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CHANGES IN THE PHYTOCHEMICAL COMPONENTS IN WINE GRAPE VARIETIES DURING THE RIPENING PERIOD

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Abstract

The aim of this study was to determine phytochemical components of Tannat, Cabernet Sauvignon, Malbec, Merlot and Shiraz wine grape varieties during the ripening period. As amounts of total phenolic compounds in different parts of the grape varieties, the highest total phenolic values for berry peel were found to be 300.58 µg GAE/mg in Cabernet Sauvignon, 974.23 µg GAE/mg in Malbec for pulp, 447.01 µg GAE/mg in Merlot for seed. The total flavonoid content in peel, pulp and seeds of varieties were found to be varied between 46.95 µg QUE/mg and 148.01 µg QUE/mg. In conclusion, total bioactive compounds of the grape differed significantly based on variety and grape part. Since higher bioactive compounds were found in pulps for all grape varieties, grapes should be consumed as a whole grape. This study also showed that these grapes are a potential source of natural bioactive compounds. It can be concluded that selected grape varieties and their parts can be considered a good source of phenolic and antioxidants.

Key words: *Grape, Diyarbakir, phenolic, flavonoid, cluster, berry, seed*

INTRODUCTION

Grapes are considered as a significant source of antioxidants in fruit species in the world (Pirinccioglu et al., 2012). Due to this property, it is a kind of fruit with the importance increasing day by day (Macheix et al., 1990). Among the types of grapes, especially red grapes, grape juice and major phenolic compounds found in red wine are called as flavonoids anthocyanins and flavonols (Rice-Evans et al., 1996; Singleton 1982; Palomino et al., 2000). It is reported that (Morris and Cawthon 1982; Bravdo et al., 1985; Matthews and Anderson 1988; Iland, 1989; Nadal and Arola 1995; De La Hera Orts et al., 2005) these substances that are important in terms of human health and found in grape vary according to the varieties of the grapes (Landrault et al., 2001), climate and soil conditions of the place where it grows (Spayd et al., 2002 ; Mateus et al., 2001), the maturity levels (Cangi et al., 2011), cultural practices (Babalik et al., 2009) and post-harvest transactions (Revilla et al., 2001).

Among the climate features of the vineyard areas, the place and vector issues especially the temperature, humidity and insolation are encountered as the important factors affecting the synthesizing the of phenolic compounds and antioxidant substances and the other phytochemicals. Considering these factors having very important impact on the ripeness and all compounds of ripeness, it is seen that some studies have been carried out to identify the phytochemical features of grape varieties grown in different ecologies in our country recently. (Deryaoglu and Canbas 2003; Karadeniz et al., 2005; Aras, 2006; Orak, 2007; Kelebek, 2009; Ozden and Vardin 2009; Uluocak, 2010; Bayir, 2011; Toprak, 2011; Kaplama, 2012).

Increased competition in the wine sector has led to the increasing demand for quality wine grapes and thus the emergence of the concept of quality in the grapes for wine to the forefront. In growing quality grapes, as well as the effects of the ecological factors in growing grapes especially the climate factors, the cultural applications performed in the viticulture have very significant effects on the the phytochemicals properties. By identifying the effects of the range of cultural applications like pruning (Pehlivan and Uzun, 2015), cultivation (Babalik et al., 2009) and irrigation (Bravdo et al., 1985; Matthews and Anderson

1988; Nadal and Arola, 1995) performed to receive production with the highest efficiency and quality on the phytochemical properties such as phenolic compounds, tannin and antioxidants and performing due to the information obtained will be useful.

Except for the effects of cultural applications performed in the vineyards on the physical changes in the bunch and berry features of the grape varieties and the properties such as brix, pH and total acidity in unfermented grape-juice (Tangolar et al., 2002; 2005 and 2010), it is very important to identify its effects on the amount of phenolic substance that is one of the most important quality indicators, and phyto-chemical properties including anthocyanin and antioxidant capacities. In the literature, it is seen that the studies to identify the effects of the cultural applications such as pruning, irriga-tion and fertilization in the varieties grown in the ecological conditions of our country are not too much (Pehlivan and Uzun, 2015).

This study was conducted to determine phyto-chemical components of Tannat, Cabernet Sauvignon, Malbec, Merlot and Shiraz wine grape varieties during the ripening period in the ecological conditions of Diyarbakır/Turkey.

MATERIALS AND METHODS

The research was carried out in the Dicle University Faculty of Agriculture Department of Horticulture in 2011 and 2012 years. In the research, Cabernet Sauvignon, Merlot, Shiraz, Malbec and Tannat red wine grape varieties are used as materials.

Grape varieties are grown as grafted into 110 R rootstocks. Vines are 7 years old. Planting distances rows are 1 m and intra-row is 2.5 m. Mid wire cordon training system was applied to the vines from 60 cm height. While making yield pruning to the vines, it was loaded as 18 buds/vine stock. Vineyard area has clay loam soil type. The applications such as irrigation, fertilizers and disease and pest control are done regularly in the vineyard.

Within the scope of the research, the chemical change occurred in Total Soluble Solids (TSS), total acidity and pH values during veraison and maturity periods of grape varieties has been determined (Ozdemir et al., 2006; Tangolar et al. 2010).

Besides, in order to determine the phyto-chemical change in peel, pulp and seeds of the grape samples, total phenolic compound amount and total flavonoid amount were detected (Chandler, 1983; Slinkard et al., 1997; Baydar et al., 2007).

RESULTS AND DISCUSSIONS

As a result of the study, total soluble solids (TSS) values of grape varieties showed significant differences according to the types and years. When TSS values of the grape values during veraison period of 2011 were examined (Table 1), it was determined that the highest value was in the Merlot variety (14.00%) and the lowest value was in Malbec varieties (11.33%). The difference between TSS values of the varieties was not found to be significant in 2012. TSS values were determined between 12.00% and 13.66%. When TSS values of the maturity times of the grape variety between the years of 2011 and 2012 were examined, the highest value was determined in Merlot grape varieties (25.33%) and the lowest value was determined to be in the Malbec grape variety (20.66%) in 2011 among the varieties included in the same letter group.

In all varieties, TSS amount has rapidly increased since the period of veraison and the yields reached to the period of harvest time after 3-6 week maturation process according to the varieties. In both years, TSS amount that was low in the period of veraison was determined to reach 20-25% of values that is desired during the harvest time.

In the trial made in Adana by Tangolar et al., (2005) in the years of 2002-2003, the TSS amounts in Chardonnay, Cabernet Sauvignon, Narince and Okuzgozu were determined to be 24.1-23.2-20.7 and 19.9% respectively in the second year. The researchers reported that there may be significant changes in the rate of TSS according to the varieties and the years. Indeed, as a result of this study, while the difference between TSS values in the veraison time of the grape varieties was important in the year of 2011, it was insignificant in 2012.

Ozdemir and Tangolar (2005) examined phenological stages (EST), temperature total values and some quality features in some table

grape varieties in Diyarbakır and Adana conditions, for two years. TSS was determined to be 12.6% and 12.7% respectively for Diyarbakır and Adana provinces in 1997 and 12.5% and 12.5% in 1998.

In both provinces, it has been reported that EST values were at the level that will not create problems for viticulture, the physiological activity in the vicinity of Diyarbakır started earlier but fruit ripening occurred in Adana earlier. Cluster, berry and grape-juice characteristics vary according to the varieties but the values among the provinces are close to each other.

As a result of a study carried out in the region of Kazova during two years, it has been reported that TSS increased in Bogazkere, Cabernet Sauvignon, Chardonnay, Emir, Merlot, Narince, Okuzgozu and Riesling varieties from the period of veraison until the harvest and the varieties except for Bogazkere and Okuzgozu reached to the sufficient level according to the desired TSS criteria in the harvest period (Sen, 2008).

As a result of the study carried out by Cangi et al., (2011) on wine grape varieties grown in Kazova (Tokat) region (Gewurtztraminer, Pinot Noir, Narince and Shiraz) TSS was determined to change 20.2% (Narince) and 22.3% (Shiraz) in the harvest period.

In maturation period, the findings related to the amount of TSS indicated that the differences emerged according to the years and varieties were related to the general characteristics of climate conditions and varieties according to the years and varieties in different years. In addition, in the cultural applications such as summer pruning performed in the vineyards in that year, the varieties can be seen to have significant impacts on TSS accumulation.

Table 1. Total soluble solids (%) during the veraison at harvest stages 2011 and 2012 year for varieties evaluated

	Veraison			Harvest		
Varieties	2011	2012	Average	2011	2012	Average
CabernetSauvignon	12.33bc	12.00	12.16c	23.33a	23.33ab	23.33b
Tannat	13.00ab	12.33	12.66bc	24.00a	24.00a	24.00b
Merlot	14.00a	13.66	13.83a	25.33a	25.33a	25.33a
Malbec	11.33c	12.66	12.00c	20.66b	21.33b	21.00c
Shiraz	13.33ab	13.33	13.33ab	24.66a	23.33ab	24.00b
LSD %5	1.01	N.S.	0.7	1.98	2.09	1.26

The difference between the means with different letters in same column was significant (P<0.05)

When the values obtained as a result of total acidity analysis of grape samples received in the process of veraison and maturity process of the varieties were examined, the acidity values were determined to be from 14.58 g/l (Merlot) to 19.02 g/l (Tannat) in the veraison process in the trial years and they ranged from 5.86 g/l (Cabernet Sauvignon) to 8.25 g/l (Tannat) in the maturity process (Table 2).

Table 2.Total acidity (g/L) during the blooming at veraison stages 2011 and 2012 year for varieties evaluated

	Veraison			Harvest		
Varieties	2011	2012	Average	2011	2012	Average
CabernetSauvignon	15.83b	15.74bc	15.83b	5.86c	5.89b	5.86c
Tannat	19.02a	18.84a	19.02a	7.92a	8.25a	7.92a
Merlot	14.58c	14.57d	14.58c	6.23bc	6.37b	6.23bc
Malbec	15.41bc	14.79cd	15.41bc	6.40b	6.43b	6.40b
Shiraz	16.18b	16.28b	16.18b	6.30bc	6.28b	6.30bc
LSD %5	1.17	1.08	1.17	0.43	0.6	0.4

The difference between the means with different letters in same column was significant (P<0.05)

Looking to the acidity values in the maturity values in 2011 and 2012, it was determined to be an increase generally and the highest acidity in 2011 and 2012 was seen in Tannat grape variety (respectively 7.92 and 8.25 g/l), the lowest value was seen to be in Cabernet Sauvignon grape variety (respectively; 5.86 and 5.89 g/l). In all varieties from the period of veraison, a great amount of decrease was observed in the total acidity amount with the

maturation in all varieties and the total acidity value has varied according to the varieties and years in the period of harvest. In the research, the lowest total acidity was determined to be from 5.86 to 5.89 g/l and the highest values were determined between 7.92 and 8.25 g/l (Table 2).

They reported in their study about the development of the grapes from the veraison stage to the extreme maturity, the berry weight increased from the date of first sample taking date and the amount of TSS increased from the process of veraison and the total acidity amount increased up to the process of veraison; it started to decrease after this process and the ratio of decline decreased up to the maturity; the amount of tartaric acid has continuously decreased since the beginning of the maturity and the amount of it remained almost fixed up to the end of the maturity (Agaoglu, 2002; Sen 2008).

In a study carried out with Bogazkere, Cabernet Sauvignon, Chardonnay, Emir, Merlot, Narince and Okuzgozu, Riesling varieties in Kazova region for two years, it is reported that the total acidity decreased rapidly from the period of veraison, the highest total acidity was detected in Bogazkere and Okuzgozu varieties and the lowest one was detected in the variety of Emir in the harvest period (Sen, 2008).

When pH values of grape varieties determined during veraison and maturity periods were examined (Table 3), the highest pH values were determined in Merlot variety (respectively; 2.87 and 2.86) and the lowest values were determined in Malbec variety (respectively; 2.44 and 2.45) in veraison periods in the years of 2011 and 2012.

Table 3. pH during the blooming at veraison stages 2011 and 2012 year for varieties evaluated

	Veraison			Harvest		
Varieties	2011	2012	Average	2011	2012	Average
CabernetSauvignon	2.84a	2.84a	2.84b	3.90bc	3.91b	3.90b
Tannat	2.53b	2.51b	2.52c	3.84c	3.82c	3.83b
Merlot	2.87a	2.86a	2.86a	4.01ab	4.03a	4.02a
Malbec	2.44c	2.45c	2.45d	4.05ab	4.06a	4.05a
Shiraz	2.44c	2.46c	2.45d	4.07a	4.09a	4.08a
LSD %5	0.03	0.02	0.02	0.13	0.06	0.06

The difference between the means with different letters in same column was significant (P<0.05)

As approaching to the maturity time of the grape varieties, it was determined that pH values increased. During the maturity process, pH values among the varieties were determined to vary from 3.82 to 4.09.

As a result of being examined of pH value in the berries during the maturation process of Gewurtztraminer, Pinot Noir, Narince and Shiraz that are among the wine grape varieties grown in Kazova (Tokat) region, pH was determined to vary from 3.27 (Pinot Noir) to 4.20 (Shiraz). When the values obtained from our study are examined, the pH values among the varieties at the time of maturity are seen to vary from 3.82 to 4.09.

Winkler et al., (1974) have reported that pH significantly increased until the grapes matured; with this change in pH, the unsuitable tastes in flavor and eating quality are covered and changed. It is reported that the pH during the grape increased in parallel with the increase in TSS during maturation and used as a decisive criteria in determining optimum harvest time. As the maturity criteria of grapes especially grown in warmer areas, pH can be used as maturity criteria (Fanizza, 1982). Indeed, Amerine et al., (1972) reported the lowest acceptable acid amount must be 0.65 g/100 ml, also pH in red table wine should be lower than 3.4.

When the maturity index values of grape varieties grown in Diyarbakir province in 2011 and 2012 are analyzed (Table 4), it is seen that the highest value belongs to Merlot grape variety (40.63) and the lowest value (30.37) belongs to Tannat grape variety in 2011.

In 2012, similar to the previous year, the highest value was found to be in the Merlot grape variety (39.92) and the lowest value was in the Tannat grape variety (29.18). The maturity index values of grape varieties are determined to vary from 29.77 to 40.27 on average.

Table 4. Maturity index (Total soluble solids (TSS) / Acidity)
during the veraison at harvest stages 2011 and 2012 year for varieties evaluated

Varieties	2011	2012	Average
CabernetSauvignon	39.81a	39.60a	39.71a
Tannat	30.37b	29.18c	29.77b
Merlot	40.63a	39.92a	40.27a
Malbec	32.34b	33.23bc	32.79a
Shiraz	39.15a	37.15ab	38.15a
LSD %5	4.41	5.62	3.08

The difference between the means with different letters in same column was significant (P<0.05)

In 2007, TSS was found to be 21.7 (%) during maturation period in Shiraz grape variety grown in Kazova; Total Acidity to be (g/l) 6.45 and maturity index to be 33.64, while in 2008 TSS was found to be 22.3 (%), Total Acidity to be (g/l) 7.05 and maturity index to be 31.63 (Uluocak, 2010). In our study, the average maturity index value in Shiraz variety was found to be slightly higher amount as 38.15.

As a result of the studies performed in Kazova region, the maturity index values of Bogazkere, Cabernet Sauvignon, Chardonnay, Emir, Merlot, Narince, Okuzgozu and Riesling varieties during harvest periods vary from 18.18 (Bogazkere) to 33.90 (Emir) according to the varieties (Sen, 2008).

When the total phenolic compound amounts in pulp, peel and seeds of grape varieties grown in Diyarbakir province are examined, it has been determined that the differences among the varieties are statistically significant (Table 5).

Table 5.Total phenolic content (µg GAE/mg) in grape berry skin, flesh and seed

Varieties	Peel	Pulp	Seed	Total
CabernetSauvignon	300.58a	107.03c	68.33c	475.94
Tannat	167.06b	697.86b	445.76a	1310.68
Merlot	92.50c	657.46b	447.01a	1196.97
Malbec	108.16c	974.23a	390.23b	1472.62
Shiraz	89.05c	667.13b	411.16ab	1167.34
LSD %5	34.931	129.89	43.96	

The difference between the means with different letters in same column was significant (P<0.05)

When the amount of phenolic compounds found in many different parts of the berries of grape varieties are examined, in the highest values in the peel are found in Cabernet Sauvignon variety, in pulp in Malbec variety and in seed in Tannat variety. When the phenolic compound amounts found in the different parts of the berries of grape varieties are examined, the highest values in the peel are found in Cabernet Sauvignon variety, in the pulp, they are found to be in Malbec variety and in the seed they are found in Tannat variety. The maximum amount of phenolic compounds found in Cabernet Sauvignon variety (300.58 µg GAE/mg), and the least amount is found in the Shiraz grape variety (89.05 µg GAE/mg). Considering the amount of phenolic compounds in the pulp, being different from the peel and the seed, the highest value was found to be in the Malbec grape varieties (974.23 µg GAE/mg) and the least was found to be in the Cabernet Sauvignon variety. When the total amounts of phenolic compounds in the seed are compared, it has been determined that the highest value is found in the Merlot grape variety and the lowest value is found in Cabernet Sauvignon grape variety. The total phenolic compound identified in the peel, pulp and seeds of the varieties has been identified to vary from 475.94 to 1472.62 µg GAE/mg (Table 5).

It has been identified in different research that total phenolic amounts vary according to the variety and year and decreased during maturation period (Doshi et al., 2006; Navarro et al., 2008; Jin et al., 2009). Saidani Tounsia et al., (2009) examined the total phenolic amount in the methanol extract of three types of red grape seeds and found the equivalent of respectively 427.00 mg/100g, 218.00 mg/100g and 112.81 mg/100g of gallic acid for dry weights of Muscat, Shiraz and Carignan varieties. A similar study was carried out by Hogan et al., (2009) and it was examined the

total phenolic content of the three types of Virginia black wine grapes in various regions of northern France by made and Cabernet in Virginia black wine grapes in northern France as Cabernet Franc 1, Cabernet Franc 2 and Cabernet Franc 3 and, as a result, they were identified to be equivalent of respectively 1.82 ± 0.07mg/g, 1.47 ± 0.05, mg/g 0.63 ± 0.02 mg /g of gallic acid.

As a result of their study, Ozden and Vardin (2009) have found that the total phenolic compound concentration of some grape varieties grown in Sanliurfa conditions such as Merlot, Chardonnay, Cabernet Sauvignon and Shiraz *(V. vinifera* L.) grape varieties vary from 1805 mg/kg to 3170 mg/kg in terms of total antioxidant activity and certain phytochemical properties. While the highest concentration of phenolic compounds was being found in Chardonnay variety, the lowest concentration was found in Shiraz variety.

In their study, Gokturk Baydar et al., (2011) have identified grape seeds and peel extracts belonging to Cabernet Sauvignon, Kalecik Karasi and Narince grape varieties, antioxidant properties of wine and the content of phenolic compounds. Total phenolic content was determined to vary from 522.49 to 546.50 mg GAE g^{-1} in seed extracts and from 22.73 to 43.75 mg GAE g^{-1} in peel extracts and from 217.06 to 1336.21 mg L^{-1} in wine. The radical scavenging effects of the samples and reducing capacities have varied depending on grape varieties, the parts of the grape and wine type.

Kanner et al., (1994) analyzed total phenolic compound amounts by harvesting the grapes in optimal harvest ripeness in their study conducted with seven different table (Miabell Concord, Flame Seedless, Emperor, Thomson Seedless, Red Globe and Red Malaga) and seven different wine (Calzin Petite Shiraz, Merlot, Cabernet Sauvignon, Cabernet Franc, Sauvignon Blanc and Chardonnay) grapes. They reported that phenolic compounds in wine grapes vary from 230 to 1236 mg/l and Calzin and Petit Shiraz grape varieties have the highest phenolic content.

It has been identified in different researches that total phenolic types vary according to the year and variety and they decrease during the maturity process (Doshi et al., 2006; Navarro et al., 2008; Jin et al., 2009). Saidani Tounsia et al., (2009) examined the total phenolic amount in methanol extract of three types of red grape seeds and they found equivalent to respectively 427.00 mg/100g, 218.00 mg/100g and 112.81 mg/100g of gallic acid for Muscat, Shiraz and Carignan varieties in their dry weights. A similar study was carried out by Hogan et al., (2009) and it was examined the total phenolic content of the three types of Virginia black wine grapes in various regions of northern France by made and Cabernet in Virginia black wine grapes in northern France as Cabernet Franc 1, Cabernet Franc 2 and Cabernet Franc 3 and, as a result, they were identified to be equivalent of respectively 1.82 ± 0.07mg/g, 1.47 ± 0.05, mg/g 0.63 ± 0.02 mg /g of gallic acid. As a result of the analysis made in grape varieties examined in Diyarbakir conditions, the total amount of flavonoids in the pulp, peel and seed of the berry were found to vary greatly among varieties (Table 6).

Table 6.Total flavonoid content (µg QUE/mg) in grape berry skin, flesh and seed

Varieties	Peel	Pulp	Seed	Total
CabernetSauvignon	5.18e	60.99b	9.72ab	75.89
Tannat	13.28b	53.62c	7.61bc	74.51
Merlot	5.85d	29.46d	11.64a	46.95
Malbec	10.17c	58.37bc	7.28bc	75.82
Shiraz	19.65a	122.25a	6.11c	148.01
LSD %5	0.65	5.34	3.06	

The difference between the means with different letters in same column was significant (P<0.05)

When the total amount of flavonoid compounds is examined, the total flavonoid amount found in the peel, pulp and seed was detected to vary from 46.95 to 148.01 µg QUE/mg. It has been detected that the flavonoid content in the peel is found mostly in Shiraz grape variety (19.65 µg QUE/mg) and the lowest one is found in Cabernet Sauvignon (5.18 mg QUE/mg) grape variety. Considering the flavonoid substance content in the pulp, it has been detected that the

highest value is found again in Shiraz grape variety (122.25 µg QUE/mg) and the lowest one is found in the Merlot grape variety (29.46 µg QUE / mg).
When flavonoids substance amounts found in the seed were analyzed, the highest value was found to be in Merlot grape varieties (11.64 µg QUE / mg), and the lowest value was found to be in Shiraz grape varieties (6.11 µg QUE/mg) (Table 6).

CONCLUSIONS

In the chemical analysis performed with one-week intervals from the period of veraison to the maturity, it has been determined that while the grapes are ripening, there is an decrease in tartaric acid and an increase in TSS and pH and these parameters vary in accordance with the years and varieties.
As a result of the examination of the grape-juice features of the varieties used in the research, it has been seen that the amount of TSS rapidly increased in all varieties since the period of veraison and it reached to the harvest period of the grapes after 3 to 6-week maturation period according to the varieties. In both hears, the amount of TSS that was low in the period of veraison reached to the 20-25% of desired values during the harvest period.
When the values obtained as a result of tartaric acid analysis of the grape samples received in the periods of veraison and maturity are examined, the acidity value in the period of veraison in trial years was determined to vary from 14.58 g/l (Merlot) to 18.84 g/l (Tannat) and in the period of maturity, it was determined to vary from 5.86 g/l (Cabernet Sauvignon) to 7.92 g/l (Tannat).
When the pH values of grape varieties determined during the periods of veraison and maturity are examined; the highest pH values during veraison periods in 2011 and 2012 were determined to be in Merlot varieties (respectively; 2.87 and 2.86), the lowest values in the Malbec variety (respectively, 2.44 and 2.45). As approaching to the maturation time of the grape varieties, an increase was determined in the pH values.
According to the results of maturity index that is another feature examined in the research, in both trial years it has been determined that the highest value belongs to Merlot grapes variety while the maturity index value varied between 29.77 and 40.27 on average.
As a result of the research, the highest values in terms of the amounts of phenolic compounds in the research have been determined to be in the peel in Cabernet Sauvignon variety (300.58 µg GAE/mg), in the pulp they are found to be in Malbec variety (974.23 µg GAE/mg) and in the seed they are found in Merlot variety (447.01 µg GAE/mg). When the flavonoid amounts are compared, it has been determined that the total flavonoid amount varied from 6.95 µg QUE/mg to 148.01 µg QUE/mg. the flavonoid content found in the peel is found mostly in the Shiraz (19.65 µg QUE/mg) grape variety and the lowest value was found in Cabernet Sauvignon (5.18 µg QUE/mg) grape variety.
Considering the flavonoid substance content in the pulp, the highest value was found again in Shiraz (122.25 µg QUE/mg) grape variety like in the peel and the lowest value was found in Merlot (29.46 µg QUE/mg) grape variety. When the flavonoid amounts in the seed are compared, it has been determined that the highest value belongs to Merlot grape variety (11.64 µg QUE/mg) and the lowest value belongs to Shiraz grape variety (6.11 µg QUE/mg).
Among plant-derived foods, fruits and vegetables are natural sources that are rich in phenolic substances. Today, it is clear that the increase in escaping from the artificial substances will increase the significance of the natural phenolic substances. Besides the use opportunities in the fields of food, ladder and pharmacology, it is seen that understanding the mechanism of action of phenolic substances with significant effects on human health and it is important to investigate the paths to be able to use technologically.

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