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FATTY ACID COMPOSITION OF SEED AND LEAF OILS OF PUMPKIN, WALNUT, ALMOND, MAIZE, SUNFLOWER AND MELON

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Oils constitute one of the three major classes of food product, the others being proteins and carbohydrates. However, since the turn of the century, vegetable oils have supplanted lard and beef tallow as the major source of dietary [1]. Recent studies on seed of plants indicate they are potential sources of oils for nutritional, medicinal, and industrial purposes [2]. Fatty acid was the main components of oils.

Walnut oil is a component of dry skin creams, antiwrinkle and antiaging products, because it presents moisturizing properties as well as free radical scavenging capacity [3]. Pumpkin seed oil is used widely as salad oil in the South of Austria and the adjacent regions in Slovenia and Hungary. Recently, it is also applied to treat minor disorders of the prostate gland and the urinary bladder [4]. Maize is one of the classic starchy staple foods and it contains more lipid per volume than major starchy staple grain [5].The fruit melon contains large quantities of seed which are reported to possess medicinal properties [6]. Melon seeds (*Cucurbita* spp. *Citrullus* sp.) are rich in oil and protein [7], and although none of these oils has been utilized on an industrial scale, many are used as cooking oils in some African and Middle Eastern contries [8]. From this point of view, the occurrence of the unusual fatty acids and /or the high concentrations of the usual fatty acids in the seeds and leaves is chemotaxonomically and bio-chemically important.

In this study, the fatty acid composition of the seed and leaf oils of almond, pumpkin, melon, walnut, sunflower, and maize was investigated using gas chromatography. This is the first report on the fatty acid composition of leaves.

The experimental results are summarized in Table 1, which shows the percentage content of individual fatty acids. The ordinary fatty acids identified included especially palmitic acid (16:0) and a mixture of fatty acids with 18 carbon atoms (especially 18:0, 18:1, 18:2, and 18:3). The seed oils contained fatty acids with 6, 12, 14, 17, 20, 22, and 24 carbon atoms in smaller amounts. The oil contained fatty acids with carbon atoms 8 and 10 in trace quantities when the concentration of these acids was less than 0.01%. Oleic acid (42.49 and 68.63%, respectively) was the dominant fatty acid in the pumpkin and almond seed oil. However, the dominant fatty acid in the walnut, maize, sunflower, and melon seed oils was 18:2 (58.24, 56.90, 59.22, and 56.92%, respectively).

The 7 saturated fatty acids (6:0, 12:0, 14:0, 17:0, 20:0, 22:0 and 24:0) in the seed oils were detected in small quantities (0.01–0.74%) except 16:0 (4.66–12.26%) and 18:0 (0.4–5.22%) and the total saturated fatty acids percentage was in the range of 6.46 and 18.19%. The most abundant unsaturated fatty acids in the seed oils were 18:1, 18:2 and 18:3 acids. The other unsaturated fatty acids in the seed oils were in the range of 0.01 and 0.37%. The total unsaturated fatty acids of seed oils was in the range of 79.84 and 90.7%.

In this study, the fatty acid composition of leaf in the *n*-hexane extract was determined. The experimental results are summarized in Table 1, which shows the percentage content of individual fatty acids.

The relation between seed and leaf fatty acid composition was showed. The fatty acid content in the leaf and seed oils was different. Interestingly, caproic, behenic, and lignoseric acid were found in important amounts in the leaf oils while they were found in very small quantities in the seed oils. The composition of fatty acids is dependent on several factors (variety, area in which the plants are grown, climate, and ripeness). It can be seen that the iodine values for the seed oils and leaf oils (Table 1) are consistent with the correspondling total unsaturation of the fatty acids.

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TABLE 1. Fatty Acid Composition (percentage levels) of Seed and Leaf Oils

Fatty acid	Seed oils						Leaf oils				
	Pumpkin	Walnut	Almond	Maize	Sunflower	Melon	Pumpkin	Walnut	Almond	Maize	Sunflower
6:0	0.03	0.03	0.07	0.17	-	0.01	2.43	4.11	3.67	3.61	7.59
8:0	Tr.	-	Tr.	-	Tr.	-	0.63	0.34	0.38	-	0.42
10:0	-	-	Tr.	-	-		0.27	0.34	0.41	-	3.02
12:0	0.01	-	-	-	Tr.	Tr.	-	-	-	2.53	-
14:0	0.12	0.03	0.03	0.09	0.05	0.05	0.53	0.92	-	2.85	-
16:0	12.26	6.82	5.97	11.03	4.66	8.16	1.62	4.21	2.56	8.19	0.87
16:1	Tr.	0.06	0.03	0.06	0.02	0.01	-	0.79	-	-	-
17:0	Tr.	0.05	0.05	0.06	0.06	Tr.	-	-	-	-	-
17:1	0.05	0.02	0.09	-	0.05	0.03	-	-	-	-	-
18:0	5.22	3.74	1.85	1.7	0.4	Tr.	-	-	-	3.34	-
18:1	42.49	17.31	68.63	25.52	27.73	32.7	0.93	-	0.74	-	-
18:2	36.99	58.24	21.77	56.9	59.22	56.92	2.21	2.73	1.4	4.96	11.56
18:3	0.11	11.37	0.06	1.04	0.01	0.17	4.03	13.65	5.88	21.35	0.73
20:0	0.37	0.13	0.1	0.37	0.26	0.01	-	-	-	2.71	-
20:1	0.1	0.08	0.07	0.05	0.01	0.01	-	1.71	4.14	-	3.02
20:2	-	0.02	-	-	-	0.01	-	-	-		-
22:0	0.11	0.03	0.03	0.19	0.74	0.05	3.67	5.34	28.46	1.63	4.13
22:1	-	0.29	0.05	-	0.01	-	4.71	-	-	-	-
22:2	-	-	-	-	-	0.04	0.83	-	-	-	-
24:0	0.07	0.35	-	0.22	0.29	0.08	10.64	8.54	11.67	-	-
24:1	0.1	0.05	-	-	0.01	0.18	-	-	-	-	-
$\Sigma_{sat.}$	18.19	11.18	8.1	13.83	6.46	8.34	19.79	25.85	47.15	24.86	16.03
$\Sigma_{unsat.}$	79.84	87.44	90.7	83.57	87.06	90.07	12.71	18.88	23.83	26.31	15.31
Iodine value, g/100 g	100.8	145.6	96.82	123.14	126.3	127.02	18.53	42.43	21.64	32.54	24.27

Tr.: traces (concentration less than 0.01% of the total fatty acids).

-: not dedected.

The iodine values (g/100 g) of seed and leaf oils. Seed oils: pumpkin - 100.8; walnut - 145.6; almond - 96.82; maize - 123.14; sunflower - 126.3; melon - 127.02. Leaf oils: pumpkin - 18.53; walnut - 42.43; almond - 21.64; maize - 32.54; sunflower - 24.27.

Plant Materials. The samples of seed and leave were collected on August 2005 at Corlu, Turkey. Seeds were ground and leaves were powder-homogenized after they were dried.

Oil Extraction. The oil was extracted from dried powdered seeds and leaves for 12 h in a Soxhlet extractor using *n*-hexane as a solvent. The solvent was removed by a rotary evaporator. The fatty acid composition was studied by gas chromatography.

Methylation Procedure. Fatty acid methyl esters were prepared as in [9].

Gas Chromatography. The fatty acid methyl esters were analyzed in an Agilent 6890 N gas chromatography equipped with a flame ionization dedector (FID). The components were separated in an Agilent DB 23 capillary column (60 m with internal diameter of 250 μm and film thickness of 0.25 μm). The following chromatographic conditions were observed: column temperature program, 130°C for 1 min, 130–170°C at 6.5°C/min, 170–215°C at 2.75°C/min, 215°C for 12 min, 215–230°C at 4°C/min, 230°C for 3 min; injector temperature: 250°C; detector temperature: 250°C; carrier gas: helium; gas linear speed: 45 mL/min; air linear speed: 300 mL/min; split mode:1:150; volume of injected sample: 1 μL; internal standard: Supelco 37 component FAME mix 10.000 μg/mL. Fatty acids were identified on the basis of pure fatty acid methyl ester and expressed as percentage of total fatty acids (area/area), including minor fatty acids.

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