pazarlaması. Marmarabirlik Yayınları. 3:66.