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Physiochemical Composition of Fig Seed Oil from Turkey

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Abstract: Fig (*Ficus carica* Linn (Moraceae)) is a deciduous tree that grows in tropical and subtropical zones [1]. *Ficus carica* has a broad spectrum of pharmacological activity and is widely used in traditional medicine. Research has found its use in more than 40 areas. Some of these are gastrointestinal, endocrine, respiratory, reproductive system disorders [2]. The fig seed oil contains alpha-linolenic acid (ALA), which is highly beta-sitosterol and herbal omega [3]. It can be used as a supplement in the treatment of diseases such as cardiovascular disorders, gastrointestinal disorders, and diabetes. Fig seed oil can be a good choice for skin hydration when used externally. In our study, the fig seed oil was analyzed by gas and liquid chromatography. In this study where linoleic acid (C18:2) and linolenic acid (C20:0) ratios found in fig seed oil composition were evaluated, the health benefits of two fatty acids were discussed based on the literature.

Key words: *Ficus carica*, fig seed oil, linoleic acid, linolenic acid, fig.

1. Introduction

Ficus carica, called fig, is a member of the mulberry family (Moraceae) [2] (Fig. 1). Fig has more than 700 known species with a very large family [3]. *Ficus carica* is a temperate species found in Southwest Asia and the Mediterranean region [2]. Turkey meets 26% and Egypt, Iran, Greece, Algeria, and Morocco together meet 70% of the world fig production [4]. It has been widely cultivated since ancient times for its fruits with high nutritional value [2]. Various parts of the plant, such as bark, leaves, fruit, seeds, latex, have medicinal importance [1]. This herb has attracted the attention of researchers in the medical sciences such as Ayurveda, Unani, and Siddha for traditional treatment. Various researches have been carried out to preserve its traditionality [2].

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1.1 Ficus carica Chemical Structure

The predominant bioactive compounds include phenolic compounds, phytosterols, anthocyanins, and organic acids that contribute to antioxidant activity. Fig also contains a large number of volatile compounds that exhibit anti-inflammatory, anti-edema, and cytotoxic activities [5]. Fifty-nine volatile compounds have been identified in other parts of the plant, including mono terpenes, sesqui terpenes, and norisoprenoids. These compounds, except for mono terpenes, are mainly found in the leaf of the plant. The leaf has a rich content of anthocyanidins [5, 6]. Four triterpenoids have been identified in the leaf: bauerenol, lupeol acetate, methyl maslinate, and oleanolic acid [6]. Fig is a source of potassium, calcium, iron, vitamin K [1].

1.2 Fig Seed

Fig seeds may be large, medium, small and range from 30 to 1,600 per fruit. Dry seeds contain 30% fixed oil. The fatty acids it contains are as follows: oleic 18.99%; linoleic 33.72%; linolenic 32.95%; palmitic 5.23%; stearic 2.1.8%; arachidic 1.05% [1].

1.3 Health Benefits

Fruits, pulp, leaves, roots, and latex of fig tree have been used as part of traditional medicine in India and China. Antispasmodic, antibacterial, anti-inflammatory and natural laxative effects were utilized [5, 7, 8, 9]. The laxative effect is probably due to the bulk of seeds and fibers [1].

The polyphenols, flavonoids, and anthocyanins have high antioxidant capacity [1]. The anthocyanin content of figs may help to maintain healthy blood lipid levels and play an important role in the prevention of obesity, diabetes, cardiovascular disease, and certain cancers [10].

The leaves and roots of the fig tree contain plant sterols (especially modified triterpenes) that have been shown to reduce cholesterol levels by blocking exogenous cholesterol absorption [6].

2. Materials and Methods

Oil from *Ficus carica* L. seeds was obtained by cold press method without heat treatment in environments not exceeding 30 °C. The oil is fixed oil and is a clear, yellow liquid with a distinctive odor and taste. All procedures were performed under GMP (good manufacturing practices) conditions. In our study, gas and liquid chromatography was used. All methods were applied as specified in the Turkish Pharmacopoeia [11].

3. Results

The fig seed oil which oil composition was determined by gas chromatography was found to contain 9 major fatty acids (Fig. 1 and Table 1).

The sum of the percentage areas of saturated fatty acids with a carbon number of less than 16 is not more than 0.3%. Oil yield is 22.7%.

The full spectrum of the eight vitamin E isomers contains 4 tocopherols and 4 tocotrienols. In our study, a high rate of γ-tocopherol (4,267 ppm) was detected in fig seed oil (Table 2).

The most predominant sterol was beta-sitosterol (66.43%) (Table 3).

Antioxidant effect of the oils and free radical scavenging activity against DPPH were shown in Table 4. Fig seed oil showed high scavenging activity. Phenolic compounds of fig seed oil are that have the features which are called anticarsinogenic, antioxidative, antimutagenic, holding the free radicals and the inhibition of lipid peroxidation (Table 5). Total phenolic content radical scavenged activity [12].

Fig. 1 ***Ficus carica*** **[1].**

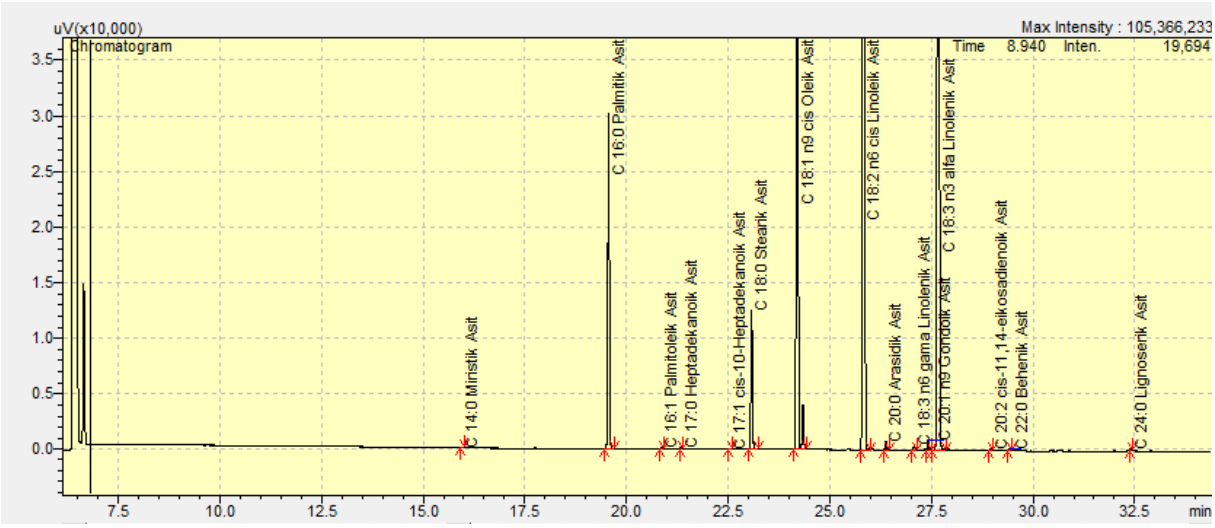

Fig. 2 Chromatogram of fig seed oil.

Table 1 Fig seed oil fatty acid composition.

Fatty acids	%
Palmitic acid C16:0	5.0%-9.0%
Stearic acid C18:0	2.0%-4.0%
Oleic acid C18:1 (n-9)	14.0%-24.0%
Linoleic acid C18:2 (n-6)	20.0%-35.0%
α-linolenic acid C18:3 (n-3)	32.0%-50.0%
γ-linolenic acid C18:3 (n-6)	0.17%
Arachidic acid C20:0	Max. 0.7%
Eichosenoic acid C20:1 (n-9)	0.5%
Behenic acid C22:0	Max. 0.5%

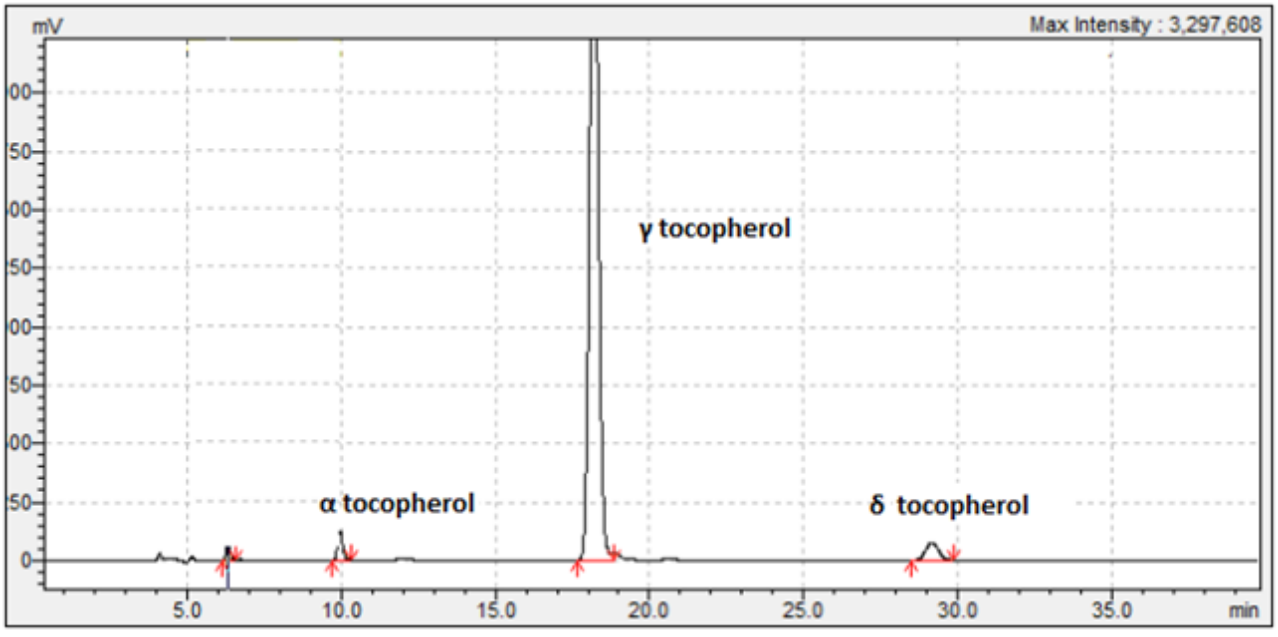

Fig. 3 α, γ, and δ-tocopherol peaks in fig seed oil chromatogram.

Table 2 Fig seed oil tocopherol composition.

	α-tocopherol (ppm)	γ-tocopherol (ppm)	δ-tocopherol (ppm)
Fig seed oil	157	4,267	147
Total tocopherols	4,571		

Table 3 Fig seed oil sterol composition.

Sterols	% Area in sterol composition
Campesterol	2.99
Stigmasterol	2.18
Clerosterol	0.68
Beta-sitosterol	66.43
Delta-5-avenasterol	20.15
Sitosterol	1.18
Delta-7-stigmasterol	1.28
Delta-7-avenasterol	5.07
Total sterol	6,516.20 mg/kg

Table 4 Antioxidant capacity.

Oil	Antioxidant capasity (%)
Fig seed	52.54

Table 5 Phenolic content.

Oil	Phenolics (GAE/100 g oil)
Fig seed	79.5 mg

4. Discussion

Fig seed oil was characterized by a high content of α-linolenic acid (32%-50%) and linoleic acid (20%-35%). Linoleic (n-6) and α-linolenic (n-3) fatty acids, PUFA (polyunsaturated fatty acid) types, are two essential fatty acids for human. It is not synthesized by mammals and must be ingested through diet [13].

α-linolenic (n-3) acid is a source of herbal Omega 3. One of the recommended nutrients for ocular health is Omega 3 fatty acids. Anti-inflammatory and intrinsic essential dietary lipids for the retina are recommended for photoreceptors and nerve tissue. Omega-3 fatty acids reduce risk factors for cardiovascular and age-related macular degeneration (AMD) by its anti-inflammatory effect [14]. Fig seed oil may be added to the diet due to its high α-linolenic (n-3) acid content in AMD.

Fig seed oil was found to contain vitamin E. Vitamin E protects all cell membranes from free radical damage and endothelial function reduces C-reactive protein (CRP) levels [14].

As a result, *F. carica* seed oils can be a good raw material for the supplements with their high content of mono and polyunsaturated fatty acids, volatile oil components, sterol, and tocopherol content.

The formulation contains a wide variety of essential and effective ingredients, especially herbal Omega 3, ALA (alpha-linolenic acid), and vitamin E. It can be used as an adjunctive treatment to support ocular health, especially in macular degeneration (yellow spot damage). Further studies are warranted with fig seed oil.

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