Characteristics of Beechnut Oil (*Fagus orientalis* Lipsky) of Turkish Origin

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The characteristics of beechnut oil (*Fagus orientalis* Lipsky) of Turkish origin were investigated. The fatty acid composition was determined by capillary gas chromatography. The oil showed the characteristics of a semidrying oil.

KEY WORDS: Beechnut oil, Fagaceae, *Fagus orientalis* Lipsky.

Turkey's various climatic regions make it possible to grow a variety of oil-bearing plants, with the exception of some tropical kinds. Almost 97% of edible oil consumed in Turkey is produced from olive, sunflower and cottonseed, and the remaining 3% is produced from soybean, safflower, groundnut, rapeseed, linseed and hempseed (1). Present production of triglyceride oils and fats for food and industrial uses is somewhat insufficient in Turkey. Although the total oil extraction capacity of approximately 100 plants (differing in size) is 1.1 million tons/year, only 45% of this capacity is being used. While Turkey's oil consumption for food and industrial uses increases, domestic oil production shows no growth. In 1990 and 1991, 465,000 tons and 591,000 tons crude oil, respectively, were provided through imports (2). This is mainly due to lack of sufficient domestic oil-bearing seeds to utilize the full production capacity. Therefore, there is a growing interest in evaluating new oil-bearing seeds for both edible and technical purposes.

The Beech family, Fagaceae, is a family of six genera, including 600 species (3). One of them is *Fagus*, beech, which has 10 species. It is distributed in the northern temperature zone and includes *F. grandifolia*, *F. sylvatica* and *F. orientalis* Lipsky. *F. orientalis* Lipsky grows in many regions of Turkey (4,5). Beechnut oil is used for edible purposes and for soap making in Europe, where the oil is obtained from the nuts of the European red beech tree, *F. sylvatica*. The nuts consist of 33% husks and 67% kernels. The nuts contain from 15 to 20% oil, and the kernels have over 40% oil. The cold-pressed oil is clear, yellow and viscous, and it has a sweet taste. The hot-pressed oil has a bitter taste (6).

There are a number of publications concerning the oil content and oil characteristics of the other species of beech (6–10). We investigated the oil content and characteristics of the Beechnut (*Fagus orientalis* Lipsky) (4,5) grown in Turkey.

MATERIALS AND METHODS

Beechnuts (*F. orientalis* Lipsky) were obtained from Kirklareli, located in the Marmara region of Turkey. Reagents and solvents used for the laboratory analyses were all of pure chemical grade.

Beechnuts consist of 32.6% husks and 67.4% kernels. The moisture content of the kernels was determined by drying the crushed samples to constant weight at 105°C (11). Oil content of the kernels was determined by solvent extraction in a standard Soxhlet extractor with hexane as solvent.

For the analytical investigation, preparative oil samples were obtained with a laboratory-type Carver hydraulic press (Fred S. Carver, Inc., Wabash, IN) at room temperature. Oil characteristics of *F. orientalis* Lipsky were determined according to the usual standard test methods of fat and oil analysis (11).

For the determination of fatty acid composition, the oil sample was transformed into corresponding methyl ester derivatives, and the fatty acid composition was determined by capillary gas chromatography in a Hewlett-Packard 5890 Series II aparatus (Hewlett-Packard, Waldron, Germany) fitted with a flame ionization detector, under the following conditions: column, Ultra 2 (25 m × 0.32 mm) with 0.52 μm film thickness of 5% diphenyl, 95% dimethyl polysiloxane; N_2 carrier gas at 2 mL/min; air flow of 386 mL/min; hydrogen flow of 27 mL/min; injection, split 50:1, 0.5 μL; injector temperature, 200°C; oven temperature program, 30°C (5 min), 30–170°C (5°C/min), 170°C (5 min), 170–200°C (3°C/min), 200°C (30 min); flame ionization detector temperature, 250°C. A standard mixture of fatty acid methyl esters (C8:0, C10:0, C12:0, C14:0, C16:0, C16:1, C18:0, C18:1, C20:0) also was quantitatively analyzed by gas chromatography under the same conditions. The percentage of relative peak area was compared with the weight of fatty acid methyl esters to obtain the detector response factors (all approximately 1.0).

RESULTS AND DISCUSSION

The moisture and the oil content of the kernels, as well as the chemical and physical characteristics of the beechnut oil (*F. orientalis* Lipsky), are compared in Table 1 with those of *F. sylvatica* (already reported elsewhere; refs. 7, 8 and 12). Fatty acid composition of the oil is given in Table 2. For comparison, the compositions of *F. sylvatica* kernel oils reported by Hoppe (8), Zerbe (9), Delvaux (12) and Hilditch (13) are included in the table. *F. orientalis* Lipsky oil has higher linoleic acid content (48.9%) than the others, and it has approximately 2.0% other saturated and unsaturated fatty acids. They were C8:0 (0.1%), compounds between C8:0 and C12:0 (0.2%), C12:0 (0.3%), compounds between C12:0 and C14:0 (0.1%), C14:0 (0.1%), C16:2 (0.1%), C16:1 (0.3%), compounds between C16:0 and C18:2 (0.1%), compounds between C18:0 and C20:1 (0.3%) and C20:0 (0.5%).

The oil characteristics of beechnut (*F. orientalis* Lipsky) originating from Turkey were investigated for the first time. Results of this study show that the physical and chemical characteristics of beechnut oil closely resemble those of *F. sylvatica* oil as reported previously (7,12,13).

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TABLE 1

Technological Characteristics of Turkish Beechnut Seeds

	F. orientalis Lipsky	*F. sylvatica*[a]
Kernel characteristics		
Moisture content, %	5.93	9.09
Oil content, dry basis, %	47.62	45.73[b]
Oil characteristics		
Refractive index, n_D^{20}	1.4725	1.4729–1.4752 (15°C)
Density, 21°C, g/cm^3	0.9174	0.9099–0.9226 (15°C)
Saponification value	193.50	180–201.5
Iodine value	106.61	101–120[c]
Acid value	2.91	0.78–2.40
Free fatty acid, %	1.46	—
Unsaponifiables, %	0.84	—[d]
Hydroxyl value	5.79	—
Acetyl value	5.77	4.20
Viscosity, 21°C, cSt	74.00	—

[a]Reference 7. [b]25–45 (ref. 8). [c]111.9 (ref. 12). [d]0.27 (ref. 12).

TABLE 2

Fatty Acid Composition of Beechnut Oil (%)

Oil	C16:0	C18:3	C18:2	C18:1	C18:0	C20:1
F. orientalis Lipsky[a]	8.8	—	48.9	30.4	3.2	6.7
F. sylvatica						
Hoppe (ref. 8)	5.0	—	10.0	40–76	3.5	—
Zerbe (ref. 9)	4.9	0.4	9.2	76.7	3.5	—
Delvaux (ref. 12)	11.5	2.8	33.2	48.4	—[b]	—
Hilditch (ref. 13)	12.0	2.0	38.0	48.0	—[c]	—
	10.0	—	33.0	57.0	—[c]	—

[a]Other saturated and unsaturated acids, 2.0%.

[b]Saturated present.

[c]C16:0 + C18:0 present.

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