Turkish Journal of Health Science and Life

Determination of total antioxidant capacity and fatty acid composition of olive oil samples taken from the producer and total antioxidant capacity of some olive oils offered for sale in the markets

Serdal ÖĞÜT[a]

[a] *Health Sciences Faculty, Department of Nutrition and Dietetics,Adnan Menderes University,Aydın,Turkey*

ARTICLE INFO

RESEARCH ARTICLE

Article history:

Received: 06 December 2021

Accepted: 14 January 2022

Available : 23 March 2022

[a]https://orcid.org/0000-0001-8863-7249

*Correspondence: Serdal ÖĞÜT

Adnan Menderes University, Health Sciences Faculty, Department of Nutrition and Dietetics Aydın Turkey

e-mail: serdal.ogut@adu.edu.tr

Turkish Journal of Health Science and Life

2022, Vol.5, No.1, 7-10.

ABSTRACT

Objectives: Olive oil is very valuable oil with the components it contains. It is often preferred in healthy nutrition menus. The antioxidants and fatty acids it contains make this oil valuable.

Methods: In this study, total antioxidant capacity was determined with spectrophotometer in eight riviera olive oils and eight extra virgin olive oils in different brands sold in the markets. Total antioxidant capacity and fatty acid compositions were determined in eight olive oil samples taken from the producers. Fatty acid compositions determined with gas chromatography-mass spectrometry/flame ionization detector (GC-MS/FID).

Results: As a result, when three olive oils were compared, the highest total antioxidant capacity was determined in olive oils (4.146±0.062 mM trolox equiv./L.) purchased from producers. The highest amount of oleic (72.39±0.02%) was detected in the chromatographic analyses of cold-pressed pure olive oils.

Conclusion: This research has proven once again that olive oil is a healthy food. In particular, the total antioxidant capacity of untreated pure olive oils is remarkable.

Key Words: Fatty acid composition, olive oil, total antioxidant capacity .

INTRODUCTION

Olive is a member of the Oleaceae (Oliveries) family. In Turkey, olives are harvested between October and January. Early ripening in olive production positively affects yield and quality [1,2].

Among the vegetable oils, olive oil is the main nutrient in the Mediterranean diet in terms of its nutritional and sensory qualities. It has a great importance on human health, especially due to the phenol compounds and antioxidant capacities it contains [3]. The consumption of olive oil delays aging by inhibiting oxidative stress, while providing significant protection against cancer and coronary heart disease [4,5]. It is thought that the antioxidants in olive oil may contribute to the protection against degenerative diseases and cancer [6].

The antioxidant capacity of olive oil is closely related to the amount and content of the phenolic compounds of the oil. Phenolic compounds with antioxidant properties protect cells against the destructive effects of oxidative stress [7,8]. It reduces the amount of oleic acid, LDL cholesterol and triglycerides, which are the most important components in this oil. It protects the cell membrane and lipoproteins against oxidative stress. In addition, it reduces the amount of plasma glucose and insulin [9,10].

Antioxidants have reducing agent, hydrogen donor and free radical suppressor functions. These compounds during storage they also delay the lipid peroxidation process. In this way, they extend the shelf life of foods [11-13]. In recent years, when

biotechnological applications have increased, natural nutrition has gained importance [14]. Olive oil is one of the cornerstones of a healthy nutrition.

Important fatty acids (oleic, linoleic, linolenic, etc.) found in olives are an important quality feature for olive oil. The fatty acid composition of olive oil is of great importance in the identification and differentiation of olive varieties. Factors such as fruit variety, origin, ripening time, environment, and climate and harvest time affect the fatty acid composition [15-18].

In this study, total antioxidant capacity and oil acid compositions in ready-to-consumption olive oils with different properties was investigated.

MATERIALS AND METHODS

Materials

Extra virgin olive oil (8 different brands) and riviera olive oil (8 different brands) were obtained from large markets in Aydın. Cold-pressed pure olive oils were obtained from the producers (8 different producers) located in the Didim (memecik type).

Preparation of Samples

The oil samples taken were mixed with 50% (methanol-water) solution at a ratio of 1/1. The prepared mixture was vortexed for 1 hour at room temperature. Then it was centrifuged at 5000 rpm for 20 minutes. As a result of centrifugation, two separate phases were formed. The methanolic part from the formed phases was taken as oil extract. The total antioxidant capacity of these extractant oils was measured.

Total Antioxidant Capacity Measurement

The total antioxidant capacity of the samples was measured by the method developed by Erel [19]. It is a fully automatic method that measures the total antioxidant capacity (TAC) of the sample against strong free radicals. Results were obtained by measuring spectrophotometrically on an automatic analyser. Results are expressed as mM Trolox equiv./ L.

Determination of Fatty Acids Composition

To determine the fatty acid composition, the oil samples were esterified. Esters were injected into Gas chromatography-mass spectrometry/flame determined by an ionizing detector (GC-MS/FID). The fatty acid composition was determined as %.

Statistical analyzes

Statistical analyses were made in IBM SPSS (version 25) program. Results are presented as "mean±SD".

RESULTS

Antioxidant amounts determined in olive oil samples are given in Table 1.

Table 1. Total antioxidant capacity amounts in olive oil samples.

Sample	TAC (mM trolox equiv./L.)
Riviera olive oil (n=8)	1.322±0.017
Extra virgin olive oil (n=8)	1.279±0.015
Cold-pressed pure olive oils (n=8)	4.146±0.062

When the TAC in olive oils was examined, the highest TAC value was determined in cold-pressed pure olive oils. The lowest TAC was determined in extra virgin olive oil. The mean TAC value in riviera olive oil was determined as 1.322±0.017 mM trolox equiv./L.

The fatty acid profile determined in cold-pressed pure olive oils is given in Table 2.

Table 2. The fatty acid profile in cold-pressed pure olive oils

Oil acid	%
Miristic acid	0.01±0.00
Palmitric acid	13.18±0.01
Palmitoleic acid	0.88±0.00
Heptadecanoic acid	0.09±0.00
Heptadecenoic acid	0.10±0.00
Stearic acid	2.65±0.01
Oleic asid	72.39±0.02
Linoleic acid	13.61±0.01
Linolenic acid	0.92±0.00
Arachidonic acid	0.50±0.00
Eicosenoic acid	0.28±0.00
Behenic acid	0.09±0.00
Lignoceric acid	0.04±0.00

When the fatty acid composition of cold-pressed extra virgin olive oil was examined, the highest oleic acid (72.39±0.02) was determined. It is followed by linoleic acid and palmitic acid.

DISCUSSION

The Mediterranean diet is still considered the healthiest diet in the world. Olive oil is considered the most important nutrient of the Mediterranean diet. This is because olive oil contains a high amount of antioxidants [20]. In this study, the importance of this situation was revealed once again. Considerable antioxidant levels were determined in three olive oil types with different properties investigated within the scope of the study. Especially the antioxidant levels in olive oils (4.146±0.062 mM trolox equiv./L.) obtained directly from the producer are remarkable.

TAC method developed by Erel was used in this study [19]. There are different methods in different studies. Antioxidant activities may differ with these different methods [21]. Güzel et al. [22] determined TAC in different types of olive oils with the same method. Güzel et al. determined the highest crown values in olive oil in different types of oils (corn, sunflower, hazelnut, soybean, cotton, olive). This results show that olive oil is very valuable a nutrient.

In a study conducted in edible oils (extra virgin olive oil, sunflower oil and refined corn oil), the highest amount of antioxidants was determined in extra virgin olive oil [23]. These results show that olive oil is very healthy. In the current study, a remarkable antioxidant capacity (1.279±0.015) was determined in extra virgin olive oil.

Olive oil realizes its strong oxidation feature with its phenolic compounds. The low content of polyunsaturated fatty acids may also contribute to the antioxidant effect [23,24]. Current research results confirm this information. In the study, oleic acid, which is a monounsaturated fatty acid, was determined as the highest percentage (72.39±0.02%). polyunsaturated fatty acid percentages were determined lower [(Linolenic acid (0.92±0.00%), arachidonic acid (0.50±0.00)]. In different studies conducted in Spain and Italy, an inverse relationship was found between the consumption of olive oil and oils with high oleic acid content and breast cancer [25,26].

In a study on olive varieties harvested in different periods, unsaturated fatty acids such as oleic acid, palmitic acid and linoleic acid was determined at the highest rate [27]. The results of this study are consistent with our current research. According to Bayrak et al. also determined similar percentages of fatty acids in memecik type olives [27].

The main saturated fatty acid in olive oil is palmitric acid. The palmitric acid value should be in the range of 7.5-20% [28]. In this study, the average palmitric acid value was determined as 13.18±0.01%.

The basic fatty acid of olive oil is monounsaturated oleic acid. Oleic acid value should be in the range of 55.0-83.0% [29,30]. In this study, the average oleic acid value was determined as 72.39±0.02%.

Conflicts of interest

The author declares that they have no conflicts of interest

REFERENCES

1. Keser O, Tanay B. Zeytin sanayi yan ürünlerinin hayvan beslemede kullanım olanakları. Hayvansal Üretim. 2010;51(1):64-72.
2. Çetinkaya H. Bazı zeytin çeşidi yapraklarındaki flavanol miktarına ağaç yaşı, çeşit ve sulamanın etkisi. Harran Tarım ve Gıda Bilimleri Derg. 2017;21(2):177-184.
3. Artajo LS, Paz Romero M, Suarez M, Jose-Motilva M. Partition of phenolic compounds during the virgin olive oil industrial extraction process. Eur Food Res Tech. 2007;225:617-625.
4. Lipworth L, Martínez ME, Angell J, Hsieh CC, Trichopoulos D. Olive oil and human cancer: an assessment of the evidence. Prev Med. 1997;26(2),181-190.
5. Waterman E, Lockwood B. Active components and clinical applications of olive oil. Altern Med Rev. 2007;12(4):331-342.
6. Bucklan, G. Gonzalez CA. The role of olive oil in disease prevention: a focus on the recent epidemiological evidence from cohort studies and dietary intervention trials. Br J Nutr. 2015;113:94–101.
7. Konstantinidou V, Covas MI, Sola R, Fitó M. Up-to date knowledge on the in vivo transcriptomic effect of the mediterranean diet in humans. Mol Nutr Food Res. 2013;57(5):772–783.
8. Fitó M, de la Torre R, Farré-Albaladejo M, Khymenetz O, Marrugat J. Covas MI. Bioavailability and antioxidant effects of olive oil phenolic compounds in humans: a review. Ann Ist Super Sanita. 2007;43(4):375-381.

9. Trichopolou A, Dilis V. Olive Oil And Longevity. Mol Nutr Food Res. 2007;51:1275-1278.
10. Gorzynik-Debicka M, Przychodzen P, Cappello F, Kuban-Jankowska A, Marino Gammazza A, Knap N, Gorska-Ponikowska M. Potential Health Benefits of Olive Oil and Plant Polyphenols. Int J Mol Sci. 2018;19(3):686-7.
11. Ayar-Kayal H, Urek RO, Nakiboğlu M, Tarhan L. antioxidant activities of endemic Sideritis leptoclada and Mentha D-dumetorum aqueous extracts used In Turkey folk medicine. J Food Process Preserv. 2009;33:285– 295.
12. Lee JM, Chung H, Chang PS, Lee JH. Development of a method predicting the oxidative stability of edible oils using 2,2-diphenyl-1-picrylhydrazyl (DPPH). Food Chemistry. 2007;103:662– 669.
13. Visioli F, Poli A, Galli C. Antioxidant and other biological activities of phenols from olives and olive oil. Medi Res Rev. 2002:22.;65–75.
14. Adana F, Gezer N, Öğüt S. Sağlık yüksekokulu öğrencilerinin genetiği değiştirilmiş organizmalara ilişkin bilgi ve görüşleri. ACU Sağlık Bil Derg. 2014;5(4): 276-280.
15. Owen RW, Mıer W, Gıacosa A, Hull WE, Spıegelhalder B, Bartsch H. Isolation, structure elucidation and antioxidant potential of the major phenolic and flavonoid compounds in brined olive drupes. Food Chem Toxicol. 2000;41:703-717.
16. Fernandez-Cuesta A, Leon L, Velasco L, De La Rosa R. Changes in squalene and sterols associated with olive maturation. Food Res Int. 2013;54:1885-1889.
17. Yu L, Wang Y, Wu G, Jin J, Jin Q, Wang X. Chemical and volatile characteristics of olive oil sex tracted from four varieties grown in southwest of China. Food Res Int. 2021;140:1-9.
18. Dıraman H. Zeytin sineği (Bactrocera oleae Gml.) zararlısının zeytinyağının yağ asitleri bileşenleri üzerine etkisi Gıda. 2007;32 (5):219-226.
19. Erel O. A novel automated direct measurement method for total antioxidant capacity using a new generation, more stable ABTS radical cation. Clin Biochem. 2004;37(4):277-85.
20. Tuck KL, Hayball PJ. Major phenolic compounds in olive oil: metabolism and health effects. J Nutr Biochem. 2002;13:636–644.
21. Ou B, Huang D, Hampsch-Woodill M, Flanagan J, Deemer E. Analysis of antioxidant activities of common vegetables employing oxygen radical absorbance capacity (ORAC) and ferric reducing antioxidant power (FRAP) assays: acomparative study. J Agric Food Chem 2002;11:3122-8.
22. Güzel S, Herken EM, Erel O. Total Antioxidant Capacity and Total Phenol Contents of Turkish Edible Oils. Akademik Gıda. 2009; 7(6):13-17.
23. Baydır Türk A. Evaluation of total antioxidant amount and oxidation stability in edible oils. Journal of Science and Technology of DPU. 2019;42;19-25.
24. Andjelkovic M, Acun S, Van Hoed V, Verhe R, Van Camp J. Chemical Composition of Turkish Olive Oil – Ayvalik. J Am Oil Chem Soc. 2009;86:135–140.
25. Martin-Moreno JM, Willett WC, Gorgojo L, Banegas JR, Rodriguez-Artalejo F, FernandezRodriguez JC, Maisonneuve P. Dietary fat, olive oil intake and breast cancer risk, International J Cancer. 1994;58(6):774–780.
26. Binukumar B, Mathew A. Dietary fat and risk of breast cancer, World J Surg Oncol. 2005;3(45):1-7.
27. Bayrak A, Kırılan M, Kara HH. Determination of aroma profiles of olive oils from Turkish olive cultivars. J Am Oil Chem Soc. 2013;90:1281-1300.
28. Desouky IM, Laıla FH, Abd El-Migeed MMM, El-Hady ES. Changes in some physical and chemical properties of fruit and oil in some olive oil cultivars during harvesting stage, World Journal of Agricultural Sciences. 2009;5(6):760-765.
29. Psomiadou E, Tsimidou M, Boskou D. α-tocopherol content of Greek Virgin Olive Oils. Journal of Agricultural and Food Chemistry. 2000;48:1770-1775.
30. Runcio A, Sorgonà L, Mincione A, Santacaterina S, Poiana, M. Volatile compounds of virgin olive oil obtained from Italian cultivars grown in Calabria. Effect of processing methods, cultivar, stone removal, and antracnose attack. Food Chemistry, 2008;106:735–740.