Pak. J. Agri. Sci., Vol. 60(3), 437-444;2023
ISSN (Print) 0552-9034, ISSN (Online) 2076-0906
DOI:10.21162/PAKJAS/23.83
http://www.pakjas.com.pk

Investigating the contribution of different characteristics in the olive oil prices in the Saudi market: An Hedonic price analysis

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This study was conducted with the objective to estimate the implicit values for various olive oil attributes in Riyadh, Saudi Arabia. A hedonic price model was applied to examine 558 olive oil samples taken from nine hypermarkets with different olive oil brands. The attributes under consideration include the package size, extra virgin label, level of acidity, organic certification, purity, country of origin, place of retail market, and packaging type. Results show agreement between signs and magnitudes for the implicit values for the most attributes. The significant attributes of olive oil identified in this study are package size, level of acidity, and variables describing the country of origin, place of retail market, and packaging type. The results reveal a negative relationship between (i) the price and the size of container and (ii) the price and the level of acidity for olive oil. Furthermore, olive oil products with organic and pure label have a higher price compared to those without them. The country of origin and the type of packaging may also influence the olive oil price.
Keywords: implicit value, hedonic price model, attributes, differentiation, olive oil, Saudi Arabia.

INTRODUCTION

In the last decade, the olive oil trade has expanded globally. The global export size of olive oil increased from 3,630 metric tons with the value of USD 7976.8 million in 2010 to 9,653 metric tons with a value of USD 15268.8 million in 2020 (International Trade Centre, 2022). Saudi Arabia is one of the countries that has expressed interest in olive oil production and consumption in last two decades. More particularly, Saudi's exports have increased from only 25 metric tons with USD 147,000 as value of these exports in 2000 to 99 metric tons by USD 452,000,000 dollars in 2010, whereas the export size in 2019 reached 250 metric tons by USD 1,542,000 dollars (International Trade Centre, 2022). Also, the imports of olive oil for Saudi Arabia improved in the level of volume and value in 2019 compared to 2000. The volume of imports was 7,600 metric tons and reached more than 35,6000 metric tons, and accordingly, the value of olive oil imports increased during the same period from USD 15.4 million in 2000 to USD 123.6 million in 2019 (International Trade Centre, 2022).

Despite the apparent similarity among different brands of some specific food commodities such as olive oil, they are distinguished from each other by their unique characteristics, whether they are their ingredients or their source. These commodities are valued by the costs incurred by the commodities and the consumer's ability to pay in accordance with their preferences. Therefore, the studies in the extant literature vary according to the approach for determining the effect of variables on the price of the product on two ways. The first approach represents the effect of demographic characteristics, and the second investigates the effect of the characteristics related to the product itself in its pricing process from sellers. Furthermore, the first considers the characteristics of buyers and their willingness to pay for a number of characteristics of the commodity (Roselli *et al.*, 2018; Britwum and Yiannaka, 2019; Wang *et al.*, 2019; Bimbo *et al.*, 2020; Rizzo *et al.*, 2020; Britwum *et al.*, 2021; Bryla, 2021).

A few studies have investigated the impact of characteristics of a commodity on the price and applied the hedonic price model (Rosen, 1974) to measure the effects of the attributes of food products such as breakfast cereals in the UK (Roth, 2017), apple in Indonesian and Pakistani markets (Relawati *et al.*, 2017; Khan *et al.*, 2019), fruit beverages in the US (Leschewski *et al.*, 2016), rice in the Philippines (Cuevas *et al.*, 2016), tomatoes in South Africa (Sigidi, 2017), meat in China and Pakistan (Wahl *et al.*, 2017; Rafique *et al.*, 2018), fluid milk and yogurt in Italian market (Caso *et al.*, 2020; Stiletto and Trestini, 2020), wines in the US and Russian

Alnafissa, M.A. 2023. Investigating the contribution of different characteristics in the olive oil prices in the Saudi market: An Hedonic price analysis. Pakistan Journal of Agricultural Sciences 60:437-444.
[Received 22 Jun 2023; Accepted 10 Aug 2023; Published 29 Sep 2023]

markets (Gustafson *et al.*, 2016; Waldrop and McCluskey, 2016; Galati *et al.*, 2017), and across different product types and countries (the Netherlands and Denmark) (Edenbrandt *et al.*, 2018). In the case of olive oil, a number of studies have discussed a wide range of characteristics of this product that consumers take into account while opting for products. These characteristics were considered in different studies such as natural characteristics, production/ processing conditions, size of packaging, innovative package, quality system, additional label information, product information, vertical integration marketing (supermarket, cooperative , local firm), types of retail market, and location (Karipidis *et al.*, 2005), package size, container size, cultivar composition, production method, extraction method, localization of firm, and languages of website (Carlucci *et al.*, 2014), acidity level, origin (domestic or imported), package size, packaging, brand (retailer or manufacturer); and type of retailer (hypermarket or supermarket) (Muñoz *et al.*, 2015), cold extraction, acidity, olive variety, certified quality, private label brand, brands of the main companies of the olive oil sector, size, lightweight packaging, and protective packaging (Cabrera *et al.*, 2015), the area of origin which is defined at the macro- region level, certification of origin, the kind of plant varieties, the oils made by only one cultivar, organic farming, the processing stage of production, production volumes of the producer, the bottle size, and hand picking (Cacchiarelli *et al.*, 2016), packaging size, special shape of the bottle, supplier and brand name, natural aromatic profile, texture, country-of-origin labels, geographical indications, organic certification, and cultivar selection (Gorgitano and Sodano, 2019).

Differentiation between products could obtain higher prices for producers, which the consumer's willingness to pay a premium price to meet their desires. The premium price reflects differentiation between products in terms of various characteristics appears as an indication of consumers' desire for higher quality as well as the ability of consumers to distinguish between these characteristics. Producers certainly bear additional costs in exchange for allocating products with certain characteristics (Gorgitano and Sodano, 2019).

The previous studies that used hedonic approach refer to preferences, which vary for each country, as the consumer may prefer some attributes over other attributes through the prices paid. For example, in a study conducted in Spain, the prices were higher for products whose label mentioned the level of acidity, the variety of olives, and the "high quality" of the Andalusian and manufacturer's brand name, while no association was found with quality and characteristics such as flavor and protected designations of origin varieties (Cabrera *et al.*, 2014). Karipidis *et al.* conducted a study in Greece and found that a number of factors influenced olive oil prices; on the one hand, the use of a high-quality system, organic nature, design of package, and availability of product information had a positive effect, while on the other, the type of retail supplier and size of package had a negative effect (Karipidis *et al.*, 2005). Muñoz *et al.* (2015) performed a price analysis of olive oil products in Chile and reported that prices were positively affected by foreign origin, acidity level, container material (e.g., glass and tin), and not being a private label. In Italy, Carbone *et al.* (2018) found that the price was affected by some advantages associated with the product, raw materials, and production process. In addition, the consumers gave value to both the type of product and the region of production. However, the prices were negatively affected by volume, and the effect of protected designation of origin and organic products on the value was not proven. Also, another study targeted E-commerce retail of extra virgin of olive oil in Italy (Carlucci *et al.*, 2014) and found that the products that were organic, monocultivar, de-stoned, and available in small- and medium-sized bottles had higher prices. In addition, the prices could vary with the region of production, and e-sellers charged higher prices if the websites used more than one language.

Saudi's market has markedly expanded in recent years; there exists diversity in food products, and the consumers' desires for products with specific characteristics are fulfilled. There are only a few empirical studies that have investigated implicit price of attributes for food products in developing countries that have witnessed remarkable improvements in market such as Saudi Arabia. The olive oil market in Saudi Arabia includes products with diverse attributes, and the Saudi market has witnessed massive competition between domestic and imported products. Therefore, this study was conducted with the objective to discover whether the price of olive oil in Saudi's market reflects the main product characteristics, i.e., whether each characteristic of olive oil has a significant implicit value.

MATERIALS AND METHODS

The implicit value of olive oil attributes could be determined by the hedonic pricing method. This method is predicated on the relationship between the price of product, which is olive oil in this case, and the main attributes of this product. The hedonic pricing method was first applied by Waugh (1928). Rosen (1974) affirmed that a product's price reflects its characteristics, each of which has implicit price included in the final price of the product. Furthermore, the characteristics are subjected to demand and supply by both producers' and consumers' decisions, which gives an implicit price to specific characteristics.

In this study, the hedonic pricing model was used to estimate the implicit value of several characteristics of olive oil in the main retail market in Riyadh, Saudi Arabia using ordinary least squares technique. The study data were collected using direct observations during three months (September, October, and November) in 2021 from nine of major supermarkets in Riyadh, with around 300 branches only in Riyadh, as per Google Map, and others stores around Saudi Arabia.

The total of 558 samples of olive oil were collected from the said stores. The samples included variation in terms of brands (70 different brands) , package size (250, 500, 750, 1000, 2000, and 4000 ml), extra virgin label, organic oil or certification, the level of acidity (pH = 0.3, 0.5, 0.6, 0.7, 0.75, 0.8, 1.0, 1.5, and 2), country of origin (Saudi Arabia, Syria, Spain, Greece, Turkey, Lebanon, Palestine, Tunisia, the United Arab of Emirates, Italy), and packaging type (plastic, glass, and plate). The olive oils items with added flavorings and items on promotion were excluded from the sample.

Several approaches have been used to analyze consumer preferences for product attributes through stated preference theory and revealed preference approaches. Traditional conjoint analysis and discrete choice experiments, approaches used in stated preference theory (Delgado and Guinard, 2011) and the hedonic pricing method, have been used for revealing preference (Gorgitano and Sodano, 2019).

The hedonic pricing method identifies the product characteristics using the following equation (Costanigro *et al.*, 2011):

$z_i = (z_1, ..., z_k)$, (1)

where z_i is the *i*-th product with k characteristics.

The utility function for the consumer to consume this product is given as:

$U = U(x; z_1, ..., z_k; \alpha)$, (2)

where x is a composite good, and α is the taste parameter.

The economic principle assumes that consumers maximize their utility subject to the budget constraint $y = p(x) + p(z)$, where y is an income, *p(x) is a normalize unit price of composite good*, and *p(z)* represents the joint value of different characteristics for a particular product.

The hedonic price function, which represents the value of product attributes, describes the interaction between consumers and sellers through the following function (Costanigro *et al.*, 2011):

$p(z) = p(z_1, z_2, ..., z_k)$, (3)

A number of studies have estimated the marginal implicit prices for each attribute, which reflect the consumers' willingness to pay for a specific attribute of a particular good. As stated earlier, the hedonic pricing model has been extensively used for food products. The hedonic pricing model is non-linear, and the studies have used the log-normal form to reflect the curvature of the function, which is the result of profit function of firm and utility function of consumers. In addition, the log-normal distribution is consistent with non-negativity and right-skewness of implicit price as follows (Costanigro *et al.*, 2011):

$$\ln(P_i) = \beta_0 + \sum_{k=1}^{K} \beta_k z_{ki} + \varepsilon_i \quad (4)$$

Based on equation (4), the structure model used in this study can be defined using the following equation:

$$\ln(P_i) = \beta_0 + \beta_2 Z_2 + \beta_3 Z_3 + \beta_4 Z_4 + \beta_5 Z_5 + \beta_6 Z_6 + \beta_7 Z_7 + \beta_8 Z_8 + \beta_9 Z_9 + \beta_{10} Z_{10} + \beta_{12} Z_{12} + \beta_{13} Z_{13} + \beta_{14} Z_{14} + \beta_{15} Z_{15} + \beta_{16} Z_{16} + \beta_{17} Z_{17} + \beta_{18} Z_{18} + \beta_{19} Z_{19} + \beta_{20} Z_{20} + \beta_{22} Z_{22} + \beta_{23} Z_{23} + \beta_{24} Z_{24} + \beta_{25} Z_{25} + \beta_{26} Z_{26} + \beta_{27} Z_{27} + \beta_{28} Z_{28} + \beta_{29} Z_{29} + \beta_{31} Z_{31} + \beta_{32} Z_{32} + \varepsilon_i \quad (5)$$

Where equation (5) reflects the relationship between prices of olive oil (P) and its characteristics in Saudi Arabia market. The abbreviations used in the equation are described in Table 1, in which the variables represent six differentiation clusters of olive oil, namely, package size, natural characteristics, production/processing condition, country of origin, place of retail market, and packaging type. To avoid dummy variable trap (multicollinearity), one variable for each attribute (dummy variable) was excluded: size of package Z_1 (size = 250 ml), country of origin Z_{11} (Saudi Arabia), place of retail market, Z_{21} (market#1), and packaging type Z_{30} (glass).

Table 1. The identification of model variables.

Differentiation clusters	Variable	Description
Size of package	Z_1	If the size of package 250 ml=1, otherwise=0
	Z_2	If the size of package 500 ml=1, otherwise=0
	Z_3	If the size of package 750 ml=1, otherwise=0
	Z_4	If the size of package 1000 ml=1, otherwise=0
	Z_5	If the size of package 2000 ml=1, otherwise=0
	Z_6	If the size of package 4000 ml=1, otherwise=0
Natural characteristics	Z_7	If olive oil is extra virgin = 1, otherwise = 0
	Z_8	*Level of Acidity*
Production/processing condition	Z_9	if olive oil is organic = 1, otherwise = 0
	Z_{10}	If olive oil is pure =1, otherwise =0
Country-of-origin	Z_{11}	If from Saudi Arabia = 1, otherwise = 0
	Z_{12}	If from Syria = 1, otherwise = 0
	Z_{13}	If from Spain = 1, otherwise = 0
	Z_{14}	If from Greece = 1, otherwise = 0
	Z_{15}	If from Turkey = 1, otherwise = 0
	Z_{16}	If from Lebanon = 1, otherwise = 0
	Z_{17}	If from Italy = 1, otherwise = 0
	Z_{18}	If from Tunisia = 1, otherwise = 0
	Z_{19}	If from United Arab Emirates = 1, otherwise = 0
	Z_{20}	If from Palestine = 1, otherwise = 0
Place of retail market	Z_{21}	If from market#1 = 1, otherwise = 0
	Z_{22}	If from market#2 = 1, otherwise = 0
	Z_{23}	If from market#3 = 1, otherwise = 0
	Z_{24}	If from market#4 = 1, otherwise = 0
	Z_{25}	If from market#5 = 1, otherwise = 0
	Z_{26}	If from market#6 = 1, otherwise = 0
	Z_{27}	If from market#7 = 1, otherwise = 0
	Z_{28}	If from market#8 = 1, otherwise = 0
	Z_{29}	If from market#9 = 1, otherwise = 0
Packaging type	Z_{30}	If glass = 1, otherwise = 0
	Z_{31}	If plastic = 1, otherwise = 0
	Z_{32}	If plate = 1, otherwise = 0

Table 2 shows the descriptive statistics of the study data for olive oil products collected from nine hypermarkets in Riyadh. A total of 558 olive oil samples (average from each hypermarket = 62) were obtained. The hypermarket#3 had a wide selection of olive oil products with 89 different products

Table 2. Summary Statistics of the study observations

Variables	N	%	Mean price ($ / 100 ml)	SD
Price	**558**	**100.00**	**1.23**	**0.59**
Size of package (ml)				
250	115	20.61	1.57	0.00
500	249	44.62	1.28	0.00
750	27	4.84	1.18	0.00
1000	60	10.75	1.05	0.00
2000	67	12.01	0.91	0.00
4000	39	6.99	0.85	0.00
Natural characteristics				
Extra virgin	454	81.36	1.26	1.31
Virgin	104	17.92	1.05	2.59
Level of Acidity				
< 0.8%	144	25.81	1.36	4.78
> 0.8%	155	27.78	1.01	4.78
= 0.8%	256	45.88	1.30	0.57
Country-of-origin				
Saudi Arabia	53	9.50	1.24	2.43
Spain	259	46.42	1.01	2.34
Tunisia	48	8.60	1.17	2.36
Italy	37	6.63	1.71	2.25
Syria	51	9.14	0.97	2.44
United Arab Emirates	24	4.30	0.88	2.32
Greece	17	3.05	1.70	2.27
Lebanon	23	4.12	1.16	2.33
Turkey	36	6.45	1.01	2.38
Palestine	10	1.8	1.91	2.24
Place of retail market				
Market#1	61	10.93	1.22	2.43
Market#2	56	10.04	1.05	2.45
Market#3	89	15.95	1.47	2.05
Market#4	65	11.65	1.34	2.33
Market#5	55	9.86	1.18	2.43
Market#6	67	12.01	1.18	2.47
Market#7	51	9.14	1.06	2.44
Market#8	52	9.32	1.25	2.41
Market#9	62	11.11	1.18	2.41
Packaging type				
Glass	407	72.94	1.34	1.26
Plastic	50	8.96	0.93	2.42
Plate	101	18.10	0.97	2.60
Organic				
Yes	79	14.16	1.56	2.42
No	475	85.13	1.18	2.61
Pure oil				
Yes	422	75.63	1.31	1.31
No	132	23.66	0.98	1.70

Source: Primary data collected from Riyadh markets, Saudi Arabia

of olive oil with different brands, size, country of origin, packaging type, or other natural characteristics, while the hypermarket#7 had less choices of olive oil samples compared other hypermarkets. Over 65% of the samples of olive oil were in bottles with sizes 250 and 500 ml, while the remainder were between 750 and 4000 ml. About 81% of samples of olive oil were described as extra virgin. In addition, around 46% of olive oil samples had the level of acidity equal to 0.8%, while around 26% and 28% of samples had the level of acidity less and more than 0.8%, respectively. With respect to the country of origin for samples, 46% of observations were of Spanish origin, while other olive oil

samples in these hypermarkets were from Saudi Arabia (9.5%), Syria (9.1%), Tunisia (8.6%), Italy (6.6), Turkey (6.5%), the United Arab Emirates (4.3%), Lebanon (4.1%), and Greece (3.1%). The study sample had more of glass bottles of olive oil (73%), compared to plastic (9%) and plate (18%) containers. In addition, organic olive oils represented only around 14% of the observations, whereas 75.6% of the samples were pure and others were not, which could blend with refined olive pomace oil.

Generally, the average price of the sample is $1.23 per 100 ml of olive oil (Table 2). We found a negative relationship between the volume of olive oil containers and their mean price, and the prices decreased as 1.57, 1.28, 1.18, 1.05, 0.91, and 0.85 $/100 ml with the increase in volume 250, 500, 750, 1000, 2000, and 4000 ml, respectively, regardless of other characteristics. Also, the Saudi's market matched with other countries, as affirmed in the literature, for olive oil products have higher value for product that is described as extra virgin. The mean price for 100 ml of extra virgin olive oil was found to be $0.21. The mean price of olive oil increased with the decreasing level of acidity, and the mean price for 100 ml olive oil with acidity less than 0.8% was found to be $1.36, $1.30 for acidity equal 0.8%, and $1.01 for acidity more than 0.8%. The summary statistics of the data show a difference in mean price for olive oil according to the country of origin. The mean price for 100 ml of olive oil with Saudi Arabia as the country of origin was noted to be $1.24, whereas higher prices were associated with three other countries of origin, namely, Italy ($1.7), Greece ($1.7), and Palestine ($1.9), and other countries had lower prices, namely, Spain ($1.01), Tunisia ($1.17), Syria ($0.97), the United Arab Emirates ($0.88), Lebanon ($1.16), and Turkey ($1.01). Also, differences were observed in the mean price based on the place of retail market that sold the olive oil, which ranged between $1.05–$1.47 (Table 2). With respect to the packaging type, the olive oil samples in glass container had higher mean price ($1.34/100 ml) compared to plate ($0.97) or plastic (0$.93) containers. In addition, Table 2 shows that the mean price of organic olive oil ($1.56/100 ml) is greater than the non-organic ($1.18/100 ml) by 32%. Finally, the mean price of pure olive oil ($1.31/100 ml) was greater the non-pure ($0.98/100 ml) by 34%.

RESULTS

In this study, ordinary least squares (OLS) technique was used to estimate the hedonic price function (equation 5). The estimation results are reported in Table 3. The coefficient of determination (R-square) of regression model was found to be 0.56, which implies that the characteristics of olive oil that were included in this study explain 56% from the variation of olive oil price in Saudi market. The results of regression (Table 3) reveal a significant impact of variables package size, level of acidity, country of origin, place of retail market, and packaging type on olive oil price. However, the variable extra virgin label of olive oil did not have a significant implicit value in Saudi's market, which could indicate that Saudi consumers as such do not have any preferences for olive oil with the label of extra virgin or only virgin. This regression passed the diagnostic test to be sure that the OLS technique was appropriate for our case.

Considering the attributes of olive oil with significant implicit value, the results of regression show that the implicit values for one unit of olive oil (100 ml) corresponding to the package sizes from 250 to 500, 750, 1000, 2000, or 4000 ml were found to be −0.16, −0.23, −0.15, −0.30, and −0.41, respectively, which indicates a negative relationship between the price for one unit and the package size. Even the regression results show the negative relationship between the size of 250 ml and 1000 ml, as the increase in size reduced the price by 15%, but the discount of price was not consistent with other sizes of olive oil container. In other words, the prices of one unit of olive oil were less by 16%, 23%, 15%, 30%, or 40%, if the consumers decided to buy 500, 750, 1000, 2000, or 4000 ml, respectively, instead of 250 ml of olive oil. This finding is in agreement with the previous studies.

Along with the natural characteristics of olive oil, the level of acidity for olive oil was found to have a significant impact on the price of product by 10% if the acidity changed by 1% in the same direction (increasing or decreasing) while other attributes were constant. Also, a high degree of differentiation was found for olive oil certified as organic and pure, the prices for which were more by 18% and 22%, respectively, for products with these attributes compared to those without them and with other attributes constant. The direction (positive or negative) of the effect of the variables representing natural characteristics (level of acidity) and production and processing conditions (organic and pure oil) agreed with the sign expected.

To study the impact of the countries of origin on the olive oil price, the impact of the country of origin was compared to domestic production divided into three cases (Table 3). First, the results of this study did not show any significant differences between prices of olive oil with Saudi origin and olive oils from Syria, Turkey, Lebanon, and Tunisia, the countries from the Middle East and North Africa region. Second, the olive oils from Spain, Greece, Italy, and Palestine had significant positive values (0.10, 0.19, 0.30, and 0.55, respectively), which means that the price of olive oil increased by 10%, 19%, 30%, or 55% compared to domestic production if imported from Spain, Greece, Italy, or Palestine, with other attributes kept constant. Three out of four countries with significant positive impact are European countries. Only the olive oil imported from the United Arab Emirates had a significant negative coefficient value, which means the prices of olive oils described of Emirati original are less than the same product with domestic production.

Table 3. the regression result of hedonic price function of olive oil in Saudi's market .

Differentiation cluster	Variable		Coefficient	Std. Error
	Constant		0.15***	.09
Size of package (ml)	500	Z_2	-0.16***	.03
	750	Z_3	-0.23***	.05
	1000	Z_4	-0.15***	.02
	2000	Z_5	-0.30***	.05
	4000	Z_6	-0.41***	.06
Natural characteristics	Extra virgin	Z_7	-0.02	.04
	Level of acidity	Z_8	-0.10*	.05
Production/processing Condition	Organic	Z_9	0.18***	.04
	Pure oil	Z_{10}	0.22***	.03
Country-of-origin	Syria	Z_{12}	-0.02	.08
	Spain	Z_{13}	0.10**	.04
	Greece	Z_{14}	0.19***	.07
	Turkey	Z_{15}	-0.01	.06
	Lebanon	Z_{16}	0.00	.06
	Italy	Z_{17}	0.30***	.05
	Tunisia	Z_{18}	-0.06	.05
	UAE	Z_{19}	-2.79***	.47
	Palestine	Z_{20}	0.55***	.09
Place of retail market	Market#2	Z_{22}	-0.09**	.05
	Market#3	Z_{23}	0.15***	.04
	Market#4	Z_{24}	0.04	.04
	Market#5	Z_{25}	0.03	.05
	Market#6	Z_{26}	-0.03	.04
	Market#7	Z_{27}	-0.06	.05
	Market#8	Z_{28}	0.03	.04
	Market#9	Z_{29}	0.02	.04
Packaging type	Plastic	Z_{31}	-0.15***	.04
	Plate	Z_{32}	-0.02	.05
	R Square	0.56	Std. Error of the Estimate	0.23
	F	23.67***		

***, ** and * indicate that the parameter is statistically significant at the 1%, 5% and 10% level, respectively.

Based on the place of retail market, only two sale points (hypermarkets) had a significant impact of differentiation on olive oil prices out from other eight sale points, excluding one to take it as a base for analysis, whereas one of them had more value and the other had less value compared to the market that is taken as the base for comparison. This means that the place of retail market for olive oil had little impact on its price.

Finally, only plastic container of olive oil had a significant difference in price compared to glass container, for which the prices were reduced by 15%, while the analysis (Table 3) did not show a significant difference for another packaging type such as plate container.

DISCUSSION

These study findings found out that there is significant positive relationship between value of olive oil product in Saudi's market and the some of product characteristics such as whether its organic or the product is origin from some countries -Spain, Greece, Palestine, and Italy- comparing to domestic product, which is corresponding of the result of Cabrera *et al.* (2014), Karipidis *et al.* (2005), Muñoz *et al.* (2015), and Carlucci *et al.*, (2014). In addition, this study proves that there is a premium price for a product when it is described as pure oil. Furthermore, the results of study confirm that a value of olive oil product is lower when increasing of size of packaged and using plastic packaging instead of glass packaging. Previous studies have agreement in these results specially with impact the size and material of olive oil bottle such as Gorgitano and Sodano (2019), Cacchiarelli *et al.* (2018), Delmas and Lessem (2017), Karipidis *et al.* (2005), and Cabrera *et al.* (2014), Carlucci *et al.* (2014).

Unexpectedly, the study result does not confirm the significant impact of the attribute of extra virgin in price of olive oil in Saudi's markets, even the literature by Karipidis *et al.* (2005) approve that there was increasing in prices for extra olive oil. In addition, the results of the study show that there

are only two places of hypermarket store to buy the olive oil product have significant differences from the reference market. This result could be explained by the high competition in hypermarket level.

***Conclusion*:** The differentiation of food products according to different attributes has garnered interest from producers as well as researchers, to respond to consumer desire, which global markets move from only provide the product to provide special characteristics of food products.

Overall, the results of the study show reasonable agreement of signs and magnitudes for the implicit values for the most of olive oil attributes.

Notwithstanding the new insights that this study offers, it has a few limitations. The data for this study were limited to the market price, which reflected the offer price by retail markets. The future studies could survey the consumers and analyze their willingness to pay for different attributes and compare the result with this study. Further research could analyze the implicit price of specific attributes of food products such as the organic certification or the country of origin across different food products.

Conflicts of Interest: The authors declare no conflict of interest.

***Author's contributions statement*:** The author declare that he has done all the research works.

***Acknowledgement*:** The author of this study extend his appreciation to Researchers Supporting Project number (RSPD2023R932), King Saud University, Riyadh, Saudi Arabia.

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