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Research Article

Fatty acid profile and related properties of some olive oil samples from local market place of Kahramanmaraş, Türkiye

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Abstract

Fatty acids are the largest component group of olive oils. Fatty acid composition is one of the most frequently used criteria in the characterization of olive oils. Therefore, in this research, the fatty acid composition of 6 olive oil samples taken from local markets in Kahramanmaraş city (Türkiye) was analyzed. Using the fatty acid composition, unsaturated fatty acids, monounsaturated fatty acids, polyunsaturated fatty acids, saturated fatty acids, iodine value and quality index were calculated. It was determined that the oleic acid and linoleic acid contents of the samples (in fatty acids) were between 71.40-73.08 and 6.96-9.16 % in fatty acids. With future studies, more detailed and comprehensive information can be obtained about the olive oils offered for sale in local markets. In this way, it is thought that useful information can be provided to consumers and manufacturers who want to produce quality products.

Keywords: Oleic Acid, MUFA, PUFA, Quality Index

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INTRODUCTION

Fatty acid composition is an original data that can be used to determine the origin of olive oils. Olive oils can be characterized regionally by creating data banks with a large number of oil composition analyses [10]. 98-99% of olive oil consists of free fatty acids and triacylglycerols, defined as the saponifiable fraction. Triacylglycerols consist of three fatty acids and one glycerol [7]. Oleic acid is the highest fatty acid in olive oil, followed by palmitic acid and linoleic acid. Fatty acid compositions vary according to region and varieties [9]. Olive oil authentication and characterization have great importance not only to consumers but also to suppliers, producers, retailers, traders and legal regulators [3, 10]. Olive oils sold in national market chains, like other products, are subjected to many control and analyzes are routinely carried out by both the state and market representatives [3]. However, olive oils sold in local markets may sometimes be subject to less control. Therefore, in this research, olive oils purchased from local markets were analyzed. Fatty acids constitute the largest composition of olive oils. They are also used for the characterization and legal control of olive oils. The aim of the research was to determine the fatty acid composition of olive oils, both their compliance with legal limits and the similarities with the characteristics of the region.

MATERIAL AND METHOD

Two bottles each of six different olive oil samples were purchased from local markets in Kahramanmaraş city center (Türkiye). The labels of the samples were checked and it was seen that all of them had production permission from the Ministry of Agriculture and Forestry and their shelf life had not expired. The samples were analyzed without waiting. The standard method was used to determine the fatty acid composition of the samples [6]. According to the method, fatty acids are first subjected to methylation to obtain fatty acid methyl esters. It was then analyzed using a gas chromatography device (Perkin Elmer - Clarus 580, USA).

Saturated fatty acids (SFA) were calculated by adding myristic acid (C14:0), palmitic acid (C16:0), heptadecanoic acid (C17:0), stearic acid (C18:0), arachidic acid (C20:0) and behenic acid (C22:0). Monounsaturated fatty acids (MUFA); calculated by adding palmitoleic acid (C16:1), heptodecanoic acid (C17:1), oleic acid (C18:1) and eicosenic acid (C20:1). Polysaturated fatty acids (PUFA); calculated by linoleic acid (C18:2) and linolenic acid (C18:3). Iodine value (IV) was calculated as following formula IV = (0.93*MUFA) + (1.35* linoleic acid) + (2.62*linolenic acid) [8]. Quality index (Iq) was calculated as follows; oleic acid / (palmitic acid + linoleic acid) [4]. Statistical analyzes was done JMP computer program.

RESULTS AND DISCUSSION

In this study major fatty acids palmitic acid, palmitoleic acid, stearic acid, oleic acid and linoleic acid were determined between 12.80-14.44, 0.80-1.06, 3.30-3.79, 71.40-73.08 and 6.96-9.16. Major fatty acids of olive oil samples were given in Table 1. [9]. reported the palmitic acid, palmitoleic acid, stearic acid, oleic acid and linoleic acid of olive oils of five olive variety (‘Nizip yaglık’, ‘Ayvalık’, ‘Kilis yağlık’, ‘Halhalı’ and ‘Karamani’) from Southeastern Anatolia between13.60-16.31, 1.06-1.57, 1.55-3.82, 60.83-71.44 and 7,90-13.37 % in fatty acids. [2]. reported palmitic acid, palmitoleic acid, stearic acid, oleic acid and linoleic acid of eleven olive oil sample from Southeastern Anatolia between 9.05-16.40, 0.8-2.2, 1.3-4.2, 63.4-75.4 and 5.6-15.3 % in fatty acids. Similar results were determined for palmitic acid with thats reported by [9] and [2]. While oleic acid was within the values determined by [2], it was determined to be higher than the values specified by [9]. All major fatty acid were determined between the limits of Turkish Food Codex for extra virgin olive oil [13].

Minor fatty acids of olive oil samples were given in Table 2. Myristic acid content was determined as 0.01 for five of six samples. Heptadecanoic acid, cis 10 heptodecanoic acid, linolenic acid, arachidic acid, eicosenic acid and behenic acid of samples were determined between 0.14-0.17, 0.21-0.30, 0.18-0.26, 0.42-.050, 0.12-0.56 and 0.08-0.14 % in fatty acids. Heptadecanoic acid, Cis 10 Heptodecanoic acid, linolenic acid and arachidic acid of oils of olive cultivar from Southeastern Anatolia were reported between 0.00-0.23, 0.22-0.38, 0.77-0.88 and 0.13-0.27 in fatty acids [9]. Palmitic acid, stearic acid, oleic acid, linoleic acid and linolenic acid of oils of 34 olive genotypes from Şırnak city (southeastern anatolia region) were reported between 10.34-20.92, 2.25-3.91, 49.33-67.96, 7.52-31.51 and 0.63-2.72 % in fatty acids [12].

[2], reported the heptadecanoic acid, heptodesenoic acid, arachidic acid, eicosenic acid and behenic acid of olive oils from Southeastern Anatolia between 0.06-0.15, 0.05-0.23, 0.17-0.69, 0.20-0.26 and 0.05-0.50 % in fatty acids. In a study conducted on different olive varieties in the Southeastern Anatolia region, a decrease in palmitic, stearic and oleic acid levels and an increase in linoleic acid were reported in the oils of late harvested olives [1]. Eicosenic acid content of one sample was slightly higher than permitted limit of Turkish Food Codex for extra virgin olive oil. All of the other minor fatty acids were detected between legal limits of extra virgin olive oil [13]. MUFA, PUFA, SFA, MUFA/SFA, IV and Iq of olive oil samples were given in Table 3. These values were calculated from analysis results fatty acids. MUFA, PUFA, SFA, MUFA/SFA, IV and Iq 77.41-78.25, 7.22-9.34, 17.00-18.46, 8.28-10.76, 81.33-84.78 and 3.07-3.59 % in fatty acids respectively. MUFA, PUFA and SFA, content oils of seven olive varieties from Turkey were reported between 53.88-67.04, 8.84-23.61 and 12.48-18.94 % in fatty acids [5]. [11] reported the quality index of oils from newly developed olive genotypes in the range of 3.0-4.5 (field average). In this study higher MUFA and lower PUFA content were determined than that's of reported by [5] and similar Iq was determined with [11].

CONCLUSION

It was observed that the olive oils analyzed in this research were similar to some of the fatty acid compositions reported for olive oils from the southeastern Anatolia region. However, some results from the same region were found to be different. It is thought that the observed differences may be due to effects such as olive variety, climate, harvest maturity and harvest year. The research showed that all fatty acids, except eicosenoic acid, were within legal limits of extra virgin olive oil. It was observed that eicosenoic acid was very close to the permissible limit, but slightly higher. It is thought that it would be beneficial to conduct more studies to regionally characterize the olive oils produced.

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Table 1. Major Fatty Acids of Olive Oil Samples (% in Fatty Acids)

Sample	Palmitic Acid (C16:0)	Palmitoleic Acid (C16:1)	Stearic Acid (C18:0)	Oleic Acid (C18:1)	Linoleic Acid (C18:2)
A	14.16±0.04a	1.00±0.01ab	3.34±0.02d	72.41±0.66a	6.96±0.06b
B	14.39±0.23a	1.06±0.05a	3.30±0.01d	71.40±0.21bc	7.34±0.08b
C	13.28±0.11b	1.03±0.04a	3.79±0.01a	72.98±0.18a	7.06±0.08b
D	12.80±0.35c	0.80±0.01c	3.41±0.01c	72.38±0.45ab	9.16±0.21a
E	13.44±0.03b	1.02±0.02a	3.39±0.03c	73.08±0.18a	7.27±0.33b
F	14.16±0.03a	0.94±0.01b	3.52±0.03b	70.83±0.47c	8.93±0.10a
CV (%)	1.32	1.56	1.18	0.55	2.18

Values expressed as the mean ± standard deviation. Different letters indicate statistical difference for each colon. CV: coefficients of variation.

Table 2. Minor Fatty Acids of Olive Oil Samples (% in Fatty Acids)

Samples	Myristic Acid (C14:0)	Heptadecanoic Acid (C17:0)	Heptodesenoic Acid (C17:1)	Linolenic Acid (C18:3)	Arachidic Acid (C20:0)	Eicosenic Acid (C20:1)	Behenic Acid (C22:0)
A	0.01±0.001a	0.14±0.001d	0.21±0.001d	0.26±0.001a	0.47±0.02b	0.46±0.007c	0.08±0.001c
B	0.01±0.001a	0.15±0.001c	0.23±0.001c	0.25±0.007b	0.50±0.01a	0.12±0.001e	0.08±0.001c
C	0.01±0.001a	0.14±0.001d	0.23±0.001c	0.25±0.007b	0.42±0.01c	0.56±0.007a	0.12±0.007b
D	0.01±0.001a	0.17±0.001a	0.30±0.01a	0.18±0.001d	0.48±0.01ab	0.49±0.01b	0.14±0.007a
E	0.02±0.001b	0.17±0.001a	0.27±0.01b	0.20±0.001c	0.45±0.01b	0.50±0.01b	0.11±0.001b
F	0.01±0.001a	0.16±0.001b	0.23±0.001c	0.24±0.007b	0.50±0.01a	0.36±0.01d	0.12±0.007b
CV (%)	-	0.15	1.16	1.90	2.47	2.66	4.73

Values expressed as the mean ± standard deviation. Different letters indicate statistical difference for each colon. CV: coefficients of variation.

Table 3. MUFA, PUFA, SFA, MUFA/SFA, IV and Iq of Olive Oil Samples.

Samples	MUFA	PUFA	SFA	MUFA/SFA	IV	Iq
A	77.41	7.22	18.16	10.72	82.07	3.43
B	76.11	7.59	18.42	10.03	81.33	3.29
C	78.58	7.31	17.75	10.76	83.25	3.59
D	77.37	9.34	17.00	8.29	84.78	3.30
E	78.25	7.47	17.58	10.48	83.11	3.53
F	75.88	9.17	18.46	8.28	83.24	3.07