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FATTY ACID COMPOSITIONS OF COLD PRESS OILS OF SEVEN EDIBLE PLANT SEEDS GROWN IN TURKEY

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Seed oils from medicinal edible plants are common food ingredients and may contain significant levels of α-linolenic acid. Recently, cold press oils have been commercially available because of the consumers' desire for natural and safe food products. Cold press procedures introduce no heat to the raw material during the conventional screw press and is becoming a more interesting substitute for conventional practices. Cold pressing has less detrimental effect on beneficial components of crude oils. Additionally, cold pressing involves no organic solvent, which results in the product being chemically contaminant-free. Therefore, cold press oils rich in α-linolenic acid may be an excellent dietary source of ω-3 PUFAs. In addition to their fatty acid contents, shelf stability is also a critical factor for potential food applications [1].

Several seed oils are commercially subjected to refining process to remove undesirable components. Crude edible oil is degummed, deacidified, decolorized, and deodorized in order to produce clear, stable, pale, odorless and bland-tasting oil. In the process, greater than 95% of the phosphatides, sterol glycosides, free fatty acids, carotenoids, and approximately 32–61% of the sterols, tocopherols, and tocotrienols are removed. The deodorization temperature largely controls the degree of removal of the latter three classes of compounds [2].

Cold press anise, carrot, coriander, cumin, fennel, walnut, and wheat oils may commercially be found in Turkish markets. However, the fatty acid compositions of these seed oils, which are critical for their potential health benefits in food applications, have not been widely investigated. Therefore the purpose of this study was to determine the fatty acid compositions of the cold press oils of seven different medicinal edible plant seeds: anise, carrot, coriander, cumin, fennel, walnut, and wheat. The fatty acid chromatograms showing the composition of the cold press oils of seven different edible plant seeds are presented in Table 1.

The range of total saturated fatty acids (SFA) of the samples was between 4.73 and 13.99%. The lowest SFA belonged to coriander seed oil (4.73%). The anise seed oil had the highest SFA level (13.99%), and most of them was palmitic acid (16:0) (10.51%) followed by stearic acid (18:0) (3.3%) and myristic acid (14:0) (0.17%). The palmitic acid levels of the seed oils ranged from 3.86% in cumin oil to 10.51% in anise oil.

The total unsaturated fatty acid (TUFA) contents of the samples ranged from 85.02% to 94.58%. The highest TUFA value belonged to the coriander seed oil (95.58%). In contrast, the TUFA level of the walnut oil was the lowest (85.02%). The oleic acid (18:1; ω-9) content was predominant in anise, carrot, coriander, cumin, and fennel seeds oils, and it was the highest unsaturated fatty acid among the samples, while the linoleic acid (18:2; ω-6) was the predominant FA in walnut and wheat oils among the samples. The ranges of oleic acid in the oil samples were between 14.36–79.49%. Again the linolenic acid (18:3; ω-3) contents of the walnut and wheat oils were fairly high, 7.24 and 13.08%, respectively.

Fennel seeds are rich in essential oil, and these components are used in flavors, liqueurs, bread, pickles, pastries, fish, and cheese, and they are ingredient of cosmetics and pharmaceutical products as well [3].

Kiralan et al. [4] reported that coriander seed oil had predominantly oleic (80.23%, ω-9) and linoleic acids (13.97%, ω-6). The main fatty acid of cold press carrot seed oil was oleic acid (82.08%), followed by linoleic acid (13.19%) [1]. Unsaturated fatty acids in Greek walnut were as high as 85%, while the percentage of the saturated fatty acids was around 15% [5].

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TABLE 1. Fatty Acid Compositions of Anise, Carrot, Coriander, Cumin, Fennel, Walnut, and Wheat Seed Oils, %

Fatty acids	Cold pressed oils						
	anise	carrot	coriander	cumin	fennel	walnut	wheat
14:0	0.17	-	0.10	2.04	-	-	-
16:0	10.51	10.21	4.07	3.86	4.97	12.86	10.34
18:0	3.31	0.40	0.56	0.50	1.04	1.65	0.54
18:1 (ω-9)	63.22	75.61	78.82	62.17	79.49	22.65	14.36
18:2 (ω-6)	21.86	13.29	15.63	30.83	13.49	55.13	61.62
18:3 (ω-3)	0.56	0.20	0.13	0.10	1.00	7.24	13.08
$\Sigma_{Sat.}$	13.99	10.61	4.73	6.4	6.01	14.51	10.88
$\Sigma_{Unsat.}$	85.64	89.1	94.58	93.1	93.98	85.02	89.06
Other fatty acids	0.37	0.29	0.69	0.50	0.01	0.47	0.06

-: not detectable.

Zwarts et al. [6] found that the oleic acid contents of the oils of New Zealand-grown walnuts ranged from 14.3 to 26.1% of the total fatty acids, while the linoleic acid contents ranged from 49.3 to 62.3% and the linolenic contents from 8.0 to 13.8%. Our findings for the cold pressed seed oils were similar to the findings of the above research.

As indicated previously, results of this study showed that walnut and wheat had the highest linoleic (63.62 and 55.13%) and linolenic acid (13.08 and 7.24%) contents, respectively. The linolenic acid contents of the cold press oils of anise, carrot, coriander, cumin, and fennel were insignificant and were even below ≤ 1%. However, oleic acid was the predominant fatty acid in the anise, carrot, coriander, cumin, and fennel seed oils, and it was the highest fatty acid (79.49%) in fennel compared to the other seeds.

Cold press walnut and wheat seed oils may serve as potential dietary sources for the linolenic (ω-6) and linolenic acids (ω-3), while anise, carrot, coriander, cumin, and fennel seed oil are rich in oleic acid (18:1). These cold pressed seed oils containing no added synthetic antioxidants may exhibit very good oxidative stability and be suitable for therapeutic food preparations.

Some chemicals like tocopherol and carotenoids retained during the cold press procedure may play a significant role in the oxidative stabilities of the cold press oils. Further studies are needed to investigate the other chemical compounds present in these types of cold press oils and their potential health benefits. The results of this study demonstrated that the cold press seed oils from anise, carrot, coriander, cumin, fennel, walnut, and wheat may serve as a potential dietary source of ω-3 and mono-unsaturated fatty acids in improving human nutrition and may have potential in new functional foods.

Plant Materials. The cold pressed seed oils of anise, carrot, coriander, cumin, fennel, walnut, and wheat were obtained from the Natursan Co. (Corum, Turkey). Cold pressed extra virgin and unrefined seed oils were analyzed for fatty acid compositions. Chemicals and solvents used in the study were of commercially high grade and not subjected to further purification.

Analyses of Fatty Acids. Two milligrams of each oil sample was used to prepare the fatty acid methyl esters (FAME) for gas chromatograph (GC) according to a procedure previously described by [7]. The oil samples were homogenized with hexane–isopropanol, 3:2, v/v. For fatty acid methyl esters (FAME), 1 mL of methylation reagent (80 mL methanol + 0.5 g sodium methylate + 20 mL isooctane) was added to the 50 mg of oil. The mixture was vortexed and allowed to react for 24 hours at room temperature; then 0.25 mL of isooctane was added. The sample was then centrifuged for 5 min at 2400×g at 5°C and the liquid portion transferred to labeled Wheaton vials and stored at –20°C. The methyl esters of the fatty acids (0.5 µL) were analyzed in a Hewlett–Packard 6890 series gas chromatograph (Hewlett Packard Co., Avondale, Pa., USA.) equipped with a flame ionizing detector (FID) and a fused silica capillary column (MN FFAP (50 m × 0.32 mm i.d.; film thickness 0.25 µm). It was operated under the following conditions: oven temperature program 120°C for 1 min raised to 240°C at a rate of 6°C/min and then kept at 240°C for 15 min; injector and detector temperatures 250 and 260°C, respectively; carrier gas helium at flow rate of 40 mL/min; split ratio 1/20 mL/min.

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