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Phytochemical Research and Evaluation of Tarragon (*Artemisia dracunculus* L.) as a Food Additive

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ABSTRACT

In this study, tarragon (*Artemisia dracunculus* L.) the amount of antioxidants and phenolic substances of water-based extracts in various concentrations (25g/L, 50g/L, 100g/L) with the aroma components of the plant was determined. Various food pathogens (*Escherichia coli* ATCC 25922, *Salmonella enterica* ATCC 13076, *Listeria monocytogenes* ATCC 43251) and bacterial strains ((Gram-negative (*Vibrio harveyi* (KF443058), *Vibrio vulnificus* (KF443056), *Aeromonas veronii* (KF443053), *Vibrio anguillarum* (NR 029254.1) *and Vibrio campbellii* (MH231447.1), *Vibrio rotiferianus* (NR 042081.1), *Vibrio ponticus* (NR 029032.1), *Psychrobacter marincola* (NR 025458.1), *Pseudoalteromonas prydzensis* (NR 044803.1), *Pseudoalteromonas mariniglutinosa* (NR 028992.1) and Gram-positive *(Bacillus thuringiensis* (NR 043403.1)) obtained from naturally infected *Dicentrarchus labrax* fish were determined by the disk diffusion method on their antimicrobial properties. As a result of the study, antioxidant values were found to be 88.5% at maximum concentrations of 10%, while the total phenolic substance content was determined between 3.75-5.06 mg GAE/g values. The main component of the tarragon plant was terpinyl acetate (23.16%), followed by α-terpineol (20.08%), anethole-(Z) (8.93%), limonene (5.20%), spathulenol (4.47%), ısoeugenol (3.73%), valeric acid (3.40%), eucalyptol (3.26%). No antimicrobial activity was determined on the test microorganisms used in the study.

Keywords: *Artemisia dracunculus*, Aromatic ingredient, Antioxidant, Phenolic substance, Food additive

Tarhun (*Artemisia dracunculus* L.)'un Fitokimyasal Araştırması ve Gıda Katkı Maddesi Olarak Değerlendirilmesi

ÖZ

Bu çalışmada, tarhun (*Artemisia dracunculus* L.) bitkisinin aroma bileşenleri ile çeşitli konsantrasyonlarda (25g/L, 50g/L, 100g/L) su bazlı ekstraktlarının antioksidan ve fenolik madde miktarı tespit edilmiştir. Çeşitli gıda patojenleri (*Escherichia coli* ATCC 25922, *Salmonella enterica* ATCC 13076, *Listeria monocytogenes* ATCC 43251) ve doğal olarak enfekte olmuş *Dicentrarchus labrax* balıklarından elde edilen bakteri suşlarının ((Gram-negatif (*Vibrio harveyi* (KF443058), *Vibrio vulnificus* (KF443056), *Aeromonas veronii* (KF443053), *Vibrio anguillarum* (NR 029254.1) *and Vibrio campbellii* (MH231447.1), *Vibrio rotiferianus* (NR 042081.1), *Vibrio ponticus* (NR 029032.1), *Psychrobacter marincola* (NR 025458.1), *Pseudoalteromonas prydzensis* (NR 044803.1), *Pseudoalteromonas mariniglutinosa* (NR 028992.1) ve Gram-positive (*Bacillus thuringiensis* (NR 043403.1)) üzerinde antimikrobiyal özellikleri disk difüzyon yöntemi ile belirlenmiştir. Çalışma sonucunda antioksidan değerler maksimum %10 konsantrasyonda %88,5 olarak bulunurken, toplam fenolik madde içeriği 3,75-5,06 mg GAE/g değerleri arasında belirlenmiştir. Tarhun bitkisinin esas bileşeninin Terpinyl acetate (%23,16) olduğu bunu α-Terpineol (%20,08), Anethole-(Z) (%8,93), Limonene (%5,20), Spathulenol (%4,47), Isoeugenol (%3,73), Valeric acid (%3,40), Eucalyptol'un (%3,26) takip ettiği gözlenmiştir. Çalışmada kullanılan test mikroorganizmaları üzerinde herhangi bir antimikrobiyal aktivite belirlenmemiştir.

Anahtar Kelimeler: *Artemisia dracunculus*, Aromatik bileşen, Antioksidan, Fenolik madde, Gıda katkı maddesi

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1. Introduction

Tarragon (*Artemisia dracunculus* L.), known as a subspecies of the Asteraceae (daisy) family is a perennial aromatic plant and natural food additive (Figure 1, (URL-1)). This plant, which has a characteristic aroma and specific biological activity, is grown in Bayburt, Erzurum, Gaziantep and Şanlıurfa in our country.

Figure 1. Tarragon (*Artemisia dracunculus* L.) plant, (URL-1)

Due to its rich aromatic component content, it is common to use dried in the food sector to add smell and taste to food. Dried tarragon has 24% protein, 45% carbohydrates, 7% fat and 7% fiber. It also contains various minerals, small amounts of vitamin A and some B vitamins (Yaichibe et al., 1997; Attokaran, 2011; Nurzyńska-Wierdak and Grażyna, 2014; Bahmani et al., 2018). As a result of its rich content, it is known that tarragon plant has anti-inflammatory, antidiabetic, antiseptic activities and is also effective in insomnia, allergic rashes and dermatological treatments. In the studies conducted, it has been stated that the extracts of the plant reduce inflammation in the human skeletal muscular system, improve insulin sensitivity and have a strong healing effect in the treatment of muscle loss and obesity due to old age (Obolskiy et al., 2011; Kirk-Ballard et al., 2014; Vandanmagsar et al., 2014; Karaman and Sezgin, 2022).

Free radicals are highly reactive molecules that carry unpaired electron pairs and react with lipids, proteins and nucleic acids, causing toxic effects in the cell (Berger, 2005; Valko et al., 2006). Free radicals can cause cell death and permanent oxidative damage in the body by damaging the basic components (protein and lipid) in the cell membrane and DNA, the genetic material in the nucleus. Free radicals are among the causes of many diseases such as cancer, heart diseases, diabetes, down syndrome (Karabulut and Gülay, 2016; Gürdal, 2021; Öğretmen, 2022). In order to prevent these damages caused by free radicals, we need to consume foods with antioxidant properties that contain biological regulatory, protective and nutritional properties in our daily diet.

Antioxidants are substances that prevent the formation of free radicals in the human body and in foods (Becker et al., 2004; Atoui et al., 2005; Suja et al., 2005; Kobya et al., 2021). Antioxidants, which are mainly used in the food industry to prevent food spoilage and extend its shelf life are natural or synthetic (Çağlak and Karslı, 2016). Natural antioxidants are of plant origin (such as tocopherols, phenolic compounds, ascorbic acid and carotenoids) are multifunctional organic acids. Synthetic antioxidants (BHA (Butylated hydroxy anisole), BHT (Butylated hydroxy toluene), PG (Propyl gallate) and TBHQ (Tertiary butyl hydroquinone)) are artificial, inexpensive, highly stable substances produced in the laboratory environment by imitating natural antioxidants. Synthetic antioxidants are widely used in the food industry, but recently, their potential side effects have gained suspicion, studies to test their safety have increased, and as a result, they have been found to have toxic effects (Karsli et al., 2021). In this context, researchers are working to increase the variety and number of plant-derived natural antioxidants (Kenar, 2009; Gargacı, 2010; Küçükgülmez et al., 2011; Karslı, 2020). Antimicrobial substances are also used to stop or slow down the deterioration caused by microorganisms in addition to antioxidant substances to prevent spoilage and extend shelf life in the food industry. Antimicrobial agents are substances that prevent the growth of microorganisms even with very low concentrations. The most commonly used antimicrobial agents for this purpose are

antibiotics. In time, pathogenic bacteria gain resistance to the antibiotic substance and the antibiotic substance loses its lethal effect on the microorganism. For this reason, the development of both natural antioxidants and new antimicrobial substances is gaining momentum every day (Çelebi et al., 2015; Çağlak et al., 2022).

This study was designed to determine the antioxidant capacity, phenolic content and antimicrobial activity of the aromatic components and aqueous extracts of *Artemisia dracunculus* L. plant as a natural preservative/medicinal and aromatic plant. In the study, 15 microorganisms (*Escherichia coli* ATCC 25922, *Salmonella enterica* ATCC 13076, *Listeria monocytogenes* ATCC 43251, *Staphylococcus aureus* ATCC 25923, Gram-negative; *Vibrio harveyi*, *Vibrio vulnificus*, *Vibrio anguillanifericus* ATCC 13076, *Vibrio anguillarotii*, *Vibrio anguillarotii*, *Vibrio anguillarotii*, *Vibrio veronii*, *Psychrobacter marincola*, *Pseudoalteromonas prydzensis*, *Pseudoalteromonas mariniglutinosa*, Gram-positive; *Bacillus thuringiensis* was designed for use in the form of a medicinal and aromatic plant as a natural preservative by detecting on.

2. Materials and Methods

2.1. Plant material

Tarragon plant (*Artemisia dracunculus* L.) was obtained in dried form from a private spice company in Erzurum (Figure 2). The plant specimens, consisting of leaves and stems, were stored in a glass jar at room temperature (20±2 °C) and in a way that it would not be exposed to the sun, until they were ground for study.

2.2. Extracts Preparation

The dry supplied samples were ground with a laboratory type blender (Waring) with a diameter of 1-3 mm, prepared in pure water in concentrations of 25g/L, 50g/L, 100g/L and then extracts were obtained after the treatment in the shaken incubator (IKA KS 4000İ) at 60 °C at 150 rpm so that it didn't receive light for 24 hours. The extracts obtained were filtered with Whatman filter paper No. 1 and placed in ependorf tubes and stored at -80 °C for use during the working period in a way that would not receive light.

Figure 2. The dried tarragon (*Artemisia dracunculus* L.) plant used in the study (Original image)

2.3. Bacteria used in the study

From food pathogens; *Escherichia coli* ATCC 25922, *Salmonella enterica* ATCC 13076, *Listeria monocytogenes* ATCC 43251, *Staphylococcus aureus* ATCC 2592 and from naturally infected fish *Dicentrarchus labrax* and Gram-negative (*Vibrio harveyi* (KF443058), *Vibrio vulnificus* (KF443056), *Aeromonas veronii* (KF443053) Uzun and Öğüt (2015), *Vibrio anguillarum* (NR 029254.1), *Vibrio campbellii* (MH231447.1) Yaylacı 2019, *Vibrio rotiferianus* (NR 042081.1), *Vibrio ponticus* (NR 029032.1), *Psychrobacter marincola* (NR 025458.1), *Pseudoalteromonas prydzensis* (NR 044803.1), *Pseudoalteromonas mariniglutinosa* (NR 028992.1) and Gram-pozitif (*Bacillus thuringiensis* (NR 043403.1) Uzun (2013) strains were used.

2.4. Antioxidant activity (2, 2-diphenyl-1-picrylhydrazyl (DPPH))

The radical scavenging activity of the plant extracts was tested against 2,2-diphenyl-1-picryl-hydrazyl radical following the method described by Brand-Williams (1995) with slight modification. 100 µL of each plant extract was mixed with 3.9 ml DPPH working solution in test

tubes. Then, the mixture was vortexed and the tubes were incubated in dark for 60 min. The absorbance was read at 515 nm using a spectrophotometer (Shimadzu UV-1208, Japan). A blank solution containing the same amount of methanol and DPPH was prepared and measured. All the measurements were taken in triplicate and the mean values were calculated. The radical scavenging activity was calculated using the following equation (1):

$$\%\text{inhibition} = [(A_{control} - A_{Sample}/A_{control})] \times 100 \quad (1)$$

$A_{control}$= Absorbance of control

A_{sample}= Absorbance of the sample

2.5. Determination of total phenolic content

The total phenolic content of tarragon plant was measured using the modified method of Singleton and Rossi (1965). Briefly from the stock solution of (1 mg/mL methanol) 100 µL of the extracts were made up to 3 mL with distilled water and then mixed thoroughly with 250 µL of Folin–Ciocalteu reagent for 3 min, followed by the addition of 750 µL of 20% (w/v) sodium carbonate and 900 µL distilled water. The mixture was incubated at 40 °C for 30 min in a water bath and absorbance of the reaction mixtures was measured at 760 nm. Quantification was done on the basis of the standard curve of gallic acid concentration ranging from 100 to 800 µg/ml (r^2= 0.992). Total phenolic content calculated from the calibration curve was expressed as mg of gallic acid equivalent (GAE)/g of extract.

2.6. Determination of aromatic components

Aroma compounds were isolated using the SPME procedure. A SPME holder and divinylbenzene/carboxine/polydimethylsiloxane fiber were used to retain the volatiles accumulated in the bottle. 0.1 gram of tarragon plant was weighed into a 40 mL capacity bottle and immersed for 5 minutes without SPME fiber at 50 °C, then SPME fiber was immersed for 5 minutes with continuous mixing with a magnetic stirrer, allowing the aromatic components to adhere to the fiber (Aliferis et al., 2010). Analyzes were performed on a GC–MS (Shimadzu QP2010 Ultra) instrument with a 30 m 5-Ms column. Qualitative analysis was performed using the NIST02/ NIST147 and Wiley7 libraries integrated into the instrument.

2.7. Antimicrobial screening by disk diffusion technique

The standard disk diffusion method, which was developed based on the Bauer et al. (1959), method was used to determine the antimicrobial activity. The growth of microorganisms was carried out in tubes containing Mueller-Hinton Broth (MHB). In order to activate the bacterial cultures, the cultures taken from the bacterial stocks with the help of loop a were cultivated on Mueller-Hinton Agar (MHA) media by scratching method and incubated at 37 °C for 24 hours. Bacteria taken from pure cultures that grew after 24 hours were standardized by adjusting the bacterial density of 10^8 CFU/ml in glass tubes according to McFarland 0.5. A sterile swab was dipped into the adjusted bacterial suspension and mixed, and this swab was sown on the surface of the petri dish with Mueller-Hinton Agar (MHA) by frequently scanning it in 3 different directions. All petri plates were then left to dry at room temperature for 5-15 minutes. On the other hand, sterile discs with a diameter of 6.25 mm (Whatman 2017- 009) were impregnated with 15 µL of plant extracts under aseptic conditions. 4-6 sterile discs impregnated with the extract were carefully placed on the petri dish. Plates in which bacteria were inoculated were incubated for 24 hours at 37 °C. At the end of the period, the diameters of the inhibition zones around the discs (including 6.25 mm disc) were measured with the help of a digital caliper and the results were reported.

2.8. Statistical Analysis

Results were expressed as the means and standard deviations. Statistical comparisons between extracts were performed with variance (ANOVA) and the TUKEY test. Differences were considered significant at $P<0.05$. Statistical analyses were conducted using JMP 5.0.1 (SAS Institute, Inc.,

Cary, NC, USA) software. All tests were performed in triplicate (Sokal and Rohlf, 1987).

3. Results and Discussion

3.1. Antioxidant Activity

The results of the 25g/L, 50g/L, 100g/L extracts of the tarragon plant with the DPPH method regarding the antioxidant capture capacity and the total amount of phenolic substances are shown in Figure 3 and Figure 4.

According to the findings, the highest value was found at 10% (88.5±1.1%) and the lowest 2.5% (76.8±4.3%) concentrations in aqueous concentrations of 2.5%, 5% and 10%, in which DPHH radical scavenging activity was investigated. According to the results, when the low antioxidant activity value at 2.5% concentrations was examined statistically, it was determined that the difference from the other groups was significant ($P<0.05$). Bayramoğlu (2009) compared the antioxidant potentials of essential oils of Artemisia and Salvia species according to the DPPH method. In the study, the highest scavenging potential of DPPH radical was observed in Salvia essential oil with 83.712±0.408 inhibition according to the % inhibition values of the species. The % inhibition value of Artemisia essential oil was determined as 82.175±0.366. When the DPPH radical scavenging effect of the obtained essential oils was compared with the positive controls (BHT and ascorbic acid), it was determined that the positive controls were weaker than the oils in scavenging this radical. Singh et al. (2009) in their study, examined the results of the antioxidant activity of essential oils of Artemisia species. 146.3 µg/ml IC50 for *A. scoparia* in the DPPH method; They found values of 145.2 µg/ml IC50 in the deoxyribose method and 270.1 µg/ml IC50 in the hydrogen peroxide method. When the findings were examined, they reported that *A. scoparia* was rich in monoterpenoids and exhibited antioxidant activity, exhibiting antioxidant activity, and was ideal for use in the food and pharmaceutical industry.

The antioxidant activity values of our study, which are in parallel with these studies, have proven that *Artemisia dracunculus* belonging to the *Artemisia species* has antioxidant potential in various aqueous concentrations. It has also been observed that antioxidant activity increases depending on the concentration. It was observed that this increase was especially evident above the concentration of 2.5%.

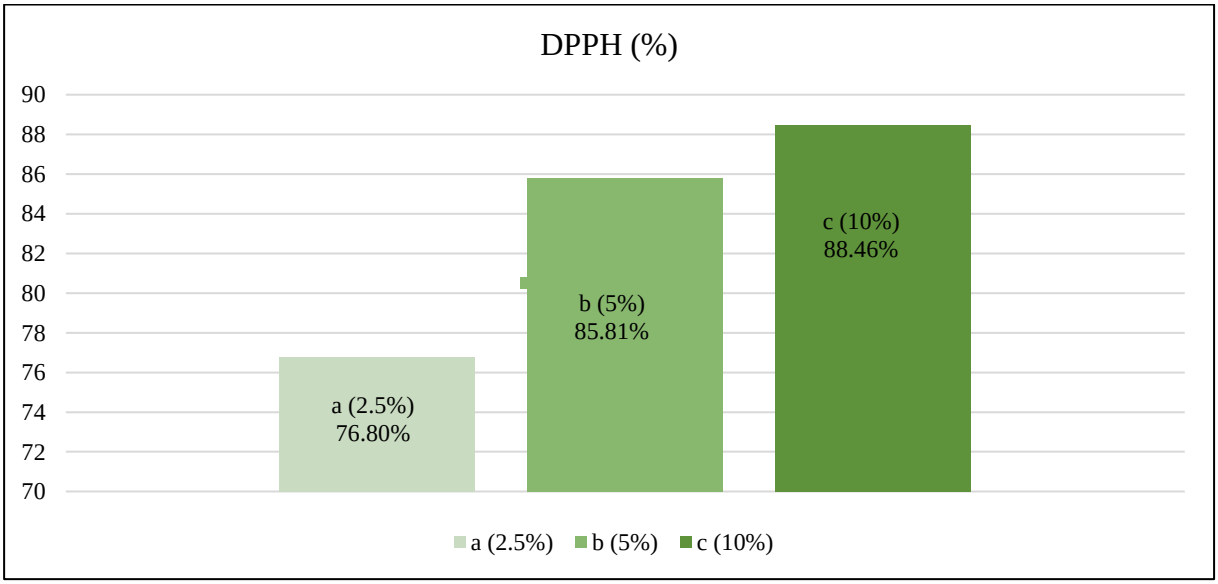

Figure 3. *Artemisia dracunculus* L. total phenolic content (mg GAE/g) (a: 2.5%, b: 5% and c: 10% concentration)

3.2. Total Phenolic Content

The amounts of phenolic substances in mg GAE/g were found to be 3.75 mg GAE/g, 4.46 mg GAE/g, 5.06 mg GAE/g in 2.5%, 5%, and 10% aqueous extracts, respectively (Figure 4). When the results of the obtained phenolic substance amount were examined, it was determined that the statistical difference depending on the concentration amount was significant ($P<0.05$). In the study conducted by Hamurcu (2016) on the antioxidant activity and the amount of phenolic substance in the stem and leaf parts of the tarragon plant in different drying (room temperature, microwave, infrared and oven) and different solvents (acetone:water, methanol:water and ethanol:water, 80% concentration), the highest value in the amount of phenolic substance was determined as 71.2 mg GAE/g in acetone extracts of plant leaves dried at room temperature, and the highest (37.55 mg) and lowest (4.67 mg) values in the amount of phenolic substance were in tarragon stems. In this study, the phenolic content of tarragon leaves means that it changes depending on its shape. In addition, in samples using methanol as solvent, 14.7627-18.9906 mg GAE/g in samples using ethanol 30.5622-55.2135 mg GAE/g in samples using acetone it was stated that the amount of 37.2134-71.2139 mg GAE/g phenolic substance.

Bahramikia et al. (2008) found the amount of phenolic substance in the extracts obtained using *A. dracunculus* leaves and ethanol as 49±4.2 mg GAE/g, while Gawlik-Dziki (2012) the total phenolic content in the aqueous extract of *A. dracunculus* was 1.02±0.05 mg GAE/ml reported. In another study, they investigated the total phenolic content of the essential oil obtained from the *A. dracunculus* plant by steam distillation and determined the total phenolic content as 0.451 mg GAE/g using the Folin-Ciocalteu method (Fildan et al., 2019). When the literature is examined, it is seen that the antioxidant activity and the number of phenolic substances of the tarragon plant vary depending on the parts of the plant, the drying method of the plant, the type of solvent and the concentration of the extract. When the data obtained in light of this information were examined, it was predicted that the phenolic substance amounts of the study revealed similar data with other studies, and the differences observed were due to the reasons explained.

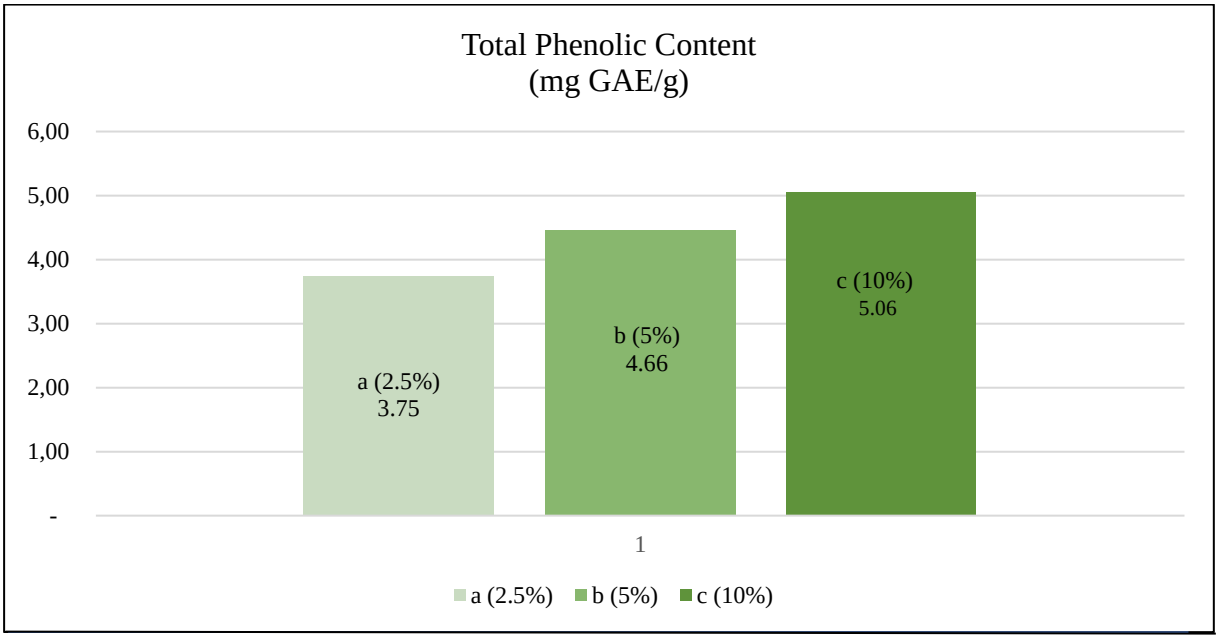

Figure 4. *Artemisia dracunculus* L. total phenolic content (mg GAE/g) (a: 2.5%, b: 5% and c: 10% concentration)

3.3. Antimicrobial activity

In the study conducted on 15 microorganisms in order to reveal the antimicrobial activity of the concentrations of the aqueous extracts (2.5%, 5% and 10%) obtained from the tarragon plant, it was observed that no significant antimicrobial property was observed. Dülger et al. (1999) tried to determine the antimicrobial activities of ethyl acetate, acetone, chlorophome and ethanol extracts prepared from *Artemisia absintium* L. on 45 test microorganisms by disk diffusion method. As a result of the study, it was stated that while acetone and ethanol extracts had an effect on *Listeria monocytogenes*, no zone formation was observed in chloroform and ethylacetate extracts, while all extracts (acetone, chloroform, ethyl acetate, ethanol) showed antimicrobial effects on *Bacillus thuringiensis*. Benli et al. (2006) investigated the antimicrobial properties of chloroform, acetone and two different methanol extracts of *Artemisia dracunculus*. They stated that chloroform and acetone extracts were more effective than methanol extract. In the study, chloroform and acetone extract was found to be effective only against *Pseudomonas aeruginosa*, methanol extract dissolved with 10 ml of water *Shigella* sp., *Listeria monocytogenes*, *P. aeruginosa*, and methanol extract dissolved with 5 ml *Escherichia coli* (RSHI, ATCC 25922), *L. monocytogenes* (ATCC 7644), *P. aeruginosa* (ATCC 27853) revealed that they formed the counterzone. There are differences between the literature research data and the data of this study, which is explained by the fact that the solvent differences used in the studies have different effects in terms of antimicrobial properties. It is thought that the antimicrobial effect of solutions using water as a solvent is less effective than other solvents, due to the fact that other solvents are better.

3.4. Aromatic components

The aromatic component analysis results of *Artemisia dracunculus* L. plant are given in Table 1. A total of 38 aromatic components were detected in the tarragon plant. Among these components, the main component was Terpinyl acetate (23.16%), followed by α-Terpineol (20.08%), Anethole-(Z) (8.93%), Spathulenol (4.47%), Limonene (5.20%), Isoeugenol (3.73%), Valeric acid (3.40%), Eucalyptol (3.26%), α-pinene (1.21%). Kordali et al. (2005) have defined 30 components in essential oil isolated from Turkish tarragon (*Artemisia dracunculus*) by hydrodistillation. The dominant components in the oil they analyzed by GC/MS (Z)-anethole (81.0%), (Z)-beta-ocimene (6.5%), (E)-beta-ocimene (3.1%), limonene (3.1%) and methyleugenol (1.8%) reported that. Chaleshtori et al. (2013), *Artemisia dracunculus* L. in their study examining the main components of essential oil methyl chavicol (84.83%), trans-ocimene (3.86%), z-β-ocimene (3.42%), limonene (1.79%) and α-pinene (0.57%) revealed their items. In addition, the majority of the compounds in the essential oil were monoterpene hydrocarbons (95.90%) and the lowest levels of sesquiterpene hydrocarbons (0.46%) stated that the main compound was methyl chavicol, the double bonded isomer of anethole. In the determination of the components (GC)/(MS) of the essential oil obtained from *Artemisia dracunculus* L. (Asteraceae) plant, which is used orally as an antiepileptic drug in Iranian public health, the main component is trans-anethole (21.1%), α-trans-oximen (20.6%), limonene (12.4%), α-pinene (5.1%), allo-okimene (4.8%), methyl eugenol (2.2%), β-pinene (0.8%), α-terpinolene (0.5%), bornyl acetate (0.5%) and bicyclogermaren (0.5%) and that the anticonvulsant and sedative effects of *A. drancunculus* may be related to the presence of monoterpenoids in the essential oil (Sayyah et al., 2004). Research conducted in the food industry in the last few years, along with the traditional uses of α-terpineol for aroma and fragrance purposes, has reported that it has multiple biological properties (antioxidant, anti-inflammatory, anticonvulsant, antimicrobial, anticarcinogenic, etc.) associated with it (Bicas et al., 2010; Molina et al., 2019). According to recent studies, another component with antioxidant, anti-inflammatory and anti-obesity properties, which is also important in terms of cosmetics and medicine, is anethole-(Z), which is widely used in the food, perfume and pharmaceutical industries due to its sweet aroma and aromatic smell (Aprotosoaie et al., 2016). The therapeutic effects of limonene, one of the most common terpenes in nature, have been extensively studied and its anti-inflammatory, antioxidant, antinociceptive, anticancer, antidiabetic, antihyperalgesic,

antiviral and gastroprotective effects have been proven. It also has a lemon-like odor, making it widely used as a flavor and fragrance additive in common foodstuffs such as juices, candies, chewing gums, soft drinks and ice creams. Limonene is one of the most common and inexpensive fragrances used in cosmetic formulation and can be found in many beauty products such as soaps, perfumes, shampoos, conditioners, and shower gels (Filipsson et al., 1998; Hirota et al., 2010; Roberto et al., 2010). In addition, limonene is an ingredient considered safe for food preservation (Sun, 2007; Chemat et al., 2012). When examined in this context, it is obvious that tarragon is a plant with the potential to take place in almost every sector (food, cosmetics, pharmacy, agriculture) with the components it contains.

Table 1. Aromatic component of *Artemisia dracunculus* L.

Components	**RI (Refractive Index)**	**Area (%)**
Phenethyl alcohol	767	0.45
Butyric acid	796	0.47
Lactate <ethyl->	790	0.62
Isovaleric acid	852	0.79
Butyric acid <2-methyl->	862	0.74
Phellandrene <alpha->	929	0.64
Pinene <alpha->	849	1.21
Valeric acid	995	3.40
Terpinene <alpha->	1021	0.87
Cymene <para->	1029	0.79
Limonene	1033	5.20
Eucalyptol	1036	3.26
Hexanol <2-ethyl->	1037	0.71
Terpinene <gamma->	1062	1.70
Sabinene hydrate <trans->	1104	0.51
Linalool	1107	2.29
Pelargonaldehyde	1111	0.45
Tridecyl methyl ketone	1114	0.78
Pinocarveol <trans->	1146	1.39
Linalool <tetrahydro->	1167	0.64
Terpinen-4-ol	1185	2.05
Terpineol <alpha->	1200	20.08
Anethole <(Z)->	1206	8.93
Piperitone	1262	0.47
Chavicol	1270	0.75
Bornyl acetate	1295	0.84
Terpinyl acetate <alpha->	1360	23.16
Isoeugenol	1369	3.73
Elemene <beta->	1403	0.47
Eugenol <methyl->	1416	1.93
Chamigrene <beta->	1432	2.03
Patchoulene <beta->	1507	0.64
Cadinene <gamma->	1528	0.80
Cadinene <delta->	1537	0.46
Humulene <alpha->	1556	0.73
Spathulenol	1594	0.86
Hermianin	1740	4.47

When the studies in the literature are examined, the determination of the main component as terpinyl acetate in our study differs, but it is consistent with the fact that it reveals similar amounts in the study data. In the determination of aroma components, different chemical compositions of essential oils can be related to the harvest time of the tarragon plant, geographical

condition, ground conditions and genetic factors, as well as the data obtained in the analysis method differences.

4. Conclusions

This study, which investigated the antioxidant activity (% DPPH radical scavenging activity), phenolic substance amounts (mg GAE/ g) and antimicrobial effects of aroma components and aqueous extracts of *Artemisia dracunculus* L. plant, a subspecies of Asteraceae family, high antioxidant capacity and phenolic substance content were determined. has been done. It has been found that the main component of the characteristic smell and aroma of the plant, which is used to flavor food in the food industry is terpinyl acetate. No significant effect was observed in terms of antimicrobial properties. In addition, it was determined that the antioxidant activity and the number of phenolic substances increased depending on the concentration amount. Based on the antioxidant potential, phenolic substance content and antimicrobial activity results of the Artemisia species in the literature, it has been clearly seen that there may be differences in the phenolic substance content, antioxidant and antimicrobial potentials of the studied plants according to the solvents and concentration differences. From the data obtained, it is thought that tarragon can be used industrially as a potential natural antioxidant and aroma source to increase the flavor of foods, thanks to its rich chemical components, especially in the production and preservation of foods that are sensitive to oil oxidation. With the study, it is thought that the use of 5% and 10% aqueous concentrations of *Artemisia dracunculus* L. in the food industry will be effective in terms of antioxidant activity. Finally, it is recommended to conduct research on this plant and to prove it as a natural preservative and flavoring in food models, especially to replace synthetic preservatives in foods.

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