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Araştırma Makalesi - Research Article

Sofralık ve Şaraplık-Şıralık Üzüm Çeşitlerinin Bazı Meyve Kalite Özellikleri ile Yağ Asit Kompozisyonları

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ÖZ

Bu çalışma farklı sofralık ve şaraplık-şıralık üzüm (*Vitis vinifera* L.) çeşitlerinin bazı kalite özellikleri (salkım ve tane ağırlığı, kuru madde, pH ve asitlik) ile stearic, palmitic, oleic, linoleic ve linolenic acit gibi doymuş ve doymamış yağ asit içeriklerini belirlemek amacıyla 2011 ve 2012 yıllarında gerçekleştirildi. Araştırmada 4 adet sofralık (Alphonse L., Cardinal, Atasarısı ve Italia) ve 7 adet şaraplık-şıralık (Narince, Hacıveli, Karaüzüm, Kargayüreği, Kızılüzüm, Turşuluk ve Şiredenlik) olmak üzere toplam 11 farklı üzüm çeşidi kullanıldı. Araştırma sonucunda sofralık üzümlerde ortalama salkım ağırlığı 521 g; tane ağırlığı 6.1 g; kuru madde %17.1 ve asitlik 4.95 g/l; şaraplık-şıralık çeşitlerde salkım ağırlığı 203 g, tane ağırlığı 2.5 g, kuru madde %19.1 ve asitlik 5.68 g/l olarak belirlendi. 100 g kuru çekirdek içerisinde sofralık üzümlerde 15.9 g, şaraplık üzümlerde 15.0 g toplam yağ bulunduğu tespit edildi. İki yılın ortalaması ve 11 çeşit dikkate alındığında; palmitik asit %5.9-10.1, steraik asit %1.9-5,2, oleik asit %9.5-18.2, linoleik asit %70.9-78,4 ve linolenik asit miktarının %0.3-0.8 arasında değiştiği belirlendi. Yapılan istatistiksel analizlerde tane ağırlığı ile stearik asit arasında pozitif korelasyon olduğu (0.9040); üzüm çekirdeğinde en fazla bulunan linoleik asit ile oleik asit (-0,8556) ve stearik asit (-0,4937) arasında ise negatif bir korelasyon olduğu ortaya konuldu. Bunun yanında beyaz şaraplık üzüm çeşitlerinin adaptasyon kabiliyetlerinin belirlenmesinde; çekirdekte bulunan oleik asit ve linoleik asit miktarının da önemli bir gösterge olabileceği düşünülmektedir.

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Fruit Quality Attributes and Fatty Acid Composition of Table and Wine Grape Cultivars

ABSTRACT

The present study was conducted to determine some quality attributes (cluster and berry weight, soluble solid content, pH and acidity), saturated and unsaturated fatty acid (stearic, palmitic, oleic, linoleic and linolenic acid) contents of different table and wine-stum grape (*Vitis vinifera* L.) cultivars in 2011 and 2012. In experiments, 4 table grape cultivars ('Alphonse *Lavallée'*., 'Cardinal', 'Atasarısı' and 'Italia') and 7 wine-stum grape ('Narince', 'Hacıveli', 'Karaüzüm', 'Kargayüreği', 'Kızılüzüm', 'Turşuluk' and 'Şiredenlik') cultivars were used (a total of 11 cultivars). In table grapes, average cluster weight was 521 g; berry weight was 6.1 g; soluble solid content was 17.1% and acidity was 4.95 $g \cdot L^{-1}$. In wine grape cultivars, average cluster weight was 203 g, berry weight 2.5 g, soluble solid content was 19.1% and acidity was 5.68 g L^{-1}. Total oil content in 100 g dry seeds was 15.9 g in table grapes and 15.0 g in wine-stum grapes. As the average of two years and 11 cultivars, palmitic acid contents varied between 5.9-10.1%, stearic acid contents between 1.9-5.2%, oleic acid contents between 9.5-18.2%, linoleic acid contents between 70.9-78.4% and linolenic acid contents between 0.3-0.8%. There was a positive correlation between berry weight and stearic acid (0.9040). The dominant linoleic acid of grape seeds was negatively correlated with oleic acid (-0.8556) and stearic acid (-0.4937). It was concluded that oleic and linoleic acid contents could be used as an indicator of adaptation capability of white wine grape cultivars.

***Keywords*- Grape Seed Oil, Correlation, Berry Weight, Narince, SSC.**

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I. INTRODUCTION

Grape is the most commonly produced fruit among the species in worldwide. There are more than 6000 cultivars in *Vitis vinifera* species [1]. This number is recorded over 1 200 in Turkey. Grape is consumed as fresh and dried grape, wine and grape juice as a grape must. Traditional foods are also produced from grapes in different countries. For instance, grape molasses (pekmez), churchkhela, vinegar like local food stuff are produced from grapes in Turkey [2].

The sugars, organic acids, mineral and vitamins in grape fruits play an important roles in human nutrition [3]. Grape seeds are residual materials from fruit juice and wine production, however these seeds are quite rich in phenolic compounds and they have antioxidant effects [4]. Grape seeds contain fatty acids and oils of these seeds are used in nutrition, cosmetics and pharmaceutical industry [4-5;]. (Konuk and Korel, 2015; Lachman et al., 2015).

Grape seeds primarily contain palmitic (C16:0), margaric (C17:0), stearic (C18:0), oleic (C18:1), linoleic (C18:2) and linolenic (C18:3) acids [6-7-8-9]. Of these acids, linoleic acid (C18:2) is the most significant one since it is not synthesized in human body and thus should be supplied externally [10] and it is the most abundant acid in grape seeds. Amount of fatty acids in grape seeds may vary based on species [9], cultivars [11- 6-12-13-4] and the year of growth [5].

The present literature review revealed that there were not any studies about the relationships between quality attributes and fatty acids of grapes. Therefore, the present study was conducted to determine fruit quality attributes and fatty acid composition of 4 table grape and 7 wine grape cultivars and to put forth the relationships between quality attributes and fatty acids.

II. MATERIAL AND METHODS

In present study, 4 table grape cultivars (‘Alphonse L.’, ‘Cardinal’, ‘Atasarısı’ and ‘Italia’) and 7 wine grape cultivars (‘Narince’, ‘Hacıveli’, ‘Karaüzüm’, ‘Kargayüreği’, ‘Kızılüzüm’, ‘Turşuluk’ and ‘Şiredenlik’) were used as the plant material.

Some characteristics of grape cultivars are presented in Table 1. Grapes were collected from the grapevines at Research and Implementation Center of Tokat Gaziosmanpaşa University in 2011 and 2012. Grapes grown under the same climate, soil and care conditions were harvested at their ripening periods and transported to laboratory in cold chain. Then, seeds were separated from the berries, washed through distilled water and preserved at room temperature (21-23 °C) for 15 days until the analyses.

Table 1. Some characteristics of grape cultivars in the experiment

Cultivars	Usage	Status	Berry Colors	Maturity Time	Seed Numbers Per Grape
Alphonse Lavallée	Table grape	Standard cultivar	Black-Purple	Medium	2-4
Cardinal *Flame Tokay X Ribier*	Table grape	Standard cultivar	Red-Purple	Early	2-4
Atasarisi *B. Cavus X Cardinal*	Table grape	Standard cultivar	Green-Yellow	Medium	2-3
Italia *Bicane X H Misketi*	Table grape	Standard cultivar	White-Yellow	Medium	1-2
Narince	Wine grape	Standard cultivar	Green-Yellow	Medium	2-3
Hacıveli	Wine grape	Local cultivar	Green-Yellow	Medium	2-3
Karauzum	Wine grape	Local cultivar	Blue-Black	Medium	2-3
Fenerit	Wine grape	Local cultivar	Red-Purple	Medium	2-3

Kızıluzum	Wine grape	Local l cultivar	Pink	Medium	2-3
Sıralık	Wine grape	Local cultivar	Green-Yellow	Medium	1-2
Tursuluk	Wine grape	Local cultivar	Green-Yellow	Medium	2-3

A. Yield and quality values

Grapes reaching to harvest maturity were harvested in accordance with Amerine and Cruise [15] method. Berry weight (g) was determined through weighing (PRECISA, BJ 1200C, Dietikon , Switzerland); sugar content (water soluble dry matter) was determined with a refractometer (ATAGO, Master T, Tokyo, Japan); pH was determined with a pH meter (WTW, InoLab® 7310 series, Weilheim, Germany); titratable acidity (g L^{-1}) was determined with electrometric titration (until our pH meter reads 8.2). All analyses were performed in 3 replicates.

B. Extraction method for fatty acids

About 5 g seed sample was decomposed in liquid nitrogen and extracted with hexane by using a soxhlet apparatus. Solvent was removed with a rotary evaporator and crude oil was obtained. Then, the resultant crude oil was used for fatty acid analyses. Methyl esters of fatty acids were formed by using AOAC method [16].

C. Gas chromatography procedure for fatty acids

Fatty acid analyses were performed in gas chromatography device (Perkin Elmer Clarus 500 Series GC) equipped with flame ionizing detector (FID). TR-FAME apolar capillary column (30 m x 0.25 mm and 0.25 m ID) was used and analyses were performed with 50:1 split ratio. Helium was used as the carrier gas with a flow rate of 0.5 ml/min.

Injector temperature was 250 ºC and detector temperature was 260 ºC. Column initial temperature was set as 100 ºC and temperature raised to 220 ºC with 2 ºC/min increments. Fatty acids were identified based on retention times of commercial fatty acid methyl ester mixture (FAME mix, Supelco 37 Comp.). The quantity of each component was calculated from the peak areas [17].
Statistical analyses: Microsoft Excel 2007 was used to express quality attributes and fatty acid results (X±SD); the statistical program JUMP (version 5.0.1a, Cary, USA) was used for correlation analyses.

III. RESULTS AND DISCUSSION

The results obtained from 4 table grape cultivars and 7 wine grape cultivars grown under the same soil, climate and care conditions are provided below.

A. Cluster and Berry Characteristics

Quality parameters of the cultivars for the years 2011 and 2012 are presented in Table 2. For table grapes, average cluster weight was measured as 521 g; berry weight as 6.1 g; soluble solid content as 17.1% and acidity as 4.95 g L^{-1}. For wine cultivars, average cluster weight was measured as 203 g, berry weight as 2.5 g, soluble solid content as 19.1% and acidity as 5.68 g L^{-1}. While table grapes had larger clusters and berries, wine cultivars had small clusters and berries.

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Table 2. Some quality parameters of grape cultivars between 2011 and 2012 in the experiment

Cultivar	Cluster Weight (g)			Berry Weight (g)			TSSC (°Brix)			pH			Total acid (g L^{-1})		
	2011	2012	mean ± SD	2011	2012	mean ± SD	2011	2012	mean ± SD	2011	2012	mean ± SD	2011	2012	mean ± SD
Alphonse L.	567±76	592±63	579±64	7,1±1,8	6,3±1,6	6,7±1,6	17,0±0,5	16,3±1,2	16,7±0,9	3,77±0,2	3,41±0,2	3,59±0,3	5,93±0,4	5,80±0,3	5,87±0,3
Cardinal	493±80	529±82	511±75	6,0±2,0	6,2±2,3	6,1±1,9	16,4±6,3	17,5±0,5	17,0±1,2	3,20±0,1	3,24±0,2	3,22±0,2	4,22±0,3	4,43±0,3	4,33±0,3
Atasarısı	563±57	596±44	580±49	6,5±1,0	6,4±0,9	6,4±0,8	17,6±1,5	17,0±1,0	17,3±1,2	3,42±0,2	3,55±0,3	3,49±0,3	4,30±0,2	5,03±0,6	4,67±0,5
Italia	413±81	415±40	413±58	5,7±1,5	4,2±0,4	5,0±1,5	17,3±0,8	17,4±0,4	17,3±0,5	3,41±0,2	3,67±0,2	3,54±0,2	4,47±0,3	5,35±0,2	4,91±0,5
Means	509	533	521	6,3	5,8	6,1	17,1	17,1	17,1	3,45	3,47	3,46	4,73	5,15	4,95
Narince	355±45	393±25	374±39	3,8±1	3,6±1,1	3,7±0,9	21,4±1,5	22,1±2,4	21,8±1,8	2,67±0,1	2,37±0,1	2,52±0,2	5,02±0,2	4,95±0,3	4,98±0,2
Hacıveli	163±15	187±15	175±19	2,9±0,9	2,8±0,8	2,9±0,8	19,5±1,4	20,4±1,5	20,0±1,4	2,41±1,4	2,51±0,1	2,46±0,1	5,30±0,1	5,39±0,4	5,35±0,3
Karaüzüm	183±24	188±19	185±19	2,1±0,6	2,3±0,5	2,2±0,5	19,7±1,5	20,6±1,5	20,1±1,5	2,42±0,2	2,53±0,4	2,47±0,3	5,93±0,4	5,54±0,3	5,74±0,4
Fenerit	174±26	203±26	189±28	2,0±0,5	2,0±0,2	2,0±0,3	17,5±0,5	15,2±0,6	16,4±1,4	2,40±0,1	2,17±0,2	2,28±0,2	5,35±0,2	5,58±0,3	5,46±0,2
Kızılüzüm	202±12	210±16	206±13	1,9±0,5	1,8±0,3	1,9±0,4	18,9±0,8	18,5±0,9	18,7±0,8	2,58±0,1	2,23±0,1	2,40±0,2	7,14±0,7	6,33±0,3	6,73±0,6
Siredenlik	122±8	133±11	127±10	1,9±0,6	1,7±0,4	1,8±0,5	18,0±0,4	17,6±1,1	17,8±0,8	2,42±0,1	2,01±0,1	2,21±0,2	4,50±0,2	5,24±0,1	4,87±0,4
Tursuluk	164±20	161±23	162±20	3,4±0,9	3,1±0,6	3,3±0,7	18,1±1,2	19,6±0,7	18,9±1,2	2,62±0,2	2,40±0,1	2,51±0,2	6,81±0,1	6,40±0,2	6,60±0,3
Means	195	210	203	2,6	2,5	2,5	19,0	19,1	19,1	2,50	2,32	2,41	5,72	5,63	5,68

Oil contents of grape seeds

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Seed oil contents of grape cultivars are given in Table 3, oil contents of white and colored cultivars (table grapes, wine grapes) are presented in Table 4. The average oil content for 100 g dry seed varied between 13.3 g (Turşuluk) and 17.0 g (Şiredenlik). Of these oils, 10.3-14.1% was composed of saturated and 85.7-89.4% was composed of unsaturated fatty acids (Table 3).

The quantity of oil in 100 g dry seed was identified as 15.9 g for table grapes and 15.0 g for wine grapes. Unsaturated fatty acid contents of table and wine grape cultivars were respectively measured as 87.7% and 87.8%. Of the grape cultivars of the present study, colored ones had higher oil contents as of 16.0% in table cultivars and 15.2% in wine cultivars. With regard to unsaturated fatty acids, colored table grapes had higher oil contents (88.9%).

Table 3. Oil contents, saturated, and unsaturated fatty acid ratios of seed of various grape cultivars between 2011 and 2012 in the experiment

Cultivars	Oil Contents (g 100 g^{-1})			Saturated Fatty Acid Ratio (%)			Unsaturated Fatty Acid Ratio (%)		
	2011	2012	mean ± SD	2011	2012	mean ± SD	2011	2012	mean ± SD
Alphonse L.	16,0	16,8	16,4±0,6	15,8	12,3	14,1±2,5	83,9	87,4	85,7±2,5
Cardinal	16,0	14,0	15,0±1,4	13,3	11,5	12,4±1,3	86,2	88,2	87,2±1,4
Atasarısı	16,9	15,6	16,3±0,9	12,5	9,6	11,1±2,1	86,9	90,0	88,5±2,2
Italia	15,0	16,5	15,8±1,1	10,8	9,7	10,3±0,8	88,9	89,9	89,4±0,7
Narince	13,5	15,8	14,7±1,6	12,3	11,9	12,1±0,3	87,6	87,9	87,8±0,2
Hacıveli	12,6	16,3	14,5±2,6	11,2	10,7	11,0±0,4	87,9	88,9	88,4±0,7
Karaüzüm	15,6	13,8	14,7±1,3	12,2	11,1	11,7±0,8	87,7	88,7	88,2±0,7
Fenerit	12,5	15,6	14,1±2,2	11,5	11,3	11,4±0,1	87,3	88,4	87,9±0,8
Kızılüzüm	17,4	16,0	16,7±1,0	12,5	11,4	12,0±0,8	86,5	88,2	87,4±1,2
Şiredenlik	16,7	17,2	17,0±0,4	11,8	11,4	11,6±0,3	87,9	88,3	88,1±0,3
Turşuluk	14,6	12,0	13,3±1,8	11,9	12,1	12,0±0,1	86,7	86,9	86,8±0,1
Means	15,2	15,4	15,3±1,6	12,3	11,2	11,8±1,3	87,0	88,4	87,7±1,3

Table 4. Oil contents, saturated, and unsaturated fatty acid ratios of seed of various grape cultivar according to usage and colors

Usage	Colors	Oil contents (g 100 g^{-1})			Saturated fatty acid ratio (%)			Unsaturated fatty acid ratio (%)		
		2011	2012	Means± SD	2011	2012	Means± SD	2011	2012	Means± SD
Table grape	White	16,0	15,4	15,7±1,2	14,6	11,9	13,2±1,9	85,1	87,8	86,4±1,9
	Colored	16,0	16,1	16,0±0,9	11,7	9,7	10,7±1,3	87,9	90,0	88,9±1,4
	Mean.	16,0	15,7	15,9±0,3	13,1	10,8	12,0 ±2,0	86,5	88,9	87,7±2,0
Wine grape	White	14,4	15,3	14,8±2,0	11,8	11,5	11,7±0,5	87,5	88,0	87,8±0,7
	Colored	15,2	15,1	15,2±1,7	12,1	11,3	11,7±0,6	87,2	88,4	87,8±0,8
	Means	14,8	15,2	15,0 ±0,4	11,9	11,4	11,7±0,4	87,3	88,2	87,8±0,5

Fatty acid composition of grape seeds

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Of saturated fatty acids, palmitic and stearic acid were encountered in grape seed samples and of unsaturated fatty acids, oleic, linoleic and linolenic acids were encountered (Table 5). With regard to fatty acid composition of the samples, samples had linoleic acid the most and it was followed by oleic, palmitic, stearic and linolenic acids. In all samples, palmitic acid (saturated fatty acid) (8.9%) and linoleic acid (unsaturated fatty acid) (74.1%) were the most abundant fatty acids. Considering the average of two years and 11 cultivars, it was observed that palmitic acid content varied between 5.9% (Atasarısı) and 10.1% (Narince); stearic acid between 1.9% (Hacıveli and Fenerit) and 5.2% (Atasarısı); oleic acid between 9.5% (Hacıveli) and 18.2% (Italia); linoleic acid between 70.9% (Alphonse L. and Italia) and 78.4% (Hacıveli); linolenic acid between 0.3% and 0.8%.

Fatty acid compositions of table and wine grapes based on their colors are presented in Table 6. Table grapes had higher stearic (4.5%) and oleic (15.1%) acid contents; wine grapes had higher palmitic (9.7%), linoleic (75.3%) and linolenic (0.8%) acid contents. While white-colored table grapes had high stearic (4.7%), oleic (15.4%) and linoleic (73.2%) acid contents, colored ones had higher palmitic (8.9%) acid content. In wine grapes, fatty acid composition did not significantly vary based on color. There were significant differences in fatty acid composition of both table and wine grapes in different years.

Table 5. Saturated fatty and unsaturated acid profiles of seed of various grape cultivars between 2011 and 2012 in the Experiment

Usage	Colors	Saturated fatty acid (%)						Unsaturated fatty acid (%)								
		Palmitic (C16: 0)			Stearic (C18: 0)			Oleic (C18:1)			Linoleic (C18:2)			Linolenic (C18:3)		
		2011	2012	Means± SD	2011	2012	Means± SD	2011	2012	Means± SD	2011	2012	Means± SD	2011	2012	Means± SD
Table grape	Alphons	10,	8,5	9,5±1,4	5,3	3,8	4,6±1,1	15,	13,	14,4±1,3	68,	73,	70,9±3,7	0,4	0,5	0,5±0,1
	Cardinal	8,7	7,8	8,3±0,6	4,6	3,7	4,2±0,6	16,	13,	15,1±2,0	69,	74,	71,7±3,3	0,3	0,5	0,4±0,1
	Atasarısı	6,4	5,3	5,9±0,8	6,1	4,3	5,2±1,3	13,	12,	12,7±0,6	73,	77,	75,4±2,8	0,4	0,4	0,4±0,0
	Italia	6,3	5,8	6,1±0,4	4,5	3,9	4,2±0,4	19,	16,	18,2±1,8	69,	72,	70,9±2,5	0,3	0,3	0,3±0,0
Wine grape	Narince	10,	9,9	10,1±0,3	2,0	2,0	2,0±0,0	13,	12,	12,8±1,0	73,	75,	74,7±1,3	0,3	0,2	0,3±0,1
	Hacıveli	9,3	8,8	9,1±0,4	1,9	1,9	1,9±0,0	10,	8,6	9,5±1,3	76,	80,	78,4±2,5	0,9	0,2	0,6±0,5
	Karaüzü	10,	9,2	9,7±0,7	2,0	1,9	2,0±0,1	13,	9,9	11,6±2,4	74,	78,	76,3±3,0	0,2	0,4	0,3±0,1
	Fenerit	9,6	9,4	9,5±0,1	1,9	1,9	1,9±0,0	11,	10,	11,0±0,7	75,	77,	76,4±1,8	0,7	0,3	0,5±0,3
	Kızılüzü	10,	9,5	10,0±0,7	2,0	1,9	2,0±0,1	14,	10,	12,6±2,6	71,	76,	74,2±3,8	0,6	0,6	0,6±0,0
	Şiredenli	9,8	9,5	9,7±0,2	2,0	1,9	2,0±0,1	12,	10,	11,5±0,9	74,	76,	75,9±1,3	0,9	0,7	0,8±0,1
	Turşuluk	10,	10,	10,0±0,1	2,0	1,9	2,0±0,1	13,	12,	13,3±0,5	72,	73,	72,9±2,3	0,8	0,7	0,8±0,1
Means		9,2	8,5	8,9±1,6	3,1	2,7	2,9±1,4	13,	12,	13,0±2,5	72,	76,	74,1±3,3	0,6	0,4	0,5±0,1

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Table 6. Satured and Unsatured fatty acid profiles of seed of various grape cultivars according to usage and colors (%)

Usage	Colors	Saturated fatty acid (%)						Unsaturated fatty acids (%)							
		Palmitic (C16: 0)			Stearic (C18: 0)			Oleic (C18:1)			Linoleic (C18:2)			Linolenic (C1	
		2011	2012	Means± SD	2011	2012	Means± SD	2011	2012	Means± SD	2011	2012	Means± SD	2011	2012 Mea
Table grape	White	6,4	5,6	6,0±0,5	5,3	4,1	4,7±1,0	16,3	14,6	15,4±3,4	71,3	75,1	73,2±3,4	0,4	0 0
	Colored	9,6	8,2	8,9±1,2	5,0	3,8	4,4±0,8	15,9	13,6	14,7±1,4	68,8	73,8	71,3±2,9	0,4	0 0
	Means	8,0	6,9	7,4±1,8	5,1	3,9	4,5±0,8	16,1	14,1	15,1±2,4	70,0	74,4	72,2±3,1	0,4	0 0
Wine grape	White	9,9	9,6	9,7±0,5	2,0	2,0	2,0±0,1	12,4	11,1	11,8±1,7	73,5	76,5	75,0±3,3	1,6	0 1
	Colored	10,1	9,4	9,7±0,5	2,0	1,9	1,9±0,1	13,1	10,4	11,7±1,8	73,6	77,6	75,6±2,6	0,5	0 0
	Means	10,0	9,5	9,7±0,5	2,0	1,9	1,9±0,1	12,7	10,8	11,7±1,7	73,5	77,0	75,3±2,9	1,1	0 0,4 0,8

Correlations between berry quality attributes and fatty acid composition

The correlations between some quality attributes and fatty acid compositions of grape cultivars are given in Table 7. Berry weight significantly influenced fatty acid composition of all cultivars. While such an effect was negative for palmitic and linoleic acid, it was positive for the other fatty acids. The berry weight had the greatest influence on stearic acid (0.9040). There were not any literature to compare the present results with earlier ones.

Table 7. Correlations between fatty acid and quality parameters

	Fatty acid				Quality parameters		
	Palmitic	Stearic	Oleic	Linoleic	Berry weight	TSSC	TA
Unsaturated fatty acid	-0,5811*	-0,2143	-0,2061	0,6151*	-0,2162	0,0844	-0,2711
Palmitic		-0,6425*	-0,3429	-0,0242	-0,5574*	0,3878	0,5157*
Stearic			0,6033*	-0,4937**	0,9040*	-0,5071**	-0,4588**
Oleic				-0,8556*	0,5599*	-0,3233	-0,1741
Linoleic					-0,4873**	0,3001	-0,0837
Berry weight						-0,3746	-0,423**
TSSC							0,1329

*: p<0,01 **: p<0,05

It is expected that wine grapes cultivars should have thin skin, abundant juice, soluble solid content between 18.0-22.0% and acidity of between 5.0-8.0% [18;3;19]. Cluster weight increased and berry weights decreased in years in all cultivars. Increase or decreases in dry matter and acidity values varied based on the cultivars. In viticulture, the quantity and quality of the cultivars are likely to vary in years. Such variations may result from the age of the grapevine, climate factors of that year, differences in technical and cultural practices, some pests and diseases [20- 21-22-23- 24-25].

Previous researchers reported various oil contents for grape seeds. Yoo [26] reported fatty acid contents of grape seeds as between 11.3-16.9%, Göktürk Baydar and Akkurt [11] as between 11.6-19.6%, Akın and Altındişli [14] as between 11.9-14.3%, Ahmadi and Siahsar [27] as between 14.7-16.0%,Özcan et al. [28] as

between 5.4-10.8%; Demirtaş et al. [29] as between 15.3-20.7%, Fernandes et al. [30] as between 3.9-12.4% and Shiozaki and Murakami [9] as between 10.9-11.5%. Current findings comply with those earlier findings, however, the total oil content of Şiredenlik grape cultivar in 2012 (17.2%) was over the previous upper limits.

Fatty acid composition values comply with the findings of various earlier researchers [26-11-12-6-14-8-5]. In all cultivars, palmitic, stearic and oleic acid contents decreased in the second year as compared to the first year; linoleic acid content on the other hand increased in the second year. For instance, while palmitic, stearic, oleic and linoleic acid content of Cardinal cultivar was respectively measured as 8.7%, 4.6%, 16.5% and 69.4% in 2011, the values were respectively observed as 7.8%, 3.7%, 13.7% and 74.0% in 2012 (Table 5). Göktürk Baydar and Akkurt [11] reported fatty acid compositions of table and wine grapes respectively as palmitic acid (8.3-8.2%), stearic acid (5.1-8.6%), oleic acid (21.5-20.8%), linoleic acid (64.2-65.6%) and linolenic acid (0.4-0.4%). Palmitic and oleic acid contents were higher in table grapes and oleic and linoleic acid contents were higher in wine grapes of that study. Current findings comply with the results of Göktürk Baydar ve Akkurt [11] with regard to oleic and linoleic acid, however the results on stearic and palmitic acid were different.

Narince grape cultivar is the common cultivar in Tangolar et al. [12], Göktürk Baydar and Akkurt [11] and the present study. Oleic and linoleic acid content of the cultivar was reported as 20.5% and 66.1%, respectively in Tangolar et al. [12], as 18.7% and 68.4% in Göktürk Baydar and Akkurt [11] and as 12.8% and 74.7% in present study. Considering three different locations (Adana, Ankara and Tokat) for this cultivar, remarkable results were observed with regard to oleic and linoleic acid contents. The grapes used by Tangolar et al. [12] were sampled from Adana province (altitude: 195 m, annual average temperature: 17.5 °C, effective heat summations: 2898 degree days); the grapes used by Göktürk Baydar and Akkurt [11] were collected from Ankara province (altitude: 899 m, annual average temperature: 10.9 °C, effective heat summations: 1450 degree days); the grapes used in present study were sampled from Tokat province (altitude: 632 m, annual average temperature: 11.8 °C, effective heat summations: 1599 degree days) [3]. Narince grape cultivar is cultivated the most in Tokat province of Turkey [31] and the cultivation of this cultivar has centuries-old history. Considering these three data, it was concluded that "low oleic acid and high linoleic acid content could be used as an indicator to determine adaptation capability of white wine grapes".

The dominant linoleic acid in grape seeds was negatively correlated with oleic acid (-0,8556) and stearic acid (-0,4937). These findings comply with the results of Göktürk Baydar and Akkurt [11] and Sabır et al. [8] .

There are several grape cultivars worldwide that can be considered as heritage of humanity. They are consumed in different ways in places where they grow. Regardless of the way of consumption, grape is a significant nutrient for humans. Present findings revealed that linoleic acid, oleic acid, palmitic acid and stearic acid were the dominant fatty acids in grape seeds. Table grape cultivars were richer in stearic and oleic acid and wine cultivars were richer in palmitic and linolenic acid. Fatty acid contents of grape seeds may vary in years. As it was in Narince grape cultivar, oleic acid and linoleic acid contents may indicate the places where a quality product of a cultivar can be achieved. There are significant relationships between quality attributes of a grape berry and fatty acid composition.

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