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B R I E F C O M M U N I C A T I O N S

INVESTIGATION OF SOME COMPOSITIONAL PROPERTIES OF *Capparis spinosa* SEED OIL GROWING WILD IN IRAN FROM COMMERCIAL UTILIZATION APPROACH

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The fruits of *Capparis spinosa* of the family Capparidaceae grow wild in different parts of Iran and are especially widely distributed in Dashte-Moghan [1]. Previous studies refer to the possible exploitation of some of the seed fats of the Capparidaceae family for industrial purposes. Only a few studies on the fatty acid composition and other characteristics of seed oil from *C. spinosa* are available [2–6]. This study was made to analyze the chemical properties of seeds and oil extracted from *Capparis spinosa* collected from different regions of Dashte-Moghan in order to determine the possibility of commercial utilization and to assess the potential use of the extracted oil in the edible oil industry.

Table 1 gives the fatty acid composition. The most predominant fatty acid is linoleic acid, with a mean value of ~47%. In addition to linoleic acid, the seed oil contains higher amounts of oleic acid and its isomer, *cis*-vaccenic acid, with mean values of ~23% and 13%, respectively. The seed oil also contains appreciable amounts of saturated fatty acid, especially palmitic acid, ~9%, and stearic acid, 2%. The results of fatty acid composition are in agreement with those previously reported in [6]. These results do not agree with those of other researchers who previously reported the contents of the three most important fatty acids. They found that the most abundant fatty acids were (oleic ~45%, linoleic ~25%, palmitic ~13%), (oleic ~45%, linoleic ~31%, palmitic ~12%), and (oleic 57%, linoleic 11%, palmitic 21%) which together compose about 83, 88, and 89% of the total fatty acids [2–4]. The major fatty acid in those studies was oleic acid, ranging from 45% to 57%. According to the results of this study, *C. spinosa* seed oil is regarded as oleic-linoleic oil. In comparison with the most recent Codex Standard [7], the fatty acid composition is comparable with sesame and peanut oils. The unsaponifiable matter of *C. spinosa* oil was 2.36%. It is higher than the amount of unsaponifiable matter in sesame oil, ≤2%, and peanut oil, ≤1%, as reported by the Codex Alimentarius Commission [7].

According to Table 2, the β-carotene content of *Capparis spinosa* seed oil is ~280 mg/kg and is close to unbleached palm stearin, with total carotenoids (as β-carotene) ranging from 300 to 1500 mg/kg [7]. However, it is notable that there are no data in the literature on *C. spinosa* β-carotene seed oil for comparison purposes. There are also no data on the phenolic content of *C. spinosa* seed oil in the literature. The total phenolic content of *Capparis spinosa* seed oil is ~87 mg/kg. The content of phospholipids in *C. spinosa* seed oil is 0.246%, and this corresponds to a similar observation, 0.3%, in [6], which reported that phosphatidylinositols, phosphatidylethanolamines, and phosphatidylcholines are the major components of the total phospholipids. In another literature report on the lipid complex of the epigeal part of *C. spinosa* [5], the phospholipids amounted to 4.4 g (8%), and the main components of the total phospholipids were phosphatidylglycerols, phosphatidylethanolamines, and phosphatidylcholines. Also, in comparison with that reported by Codex Alimentarius [7] in peanut oil, 0.6–2%, depending on the maturity of the peanuts from which the oil is extracted, *C. spinosa* seed oil has a lower phospholipid content.

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TABLE 1. Fatty Acid Composition of *Capparis spinosa* Seed Oil[a], %

Fatty acid	Value	Fatty acid	Value
12:0	0.11 ± 0.03	18:2 (*n*-6)	47.37 ± 1.62
14:0	0.44 ± 0.1	18:3 (*n*-3)	1.16 ± 0.18
16:0	8.93 ± 0.36	20:0	0.5 ± 0.14
16:1 (*n*-7)	1.89 ± 0.13	20:1 (*n*-9)	0.31 ± 0.07
17:0	0.12 ± 0.03	22:0	0.57 ± 0.31
17:1	0.26 ± 0.06	SAFA	13.12
18:0	2.45 ± 0.15	MUFA	38.38
18:1 (*n*-9)	22.71 ± 0.28	PUFA	48.53
18:1 (*n*-7)	13.21 ± 1.26		

[a]All the given values are means of three determinations ± standard deviation.
SAFA – saturated fatty acid; MUFA – monounsaturated fatty acid; PUFA – polyunsaturated fatty acid.

TABLE 2. Chemical Characteristics of *Capparis* Oil

Properties	Value	Properties	Value
Unsaponifiable matter, %	2.36 ± 0.01	Phospholipid content, μg/g	2460 ± 2.65
Total phenolic content, μg/g	86.61 ± 0.031	*β*-Carotene content, μg/g	279.95 ± 0.05

All the given values are means of three determinations ± standard deviation.

TABLE 3. Levels of Sterols in *C. spinosa* oil, %

Constituent	Value	Constituent	Value
Cholesterol	0.35 ± 0.03	Δ^5-Avenasterol	7.06 ± 0.04
Brassicastrol	0.58 ± 0.02	Δ^7-Stigmasterol	0.30 ± 0.01
Campesterol	13.22 ± 0.03	Δ^7-Avenasterol	1.77 ± 0.04
Stigmasterol	9.60 ± 0.06	Others	16.32
β-Sitosterol	50.80 ± 17	Total sterols, mg/kg	2702.61

All the given values are means of three determinations ± standard deviation.

TABLE 4. Levels of Tocopherols and Tocotrienols in *C. spinosa* oil, %

Constituent	Value	Constituent	Value
α-Tocopherol	1.15 ± 0.02	*δ*-Tocopherol	4.81 ± 0.04
α-Tocotrienol	0.24 ± 0.02	*δ*-Tocotrienol	1.03 ± 0.01
γ-Tocopherol	85.88 ± 0.04		

All the given values are means of three determinations ± standard deviation.

Table 3 shows the sterol composition of seed oil of *C. spinosa*. In addition to sitosterol, which amounted to ~60% of the total amount of sterols, campesterol and stigmasterol were predominant, comprising about 13 and 10% of the total sterols, respectively. Δ^5-Avenasterol and Δ^7-avenasterol amounted to 7% and 1.77% of the total amount of sterols, respectively. According to Table 3, in *C. spinosa* oil, the amounts of each sterol were more comparable to peanut oil than to sesame oil [7], although the amount of *β*-sitosterol in sesame oil was higher than in *C. spinosa* oil. Basically, these results disagree with those reported by [4] for *C. spinosa* in Turkey.

Table 4 shows the content and composition of tocopherols and tocotrienols of seed oils from *C. spinosa*. γ-Tocopherol is predominant tocopherol, ~90 mg/kg, whereas δ-tocopherol accounted for ~5% of the total tocopherols. The value of γ-tocopherol was ~89 mg/kg. The reported amount of tocopherol in seed oil of *C. spinosa* is comparable to that found in other commonly used seed oils such as sunflower oil or rapeseed oil, but the results of this investigation are comparable with the results obtained for peanut and sesame oils, and the value of γ-tocopherol in *C. spinosa* seed oil is near that in peanut oil [4].

All chemicals used were of analytical grade from Merck, but α-cholestanol, α-tocopherol, β-carotene, and syringic acid standards were purchased from Sigma Chemical Company (St. Louis, MO).

Plant Material. Ripe fruits of *Capparis spinosa* were picked from wild plants at different locations in Dashte-Moghan. Fruit peels and pulps were removed from the seeds. The seeds were cleaned and air-dried without direct sunlight. Afterwards, the seeds were milled and preserved at –20°C until analysis and oil extraction.

Oil was extracted with hexane in a Soxhlet apparatus for 6 h. The solvent was removed via a rotary evaporator upon boiling under reduced pressure, then was flushed with a stream of nitrogen and stored at –20°C in sealed tubes for subsequent physicochemical analyses.

Methods recommended by the Associations of Official Analytical Chemists (AOAC) [8] were used for the determination of the moisture content, total ash, crude fiber, and crude protein. Oil content was determined according to International Standard ISO 659 [9].

Analysis of Oil Extract. AOCS Official Methods [10] was used for the determination of unsaponifiable matter of the oil.

The International Standards [11] for fatty acid composition, for determination of sterols [12], and for tocopherol composition [13] were used.

The content of β-carotene [14] and the total phenolic compounds were determined [15].

Phosphorus (mg/kg) was quantified by the phosphomolybdate method and phospholipids (mg/kg) were calculated as phosphorus × 3 [16].

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