

Bioactive Compounds and Fatty Acid Composition of Oils Obtained by Different Extraction Methods from Caper (*Capparis ovata* Desf.) Seeds

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Abstract: In this study, the total phenol, total flavonoid content, antioxidant capacity, phenolic component and fatty acid profiles of caper seed oils extracted by solvent extraction, sonication extraction and cold press methods were revealed. Total phenol amounts of caper seed oils extracted by cold press, sonication and solvent systems were recorded as 0.10, 0.11 and 0.16 mg GAE/100 g, respectively. There was no statistically significant differences between the total phenol values of caper seed oils provided by sonication and cold press systems ($p > 0.05$). While the flavonoid amount of the oil extracted from caper seeds by solvent extraction system is determined as 358.9 mg CE/100 g, the total flavonoid amounts of caper seed oils extracted by sonication and cold pressing methods were established as 194.6 and 83.9 mgCE/100 g, respectively. The highest antioxidant capacity was established in the oil provided by solvent extraction (1.456%), followed by ultrasonic extraction (1.453%) and cold press oil (1.448%) in decreasing order. The dominant phenolic components of caper seed oils were quercetin, kaempferol, gallic acid, resveratrol and catechin. The fatty acid detected at the highest value in caper oils extracted by different extraction systems was linoleic acid (61.16–62.74%), followed by oleic, palmitic and stearic acids in decreasing order. Other fatty acids were recorded at low levels. As a result, it can be said that the caper oil extracted by solvent extraction is richer in quercetin and linoleic acid.



Key words: caper, phenolic component, fatty acid, cold press, solvent, sonication

1 Introduction

Capers (*Capparis* spp.), a perennial shrub plant of the Mediterranean Basin, have been reported to grow spontaneously in some regions of Southeastern Anatolia, Middle East, Black Sea, Marmara and Mediterranean regions^{1, 2)}. Commonly used caper names in Türkiye are beriberi, bubu, çaltıdiken, Kapari, Keber, Kebere, gevil, kedi tırnağı and şebellah^{2, 3)}. Caper flower buds are widely consumed and commercialized in many Mediterranean countries due to their pungent taste and potential applications as a condiment or ingredient in foods⁴⁾. As a different consumption,

flower buds are preserved in vinegar, pickled and consumed as pickles. They have long been used in salad, pasta, meat, sauce and side dish recipes to add a pungent, spicy taste and aroma to dishes^{2, 4)}. Rodrigo et al.⁵⁾ reported that raw caper buds of Comun and Mallorquina varieties had an average of 79% moisture, 1.6% ash, 5.8% protein, 1.6% fat, 5.4% crude cellulose, 871 mg/kg Ca and 636 mg/kg Mg. They found that it contains 226 Na, 13 Fe and 21 mg/100 g P⁵⁾. Total phenol and total flavonoid contents of caper fruits collected in Bahrain were reported as 120.08 mg GAE/100 g and 39.96 mg RE/100 g, respectively⁶⁾. Caper

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seed oil can be considered a good source of polyunsaturated fatty acids. Linoleic acid was determined as 46.84% in *C. ovata* seed oils⁷⁾. Gupta and Chakraborty⁸⁾ established 21% palmitic acid, 57% oleic acid and 1% linoleic acid in caper seed oils. *C. spinosa* seed is a species rich in oil (30%). A high amount (70%) of unsaturated fat, oleic acid and linoleic acid was detected in seed oil^{7,8)}. The seed also contains high amounts of sterols. These are stigmasterol, sitosterol, campesterol and avenasterol. Caper seeds are also rich in tocopherol (vitamin E). Three isomers, α -tocopherol, γ -tocopherol and δ -tocopherol, have been identified^{7,9)}. Tili et al.⁹⁾ identified the fatty acid composition of caper seed oils by GC-MS and determined 90.09% fatty acids in caper fruit oils and reported that the dominant of these fatty acids was 9.12 octadecadionic acid (49.13%). Phenolic compounds, including flavonoids and tannins, are among the most abundant phytochemicals in the plant kingdom¹⁰⁾. They play a crucial role in providing health benefits, such as antimicrobial and antioxidant activities, that are essential for a balanced human diet^{10,11)}. The synthesis and accumulation of phytochemical compositions in plant tissues are influenced by genotype, growing environment and their interaction¹¹⁾. Cold press, which extracts the oil without any heat or chemical processes, ensures better nutritional properties of the oil and is a simple and environmentally friendly method as it does not require much energy¹²⁾. While the cold pressing process is slow and time-consuming, obtaining the oil depends on many factors such as shelling and heat conditioning of the seeds before extraction¹³⁾.

Although the possibility of obtaining more oil through the solvent extraction method shows the advantageous side of this extraction type, issues such as the high flammability of the solvent used, the high cost of the equipment, and the residue left by the solvent create problems with solvent extraction¹⁴⁾. In our literature studies, no information was found about the presence of tocotrienols. A large amount of carotenoids (lutein and β -carotene) and glucocapperin, which is in glucosinate structure, were detected in the seed oil of *C. spinosa* species¹⁵⁾. Considering the fatty acid profile and other bioactive components of caper seed oil, no study has been found that proves the bioactive properties, polyphenol contents and fatty acid profiles of oils extracted by different extraction methods. The objective of present report was to establish the total phenol, total flavonoid content, antioxidant capacity, phenolic component and fatty acid profiles of caper seed oils extracted by solvent extraction, sonication extraction and cold press methods.



Fig. 1 Ground Caper Seed.

2 Material and Methods

2.1 Material

The caper seeds were provided from caper (*Capparis ovata* Desf. var. *canescens*) fruits growing wild in Konya district. After the ripe caper fruits were collected, the seed pulp inside was washed on a colander and the seeds were separated from the pulp. The obtained wet seeds were immediately dried outdoors under the sun. After the caper seeds were ground, their moisture content was determined. Caper seeds have a moisture of 6.65%.

2.2 Methods

2.2.1 Obtaining oils from caper seeds

After the caper seeds were ground (Fig. 1), the seed oils were obtained by sonication (60 min.), cold press and solvent extraction methods.

2.2.2 Oil extraction methods

2.2.2.1 Obtaining oil by solvent extraction

Ground caper seed samples were weighed as 10 g and added to the Soxhlet cartridge. Each cartridge was placed separately in the Soxhlet extractor. Petroleum ether (250 mL) equal to 2/3 of the flask was added and put in the Soxhlet. The extraction process was carried out for 6 hours at 50°C by operating in the Soxhlet system. By taking the results, the % fat content was calculated.

2.2.2.2 Oil extraction by sonication extraction

Caper seeds were divided into three separate groups and each group was weighed into a cartridge of 10 g of ground caper powder and each cartridge was placed in separate balloons (250 mL) after its mouth was closed with oil-free cotton. Then, after adding 200 mL of petroleum ether, the balloon was placed in the sonication device (Bandelin Sonorex) and sonicated for 60 minutes.

2.2.2.3 Oil extraction by cold press

Cold press is a screw press that operates at variable speed with a 220-240 volt motor and its capacity is to process 1-12 kg of seeds per hour. Caper seeds were slowly

placed into the press in the chamber of the device at a certain constant speed. The press outlet head was heated to 75-80°C before extraction and the caper seeds. Cold press oil extraction was achieved by direct pressing of the seeds. Each group (500 g) of caper seeds, divided into three separate groups, was slowly manually poured into the seed chamber of the press and the oil was obtained.

2.2.3 Extraction process of oils for analysis

After 1 mL of hexane was stirred with 1 mL of oil obtained from ground caper seeds, 5 mL methanol/water (MeOH/H₂O, 60:40, v/v, pH 2) was added to solution. It was vigorously stirred for 2 minutes. Then, after the mixture was centrifugated (Hermle Z-200A) for 5 minutes at 6000 rpm, the supernatant part (methanol extract) was separated, and 2 mL hexane and 10 mL methanol/water (MeOH/H₂O, 60:40, v/v, pH 2) was added to solution. It was vortexed for 2 minutes and then centrifuged at 6000 rpm for 5 minutes. The lower phases were collected and the same process was repeated once more, and the lower phases were evaporated¹⁶⁾.

2.2.4 Moisture content

The moisture (%) of caper seeds was determined with a Kern Dbs 60-3 infrared moisture analyzer¹⁷⁾.

2.2.5 Determination of fatty acid composition

After oil samples (100 mg) were converted to fatty acid methyl esters (FAME), the fatty acid compositions of these methyl esters were identified with a Shimadzu GC-2010 gas chromatography device¹⁸⁾. The samples were injected into a gas chromatographic system (Shimadzu GC-2010) equipped with a capillary column (Tecnocroma TR-CN100, 60 m × 0.25 mm, film thickness: 0.20 µm) and flame-ionization detector (FID). The injection block and detector temperature was set at 250°C and 280°C and nitrogen was used as a mobile phase at 1.6 mL/min flow rate. The total flow rate was 80 mL/min whereas the split rate was 1/40. Column temperature was set as 120°C for 5 minutes followed by an increment of 4°C/min until reached 240°C where it was held for 25 min. The identification of fatty acid methyl esters was done by comparing the retention time of the samples with those of the standards.

2.2.6 Antioxidant activity

Antioxidant activities of the oil samples were determined by using 2,2-diphenyl-1-picrylhydrazyl (DDPH) according to the study defined by Lee et al.¹⁹⁾. After 0.1 mL of extract was stirred with 2 mL of DDPH solution, the solution was stored in the dark for 30 minutes, and then, the absorbance was read at 517 nm.

2.2.7 Total phenolic content

Total phenol amounts of oils were defined using the Folin-Ciocalteu chemical based on the report stated by Yoo et al.²⁰⁾. After pretreatments, the absorbance of sample was recorded at 750 nm. Data are given as mg GAE/100 g weight.

2.2.8 Total flavonoid content

Total flavonoid amounts of the oils provided by different extraction systems were stated according to the method specified by Dewanto et al.²¹⁾. After extracts were diluted with distilled water, 5% NaNO₂, 10% AlCl₃, 10% AlCl₃ and 1.0 M NaOH solutions were added to each test tube. The absorbance was measured at 510 nm. Data were expressed as mg CE/g(dw).

2.2.9 Determination of phenolic components

Chromatographic separation of phenolic compounds was determined by HPLC (Shimadzu LC 10A VP, Kyoto, Japan) equipped with a PDA detector (Shimadzu SPD-M20 A Diode Array Detector) and an Inertsil ODS-3 (5 µm; 4.6 mm i.d. × 250 mm) column. The mobile phase was a mixture of 0.05% acetic acid in water (A) and acetonitrile (B) with the flow rate of 0.85 mL/min at 40°C. The injection volume was 20 µL. The phenolic component profile of caper seed oil was identified using high-performance liquid chromatography (HPLC) at 280 and 330 nm. The elution programme was employed: 0-0.10 min 8% B; 0.10-2 min 10% B; 2-27 min 30% B; 27-37 min 56% B; 37-37.10 min 8% B; 37.10-45 min 8% B. The total running time per sample was 60 min. PC running Class VP chromatography manager software (Shimadzu, Japan) was used as software.

2.3 Statistical analysis

The Tukey multiple comparison test was used to interpret the data obtained as a result of the research. The data were subjected to analysis of variance (ANOVA). The averages of the main sources of variation whose differences were found to be statistically significant. The results obtained are given with their mean values and standard deviations. The analyzes carried out in the study were carried out in three repetitions.

3 Results and Discussion

3.1 Bioactive properties of caper oils extracted by different extraction methods

Total phenol, total flavonoid amounts and antioxidant capacities of caper seed oils extracted by different extraction systems are depicted in **Table 1**. While the total phenol amounts of caper seed oils vary between 0.10 (sonication extraction) and 0.16 mg GAE/100 g (solvent extraction), the total flavonoid amounts of the oil samples were characterized to be between 83.9 (cold press) and 358.9 mg CE/100 g (solvent extraction). The total phenolic quantities of the oil samples were close to each other. The total phenol amount of caper seed oil extracted by solvent extraction had the highest average value with 0.16 mg GAE/100 g. Similar results were observed in oil extracted by sonication extraction and cold pressing, with 0.10 and 0.11 mg GAE/100 g results, respectively. In general, the

Table 1 Bioactive properties content of caper seeds and bioactive properties of oils obtained by different extraction methods.

Extraction systems	Total phenolic content (mg GAE/100 g)	Total flavonoid content (mg CE/100 g)	Antioxidant activity (%)
Solvent extraction	0.16 ± 0.09*	358.9 ± 12.88 A**	1.45 ± 0.01*
Ultrasonic extraction	0.10 ± 0.05	194.6 ± 30.51 B**	1.45 ± 0.002
Cold press extraction	0.11 ± 0.05	83.9 ± 3.57 C**	1.44 ± 0.00

* $p > 0.05$, ** $p \leq 0.01$ **Table 2** Phenolic components of caper seed oils extracted by different extraction methods*.

Phenolic compounds (mg/100 g)	Cold press	Solvent Extraction	Ultrasonic Extraction
Gallic acid	4.48 ± 1.59	1.84 ± 1.60	4.05 ± 2.12
3,4-dihydroxybenzoic acid	0.71 ± 0.42	0.86 ± 0.77	0.49 ± 0.51
Catechin	2.93 ± 2.62	2.12 ± 1.21	4.10 ± 3.07
Caffeic acid	0.43 ± 0.22	0.48 ± 0.32	0.35 ± 0.13
Syringic acid	0.54 ± 0.19	0.77 ± 0.58	1.58 ± 0.05
Rutin	1.5 ± 0.33	1.39 ± 0.33	1.07 ± 0.18
<i>p</i> -Coumaric acid	0.13 ± 0.08	0.24 ± 0.15	0.39 ± 0.18
Ferulic acid	1.14 ± 0.21	0.98 ± 0.46	0.74 ± 0.59
Resveratrol	2.89 ± 0.95	2.83 ± 0.57	2.16 ± 0.95
Quercetin	9.16 ± 3.41	9.85 ± 5.56	18.28 ± 2.74
Cinnamic acid	0.69 ± 0.58	1.65 ± 0.24	2.55 ± 1.37
Kaempferol	5.43 ± 3.59	7.48 ± 2.95	9.30 ± 6.45

* It was not found to be statistically significant.

possible reason why total phenol, flavonoid amounts and antioxidant capacity results are high in caper oils obtained by solvent extraction method may be due to the transfer of a significant part of the phenolic components in the caper seed into the oil. The obtained flavonoid values were established to be statistically significant ($p < 0.01$). Considering these values, the lowest amount of flavonoids was observed in the oil obtained by cold pressing with 83.9 mg CE/100 g, followed by ultrasonic (194.6 mg CE/100 g) and solvent extraction (358.9 mg CE/100 g) in increasing amounts. The highest flavonoids determined in caper seed samples prepared with methanol are caperirutin, quercetin 3-O-glucoside, quercetin 3-O-glucoside-7-O-rhamnocyte, and caperirutin and quercetin are the flavonoids of caper with the highest antioxidant effect⁷. The main flavonoids found in capers are rutin, quercetin and catechin^{23, 24}. In a previous study, the antioxidant activity values of refined sunflower oil, refined corn germ and extra virgin olive oils were determined as 7.492, 41.173 and 68.143%, respectively²². It has been observed that the total flavonoid amount of caper oil extracted by solvent extraction process is higher than other extraction methods. If caper seed oil for flavonoid

quantities will be used, it would be better to choose the solvent extraction method. There is not much numerical difference between the antioxidant capacity values of caper seed oils obtained by different extraction systems. While the antioxidant capacity value of caper seed oil was highest in the oil obtained by solvent and ultrasonic methods, the lowest was detected in the oil obtained by cold pressing. In addition, caper fruit has been shown to be a good source of antioxidant compounds⁶. The extraction systems greatly affected the content of phenolics and antioxidant capacity of the seed oil with Soxhlet system scored higher values of the parameters than cold press method. The high level of phenolics makes seeds of caper plants a good natural source of these compounds with a possible dietary industrial and pharmaceutical utility²⁵.

3.2 Phenolic components of caper oils obtained by different systems

Phenolic component of caper seed oils extracted by different extraction systems are displayed in **Table 2**. In general, the dominant phenolic profiles of caper seed oils were quercetin, kaempferol, gallic acid, catechin and res-

Table 3 Fatty acid composition (%) of caper seed oils extracted by different extraction methods.

Fatty acids (%)	Cold press	Solvent Extraction	Ultrasonic Extraction
Myristic	0.11 ± 0.004	0.13 ± 0.01	0.11 ± 0.02
Palmitic	8.48 ± 0.15	9.47 ± 0.60	8.82 ± 0.64
Stearic	2.52 ± 0.007	2.66 ± 0.05	2.55 ± 0.03
Oleic	24.1 ± 0.02	24.37 ± 0.19	23.77 ± 0.016
Linoleic	62.74 ± 0.02*a	61.16 ± 0.28*b	62.62 ± 0.40*a
Arachidic	0.50 ± 0.04	0.52 ± 0.03	0.48 ± 0.03
Linolenic	0.95 ± 0.01**B	1.04 ± 0.01**A	1.05 ± 0.004**A
Behenic	0.58 ± 0.04	0.62 ± 0.02	0.56 ± 0.04

* $p > 0.05$, ** $p \leq 0.01$

veratrol. In general, the highest increase in caper oil obtained by ultrasonic extraction method was observed in catechin, syringic acid, *p*-coumaric acid, quercetin, cinnamic acid and kaempferol, while the phenolic components that increased the most in caper oils provided by other extraction methods were quercetin, kaempferol, catechin and *p*-coumaric acid. Although there are differences in the amounts of some components, the phenolic component amounts of caper seed oils provided by cold press and solvent extraction systems were found to be similar. The high amount of phenolic profiles in caper seed oil provided by sonication extraction may be due to the breakage and release of cell walls containing bound phenolic components during the sonication process. While the gallic acid values of the oils provided by cold press, solvent and sonication extraction systems of the caper seed sample varied between 1.84 (solvent extraction) and 4.48 mg/100 g (cold press). In addition, the catechin amounts of the oil samples ranged from 2.12 (solvent extraction) to 4.10 mg /100 g (ultrasonic extraction). The resveratrol and kaempferol values of caper seed oils were determined between 2.16 (sonication extraction) and 2.89 mg/100 g (cold press) to 5.43 (cold press) and 9.30 mg/100 g (sonication extraction), respectively. The quercetin amounts detected in caper seed oils were specified to be between 9.16 (cold press) and 18.28 mg/100 g (sonication extraction). In previous studies, the amounts of kaempferol and quercetin in chia seed were found to be between 0.0057 and 0.0435 mg/g to 0.0181 and 0.209 mg/g, respectively^{26, 27}. The rutin amounts of caper oils were characterized to be between 1.07 (sonication extraction) and 1.5 mg/100 g (cold press). The highest levels of cinnamic acid (12.55 mg/100 g) and syringic acid (1.58 mg/100 g) were established in caper seed oil extracted by sonication extraction. Gallic acid, protocatechuic acid, chlorogenic acid, catechin hydrate, ferulic, rutin hydrate, naringin, myricetin, hesperitin, luteolin, flavonose, 05.55-7.10 quercetin, and coumarin amounts of *Capparis spinosa* seeds collected from five different regions in

Tunisia were assessed to be between 2.72-8.62, 1.43-14.94, 1.23-4.62, 12.77-21.54, 1.76-3.22, 0.62-1.85, 0.57-13.56, 1.65-3.39, 0.88-2.88, 0.99-1.34, 0.42-3.25, 05.55-7.10 and 1.01-21.40%, respectively²⁸. The caffeic acid value was found to be 6.78 mg/100 g in raw caper buds³. In light of this information, the amount of caffeic acid is the least in the seed oil, while it is more in the bud. It was revealed that the amount of *p*-coumaric acid in caper seed oil had the lowest value with 0.13 mg/100 g, and the amount of quercetin had the highest value with 18.28 mg/100 g. According to the results obtained, the highest amount of phenolic component in caper seed oil (18.28 mg/100 g) was quercetin detected in the oil provided by sonication extraction system. Considering the lowest value, although the values are generally close to each other, the amount of *p*-coumaric acid (0.13 mg/100 g) was determined in caper oil obtained by cold pressing method. If it is thought to isolate quercetin from phenolic components, the extraction of caper seeds by ultrasonic extraction method would be the right choice.

3.3 Fatty acid composition of caper seed oil extracted by different extraction systems

The fatty acid profiles of caper seed oils extracted by cold press, solvent and sonication extraction applications are displayed in **Table 3**. Saturated fatty acids (palmitic and myristic), mono (oleic) and polyunsaturated fatty acids (linolenic, linoleic, arachidonic) were established in caper oils extracted by cold press, solvent and sonication extraction applications (**Fig. 2**). Myristic acid content of caper seed oil extracted by cold press, solvent and sonication extraction systems were 0.11%, 0.13% and 0.11%, respectively. According to these results, while the same value was obtained in cold press and sonication extractions, a higher value of 13% was determined in solvent extraction, although there was not much difference. While the palmitic acid values of caper oils extracted by cold press, solvent and sonication extraction systems are recorded to be between 8.47 (cold

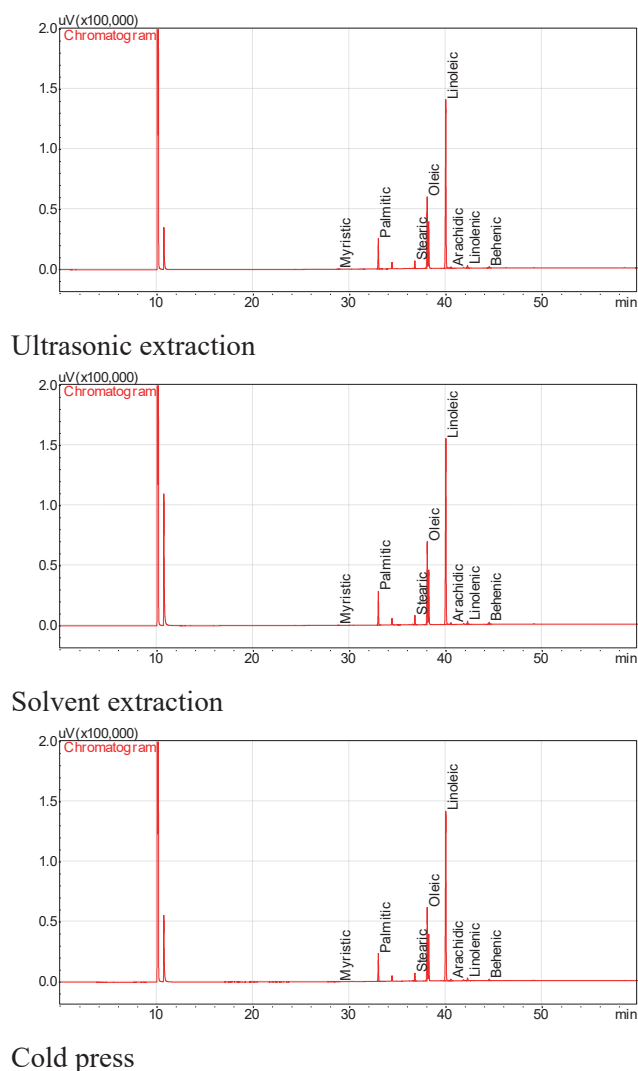


Fig. 2 Fatty acid chromatograms of caper seed oils.

press) and 9.47% (solvent extraction), the stearic acids of the oil samples were specified to be between 2.52 (cold press) and 2.66% (solvent extraction). While the linoleic acid values were identified to be between 61.16 (solvent extraction) and 62.74% (cold press), the oleic acid content of the oil samples were defined to be between 23.37% (ultrasonic extraction) and 24.37% (pre-cold). Additionally, caper seed oils contained between 0.95 (cold press) and 1.09% (ultrasonic extraction) of linolenic fatty acid. The highest arachidonic and behenic acids were established in the oil extracted by solvent extraction. In general, the highest fatty acids in caper oils were established in oil extracted by solvent extraction system, followed by cold press and sonication extraction systems in decreasing order. This may be due to the fact that all the lipids in the seed are extracted with solvent. The dynamic fatty acid composition of the oils provided by sonication extraction method may be due to the low oil release due to the soni-

cation process not breaking down the seed cell walls sufficiently. Linoleic acid, one of the polyunsaturated fatty acids, was established to be statistically significant ($p > 0.5$). Linoleic acid was obtained as 62.74% in caper seed oil extracted by cold pressing. In solvent extraction, it has a value of 61.16%. In the ultrasonic process, the amount of linoleic acid was obtained as 62.62%. The highest linoleic acid value of 62.74% was obtained by the cold press method. Caper seed oil can be considered a good source of polyunsaturated fatty acids. Linoleic acid was determined as 46.84% in *C. ovata* seed oils⁷. Gupta and Chakraborty⁸ detected 21% palmitic acid, 57% oleic acid and 1% linoleic acid in caper seed oils. In addition, Özcan and Akgül²⁹ found 13.2% and 11.3% palmitic, 4.6 and 1.8% palmitoleic, 3.2% and 2.7 stearic in *Caparris spinosa* and *Caparris ovata* caper seed oils, respectively. They identified 49.87% and 34.66% oleic, 25.2% and 24.5% linoleic, and 1.0 and 0.3% linolenic fatty acids. The fatty acid components of the caper oil were determined as 11% linoleic, 21% palmitic and 57% oleic³⁰. Tlili et al.⁹ identified the fatty acid composition of caper seed oils with GC/MS and determined 90.09% of the fatty acids in caper seed oils and reported that the dominant of these fatty acids was 9.12 octadecadionic acid (49.13%). According to another study, *C. spinosa* and *C. ovata* seed oils contained 10.23% and 8.41% palmitic, 2.61% and 2.07% stearic, 38.45% and 44.62% oleic, 23.75% and 18.26% linoleic and 1.17% and 0.56% linolenic acids³¹. It can be said that *Capparis spinosa* seed oil has a seed rich in unsaturated fatty acids and is a good source of nutraceutical compounds³². When the results obtained were compared with literature data, although there were major changes in some dominant fatty acids (oleic and linoleic), minor differences were observed in others. The differences in linoleic acids of tested caper seed oils were similar to the results of the study conducted by Tlili et al.⁹. Tlili et al.⁹ reported that linoleic fatty acid in *C. spinosa* seed oil was more than 20%. The possible reason why our results differ from literature data may be due to harvest time, type of extraction and solvent used, and some analytical conditions. These results draw attention to the use of caper seed oil, which is rich in polyunsaturated fatty acids, for food industry purposes. According to our results, the fatty acid profile of seed oils could be changed according to genetic, cultivation, harvesting and process conditions for analysis. The synthesis and accumulation of phytochemical compositions in plant tissues are influenced by genotype, growing environment and their interaction¹¹.

4 Conclusion

In this study, after the caper seed oil was extracted by cold press, solvent and sonication extraction systems, the

effect of the extraction methods on the bioactive properties, phenolic components and fatty acids of these oils was determined. The highest total phenol, total flavonoid contents and antioxidant capacities were established in caper oils provided by solvent extraction method. The highest total phenol value (0.16 mg GAE/100 g) was obtained by the solvent extraction method. Solvent extraction also has the highest value in terms of total flavonoid amount. It was determined that the total antioxidant value was the same as ultrasonic, but it was still at the highest level. The lowest total phenol, total flavonoid and total antioxidant capacities were found in ultrasonic extraction, cold press in descending order. Quercetin and kaempferol were the most abundant in percentage phenolic constituents. The phenolic component with the lowest percentage value was *p*-coumaric acid. When looking at the fatty acid composition, linoleic acid, which is a polyunsaturated fatty acid, has the highest value. This shows that the amount of polyunsaturated fatty acids in caper seed oil is higher than other acids. Although there were no major differences, it was observed that the content of the total flavonoid was at its highest value in the solvent extraction process.

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