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Fatty Acid Composıtıons of Seeds of Some Grape Cultıvar (*Vitis vinifera* L.) Grown in Turkey

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Abstract

In this study, fatty acid compositions of seeds of Horoz Karası, Büzgülü, Kara Dimrit and Göküzüm grape varieties (*Vitis Vinifera* L.) grown in Konya Province in Turkey were determined by gas chromatography method. It was identified 18 different fatty acids in seeds of the cultivars. The polyunsaturated fatty acid (PUFA) content was found to be more than the monounsaturated fatty acid (MUFA) and saturated fatty acid (SFA) content in the cultivars. Unsaturated fatty acids are the most. Linoleic acid (C18:2) was determined the most dominant fatty acid, 64.79% in Horoz Karası, 61.51% in Büzgülü, 59.33% in Kara Dimrit and 58.29% in Gök üzüm grape varieties.

Key Words: *Vitis vinifera* L., grape seed, fatty acid composition

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Introduction

Viticulture is a very important branch of agriculture in Turkey. The grape production of Turkey is 4.255.000 tons on 477.786 hectares of viticulture area (FAO, 2012). Approximately 71% of world grape production is used for wine, 27% as fresh fruit, and 2% as dried fruit (Anonymous, 2008). Grape seeds, a by-product of the winemaking industry or juice (Schieber et al. 2002). For the production of grape seed oil, only the seeds are in use, which consist to about 7–20% of oil (Matthaus, 2008). It could be thought that the production capacity of grape seeds annually is approximately 30,000 tons in Turkey (Gok Tangolar et al. 2009).

Grape seed is a well known oil seed crop containing typically 8–20% (w/w) of oil (Passos et al. 2009). The main concern in grape seed oil is the high content of the unsaturated fatty acids such as linoleic acid (72-76%, w/w), which is higher than those in safflower oil (70-72%), sunflower oil (60-62%) and corn oil (52%) (Ghisalberti, 2001). Grape seeds also contain protein, carbohydrates, polyphenols, crude fibre, ash and other inorganic materials (Agaoglu, 1999; Fine, 2000). The oil is used chiefly for edible purposes after refining.

Grape seed oil is reputed to contain plentiful antioxidants, as well as to lower cholesterol levels, vitamins (β-carotene, vitamin E and C), and phenolic compounds (Baydar et al. 2006). 60-70% of the Polyphenols, which can be extracted from grape textures, is in the seed, 28-35% is in the fruit skin and 10% is in the fruit flesh (Shi et al. 2003). Grape seed extract contains proanthocyanidins, a class of flavanols (Fine, 2000). Recent studies have shown that procyanidins in grape seeds possess antioxidative, anti-inflammatory, antiarthritic, and antitumor promoting activities (Zhao et al. 1999) and prevent heart disease and skin aging (Maffei et al. 1996).

Many species of *Vitis* were studied for especially volatile constituents. Some papers have been referred to volatile compounds in endemic grape samples (Pardo et al. 2009; Baydar et al. 2004). However, a comparative study on fatty acid profile popular grape seed samples in Turkey has not been reported up to now, according to our knowledge. Determining the fatty acid profile of them will improve the nutritional information available to consumer. Thus, the present study was carried out to determine and compare the fatty acid profile of them.

Materials and Methods

Collection of Material

The ripened grape samples were collected from four different Turkish vineyard producers, Horoz karası (Ermenek) (black color table and wine grape), Büzgülü (red color table grape), Kara dimrit (black color wine and dried grape) and Gök üzüm (white color table and dried grape) in 2010. The

seeds were excised from berries and air-dried at the room temperature under shade conditions. They were stored at room temperature until their analysis.

Fatty Acid Analysis

Ten-gramme samples of grape seed were homogenised with 80 ml of a 2:1 (v/v) mixture of chloroform-methanol, after which 4 ml 0.88% NaCl was added; the liquid was mixed and left to stand for 2 hours to allow phase separation (Folch et al. 1957). The chloroform-methanol extract was evaporated to dryness in a water bath at 50 °C under N2 flow. The lipid extracts were then converted to fatty acid methyl esters by using boron-trifluoride-methylation solution (catalogue no. 3-3021). The Fatty acid methyl esters (FAMEs) were separated and analyzed by Shimadzu 15-A gas chromatograph (GC), equipped with dual flame ionisation detector and a 1.8 m × 3 mm internal diameter packed glass column containing 100/120 Chromosorb WAW coated with 10% SP 2330. The injector and detector temperatures were 225 and 245°C, respectively. Column temperature program was 190 ^{o}C for 35 min then increasing at 30 ^{o}C/min up to 220 ^{o}C where it was maintained for 5 min. Nitrogen at a flow rate of 20 ml/min was used as the carrier gas. Conditions were chosen to separate fatty acids of carbon chain length 12 to 24. The fatty acids were identified by comparison of retention times with known external standard mixtures, quantified by a Shimadzu Class-VP software and the results expressed as percentage distribution of fatty acid methyl esters. All the chemicals used for the gas chromatography analysis procedure were obtained from Supelco Inc. (Bellefonte, PA, U.S.A.). In fatty acid analysis, five data (n = 5) were obtained for each variety. Each of the experiments was repeated three times.

Results and Discussion

The fatty acid profiles are presented in Table 1. Eighteen fatty acids were detected four grape cultivars. The fatty acid profiles of grape seeds were dominant by PUFAs, which comprised about the better part (58.43 – 65.02%) of the total fatty acids. The major fatty acid was found to be linoleic acid (18:2, ω6) for all samples. The high levels of linoleic acid (58.29 – 64.79%) are included in the fatty acid distribution, while there was a relatively low level of linolenic acid (C18:3, 0.11 - 0.22%). An inverse correlation exists between C18:2 and C18:3 in grape seeds. The presence of linoleic acid, one of essential fatty acids, is very important factor for nutritional quality of oils. The higher linoleic acid content makes grape seed oil nutritionally more valuable. The results of the present study are agreement with those of Demir & Namli (2006) and Pardo et al., (2009). The fatty acid profile of some grape seeds grown in Turkey has been investigated and their linoleic acid contents were found to be between 57.13 and 59.07% (Cibik et al. 2009). It was reported that some extracts from Syrah and Tintorera contained 64.5 and 61.4% of linoleic acid as major fatty acid, respectively (Navas, 2009).

Tablo 1. Fatty acid composition of seeds of some grape variety grown in Konya

Fatty acids	Horoz karası	Gök üzüm	Kara dimrit	Büzgülü
C 12:0	0,01	-	0,00	0,00
C 14:0	0,30	0,12	0,25	0,24
C 14:1	0,01	0,00	0,00	0,00
C 15:0	0,01	-	0,00	0,00
C 16:0	9,81	6,99	11,38	9,31
C 16:1	1,00	0,94	0,80	0,86
C 17:0	0,00	0,03	0,01	0,01
C 18:0	3,42	6,31	3,21	4,59
C 18:1	20,35	26,99	24,44	22,96
C 18:2	64,79	58,29	59,33	61,51
C 20:0	0,00	0,03	0,07	0,05
C 18:3	0,22	0,11	0,22	0,21
C 20:1	0,01	0,01	0,06	0,04
C 21:0	0,02	0,04	0,11	0,07
C 20:3	0,01	0,01	0,03	0,04
C 22:0	0,03	0,01	0,02	0,02
C 22:1	0,00	0,10	0,03	0,04
C 20:5	0,00	0,02	0,02	0,02
C 22:3	0,00	0,00	0,00	0,00
C 22:4	0,00	-	0,01	0,00
∑ Saturated	13,61	13,53	15,05	14,3
∑ Unsaturated	86,40	86,47	84,95	85,70
∑ PUFA	65,02	58,43	59,61	61,79
∑ MUFA	21,38	28,04	25,34	23,91
∑PUFA/MUFA	3,04	2,08	2,35	2,58
∑ Omega 3	0,23	0,14	0,27	0,27
∑ Omega 6	64,79	58,29	59,34	61,52
∑ Omega 3/6	0,00	0,00	0,00	0,00
∑ Omega 6/3	279,27	413,40	219,52	229,75
∑ SFA/Pufa	0,21	0,23	0,25	0,23
∑PUFA/SFA	4,76	4,35	4,00	4,35

Among MUFAs, oleic acid ranging from 20.35% to 26.99% was the dominant fatty acid. Demir & Namli (2006) have reported that oleic acid levels were between 22% and 34% for diverse origins of *Vitis*. Demir & Otludil (1997) have reported that the main MUFA in seed of three grape cultivars was oleic acid. The results clearly indicated that PUFA contents (58.43 – 65.02%) were higher than those of MUFA (21.38 – 28.04%) and SFA (13.53 – 15.05%) for all cultivars. These findings are consistent with reports of Gok Tangolar et

al., (2009) for some grape genotypes. They reported that PUFA, MUFA and SFA contents of grapes oils were 58.43 – 65.02%, 21.38 – 28.04%, and 13.53 – 15.05, respectively. The ω-6/ω-3 ratio is a good index for comparing relative nutritional value of seed oils of grape cultivars. Nutrition societies recommend a balanced ratio of these two types of fatty acids may be necessary for optimal health, normal development and prevention of chronic disease (Simopoulos, 2002). Due to dietetic habits, increased consumption of ω-3 has been proposed in the North American diet (Gebauer et al. 2005).

The ω-6 and ω-3 PUFAs of the grape cultivars accounted for 58.29 – 64.79% and 0.11 – 0.22% of the total fatty acids, respectively and the ratio of ω-6/ω-3 was between 219.52 and 413.40. The ratio of ω-6/ω-3 PUFAs found in this study was higher than the value (4.0 at maximum) recommended by the UK Department of Health (HMSO, 1994). However, values higher than the maximum may be evaluated only one factor on cardiovascular diseases while the presence of antioxidants and MUFA plays an important role as well (Moreira et al. 2001).

Conclusions

The fatty acid compositions of four grape cultivars were determined and compared. The results clearly indicate that there are differences in fatty acid compositions between cultivars. These differences vary according to cultivars, season and ecological conditions.

Grape seeds are beneficial for human health. Oil of this grape seeds can be used as a food source in human nutrition.

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