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OIL RATIO AND FATTY ACID COMPOSITION OF CHERRY SEED OIL

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ABSTRACT

Objective: Seeds of different fruits are often considered waste. Studies have shown that seeds contain hydrophobic and hydrophilic components. This is an important feature in terms of health. Therefore, the pharmacological properties of the seeds made it important for human health. In this study, oil content and fatty acid composition were investigated in two different cherry seeds which were produced as by-products in the food processing industry. Cherry seed oil was removed in an automatic hot extraction system. Hexane was used as the solvent for extraction.

Results: In two different cherry seeds, the oil ratio varied between 23.238 and 28.758. Gas chromatography mass spectrometry (GC/MS) system was used for the fatty acid composition. Dominating fatty acids were oleic acid in the range of 42.625 to 55.265 g/100 g and linoleic acid with 23.276 g/100 g.

Conclusion: With high fat content and unsaturated fatty acid composition, this seed oil can be used in the food industry.

1. Introduction

The edible part of the cherry fruit is mostly consumed fresh. In addition, different products such as juice and jam are obtained from the cherries in Turkey (1). In addition to the edible portion of cherry fruit, today stalks and seeds have gained popularity. Cherry seeds are separated as food processing by-products annually and discarded. Cherry stems are used in an increasing area of use due to the feature of edema removal (2, 3). These seeds are rich sources of oil, which are generally important for human health (4). Fatty acid composition is one of the important parameters of nutritional quality. Particularly saturated/ unsaturated fatty acid ratio is a valuable parameter for human health, economic and efficient availability (2-7).

In oil extraction, different techniques such as hot water extraction, soxhlet extraction, superheated hexane extraction and supercritical fluid extraction (SFE) are used (8, 9). Chromatographic (GC-FID, GC/MS) and spectroscopic techniques (FTIR, Raman, NMR) are used in the analysis of fatty acid components (10-21).

The aim of the present study was to compare the oil contents and fatty acids composition of two different cherry seeds by using hot extraction system and gas chromatography-mass spectrometry (GC/MS).

2. Material and Methods

2.1. Material

The samples were collected by hand in July and August in 2017 from plants growing at Burdur (Gölhisar) and Isparta (Uluborlu). Seeds were obtained from fruits by hand-processing. Then they were stored at 4°C until analysis.

2.2. Reagents

Hexane, petroleum ether, methanol and HCl were of analytical grade Sigma-Aldrich (Darmstadt, Germany).

2.3. Oil content and fatty acid extraction

The hot extraction E-816 HE is an apparatus of Buchi (Germany). About 2 g of the seed samples was weighed into an extraction thimble. The extraction thimble was set into the weighed extraction beaker and approximately 150 mL of petroleum ether was added. The conditions were: Extraction step time, 5 min; rinse step time, 30 min; drying step time, 5 min. The oil was dried by a stream of nitrogen and stored at −20°C until to analysis.

2.4. Fatty acid methyl esters (FAMEs) preparation

FAMEs were obtained by transesterification with HCl in methanol. 1000 µL of a 1.5 M HCl in methanol and 200 µL oil were mixed and shaken vigorously for 15 min in Bandelin ultrasonic shaker (Germany). Oil was methylated 2 h (70°C), and then 1 mL hexane was added to collect the FAME in hexane as above and analyzed by GC/MS (22).

2.5. Analysis of FAME by GC/MS

Gas chromatography separation and quantification was carried out using an Agilent 7890A gas chromatograph + 5975 mass detector (MSD), an auto sampler (Agilent 7693) and a MSDCHEM (Agilent, USA) data system. Injection port and detector temperature was 240°C. The injector was operated in the split mode. The split ratio was 1:20 and the flow-rate of carrier gas (helium) 2mL/min. The capillary columns used were an CP-Wax 52 CB (50m × 0.25 mm; film thickness 0.2 mm film thickness; Agilent Technologies, Inc.) Oven temperature was programmed at initial temperature of 60°C for 1 min, then raised at 13°C/ min to 175°C, increase at 4°C/min to 215°C and hold for 35 min. Each tabulated value corresponds to the average of 3 extraction replicates. GCMS analysis was carried out in electron impact mode (EI) and a quadrupole analyzer. The temperatures of ion source and quadrupole were 230 and 250°C respectively. Transfer line was set at 280°C. Full scan mode was used in a range of 30–500 m/z, at a scan rate of 5.2/s, with an ionization voltage of 70 eV. MSD ChemStation software (Agilent Technologies, Inc.) was employed for data analysis. Identification of fatty acid methyl esters (Fames) compounds was performed by comparing their mass spectra with those in the NIST Mass Spectral Library (National Institute of Standards and Technology, Gaithersburg, MD, USA). The peak areas were computed by the integration software, and percentages of fatty acid methyl esters (FAME) were obtained as weight percent by direct internal normalization (22).

3. Results and Discussion

3.1. Total oil content

The oil contents of the seeds were found between 28.758 g/100 g (dw) (Burdur - Ağlasun) and 23.238 g/100 g (dw) (Isparta - Uluborlu) (Table 1). It has been reported that cherry seeds contain approximately 36.1% oil (23). Kamel and Kakuda (3) were determined 41.90% oil. With the high content oil content, these seed oil may be used in food industry.

Table 1: Oil ratio of the cherry seed oils

Name	Oil Ratio (% Dry Basis)
Burdur - Ağlasun	28.758 ± 0.450
Isparta - Uluborlu	23.238 ± 0.325

Each value is the mean ± SD of triplicate determinations.

3.2. Fatty acid composition

Table 2 shows the composition of the fatty acid of seed oil, analyzed with gas chromatography.

Cherry seed oil was oleic acid predominating with amounts of 42.625 to 55.265 g/100 g. The content of linoleic acid of the oils ranged from 23.276 g/100 g (Burdur Ağlasun cherry seed oil) to 35.012 g/100 g (Isparta Uluborlu cherry seed oil). The relatively low content of saturated fatty acids such as palmitic acid with amounts of 10.934 g/100 g to 13.281 g/100 g is interesting from a nutritional point of view. The content of stearic acid of the oils ranged from 3.703 to 4.042 g/100 g.

The fatty acid composition found in the present investigation for cherry seed oil was similar to the fatty acid composition published by Kamel and Kakuda (3) with 7.60 g/100 g palmitic acid, 52.90 g/100 g oleic acid, and 35.00 g/100 g linoleic acid.

The results from Hu et al. (24) also confirm the presented results for cherry seed oil with 5.69 g/100 g palmitic acid, 0.88 g/100 g stearic acid, 53.42 g/100 g oleic acid, and 38.42 g/100 g linoleic acid. Uluata and Özdemir (23) published results with amount of oleic acid (45.8 g/100 g) and amounts of palmitic acid (6.90 g/100 g) and linoleic acid (41.80 g/100 g) for cherry seed oil. F. Siano et al. (25) determined 9.05 g/100 g palmitic acid, 3.02 g/100 g stearic, 35.05 g/100 g oleic acid, and 41.45 g/100 g linoleic acid in sweet cheery seed oil.

4. Conclusion

Cherry seed is by-products and the waste oil seed contain important amount oleic and linoleic fatty acid. Cherry seed oil is rich in unsaturated fatty acids. So, the oils may be used as natural antioxidative additive to improve the quality, stability of food products. Unsaturated fatty acids have been associated with a number of other diseases. They are involved in the treatment of type 2 diabetes and in the reduction of some types of cancers, such as colon cancer. The main saturated fatty acids in cherry seed is palmitic acid and stearic acid.

Table 2: Fatty acid composition of the cherry seed oils (g/100 g)

Fatty acids; (Rt)	Name	
	Burdur Ağlasun	Isparta Uluborlu
Heptanoic acid (C7:0); (10.8)	0.065 ± 0.001	0.040 ± 0.001
Nananoic acid ME (C9:0); (11.7)	0.058 ± 0.001	0.020 ± 0.001
Undecanoic acid ME(C11:0); (13.9)	0.063 ± 0.001	0.019 ± 0.001
Methyl tetradeconoate (C15:0); (18.6)	0.328 ± 0.003	0.218 ± 0.002
Palmitic acid (C16:0); (24.8)	10.934 ± 0.111	13.281 ± 0.136
Palmitoleic acid (C16:1); (25.7)	0.662 ± 0.007	0.818 ± 0.008
Heptadecanoic acid (C17:0); (29.2)	0.168 ± 0.002	0.135 ± 0.001
Stearic acid (C18:0); (31.7)	4.042 ± 0.041	3.703 ± 0.038
Oleic acid (C18:1); (33.7)	55.265 ± 0.561	42.625 ± 0.435
Linoleic acid (C18:2); (35.2)	23.276 ± 0.236	35.012 ± 0.357
γ-Linolenic Acid (C18:3n6); (37.6)	0.361 ± 0.004	0.104 ± 0.001
Eicosanoic acid (C20:0); (40.3)	0.976 ± 0.010	0.749 ± 0.008
11-eicosenoic acid (C20:1n9c); (41.0)	0.648 ± 0.007	0.218 ± 0.002
Others	3.152 ± 0.983	3.058 ± 0.989
S Saturated	16.635 ± 0.169	18.336 ± 0.185
S Monounsaturated	56.576 ± 0.574	43.661 ± 0.446
S Polyunsaturated	23.798 ± 0.139	35.116 ± 0.358
S Unsaturated	80.373 ± 0.591	78.777 ± 0.804
Saturated/Unsaturated	0.207 ± 0.001	0.231 ± 0.001

Each value is the mean ± SD of triplicate determinations. Rt: Retention time.

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