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Research Article

Determination of Antioxidant and Antimicrobial Activities of Some Medicinal Plants Grown in Şırnak Region of Turkey

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Abstract

In this study, fruits and leaves of non-wood forest products such as leaves and fruits of Pistachio (*Pistacia vera L.*), Celtis (*Celtis aetnensis*), Terebinth (*Pistacia terebinthus L.*), Hawthorn (*Crataegus monogyna*), Sumac (*Rhus Coriaria L.),* Almond (*Prunus dulcis*), Bitter Almond (*Amygdalus Amara*), and Fennel (*Foeniculum Vulgare*) which are used for medical purposes in the village of Akkoyunlu in Şırnak were investigated. Several analyzes have been used to determine antioxidant activity of herbal products. Flavonoids and total phenolics ingredients of elected herbs were examined in the present study. CUPRAC (Cupric Reducing Antioxidant Capacity) and FRAP (Ferric Reducing Antioxidant Power) analyzes were utilized for measurement of antioxidant capacity. In addition, antimicrobial capacity was determined by Minimum Inhibitory Concentration (MIC) technique for each sample.

According to the antioxidant results determined, among the samples examined fruit of the sumac (*Rhus Coriaria* L.) plant has the best antioxidant activity in almost all applied antioxidant analyzes. On the other hand, fruit of almond (*Prunus dulcis)* was found to show low antioxidant activity in almost all analyzes.

Keywords: Celtis, Terebinth, Hawthorn, Fennel, Antioxidant, Antimicrobial

Şırnak Bölgesi'ndeki Halk Arasında Tıbbi Amaçlı Kullanılan Bazı Bitkilerin Antioksidan Ve Biyolojik Aktivitelerinin Belirlenmesi

Öz

Bu çalışmada, Şırnak ilinin İdil ilçesine bağlı Akkoyunlu köyünde yetişen ve halk arasında tıbbi amaçlı kullanılan; Antep Fıstığı (*Pistacia vera L.),* Dardağan (*Celtis aetnensis)*, Menengiç (*Pistacia terebinthus L.*), Alıç (*Crataegus monogyna*), Sumak *(Rhus Coriaria L.),* Badem (*Prunus dulcis*), Acıbadem (*Amygdalus Amara*), *ve* Rezene Out (*Foeniculum Vulgare*) isimli odun dışı orman ürünlerinin meyveleri ve yaprakları incelenmiştir. Bitki ekstraktlarının antioksidan içeriklerini belirlemek için çeşitli yöntemler kullanılmıştır. Bu çalışmada seçilen bitkilerde toplam fenolik ve flavonoid içerikleri incelenmiştir. Antioksidan aktivite tayini için FRAP (Demir İndirgeme Antioksidan Gücü) ve CUPRAC (Bakır İndirgeyici Antioksidan Kapasite) analizleri kullanılmıştır. Aynı zamanda her bir örneğin antimikrobiyal aktivitesi minimum inhibisyon konsantrasyon (MİK) yöntemi ile incelenmiştir.

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Bulunan antioksidan aktivite sonuçlarına göre incelenen örnekler arasında Sumak bitkisi meyvesi (*Rhus Coriaria L.)* örneğinin hemen hemen uygulanan tüm antioksidan analizlerde en yüksek antioksidan aktiviteye sahip olduğu bulunmuştur. Diğer taraftan tüm antioksidan analiz yöntemlerinde ise en düşük antioksidan aktiviteyi Badem meyvesi (*Prunus dulcis*) bitkisi göstermiştir.

Yapılan antimikrobiyal analizler sonucunda ise genel olarak bitki ekstraktlarının kullanılan test bakterilerinden daha çok maya suşları üzerine daha etkili olduğu bulunmuştur.

Anahtar Kelimeler: Dardağan, Menengiç, Alıç, Rezene otu, Antioksidan, Antimikrobiyal

1. Introduction

Medicinal herbs have been utilized in cure of diseases by man beings since ancient times. In many developing countries, herbal medicines are an significant portion of cultures and traditions in rural societies. According to records that the World Health Organization (WHO) has published, 80% of people living in developed and developing lands usually depend on medicinal plants for health care (WHO, 2007). Demand for medicinal plants is more and more rising because of natural feautures, low side effects and low cost (Sekar and Kandavel, 2010). Medicinal plants are used in daily life as traditional medicine treatments in Turkey. Turkey is rich in terms of flora variety and is a generous resource of medicinal plants. (Demiray et al., 2009).

During the use of oxygen in human body reactive oxygen species (ROS) occur. ROS are highly reactive and cause cellular damage and several diseases, including cancer, neurodegeneration and inflammation (Asif, 2015; Baba and Malik, 2015). Plants have a large diversity of chemicals such as phenolic acid, flavonoids, quinines, alkaloids, terpenoids and emetines. These chemicals are responsible for biological activity (such as antioxidants, antimicrobials) of the plant and have therapeutic effects on human (Njume et al., 2009; Hussain et al., 2011).

Academic studiese have shown that antimicrobials found in plant extracts have a superior capability to protect food security, and consequently plants can be used as natural antimicrobials (Souza et al., 2005). The ordered antimicrobial remedy for contaminated sufferer can provide the distinction between treatment and death or long-term disability. Unfortunately, the use and misuse of antibacterials has driven the brutal dilation of durable bacteries causing the loss of effect of these “miracle drugs” (Organization 2001). Hence there is a requirement to improve alternate antimicrobial agents for the remedy of infectious illnesses. One of the approaches is to research regional medicinal herbs for probable antimicrobial features. Medicinal plants offer a high resource from which new antimicrobial and antifungal chemotherapeutic drugs may be acquired (Katalinic et al. 2006). Medicinal plants that contain natural antioxidants are quite effective against the pathogen and may limit microbial or fungal evolution (Das et al., 2010).

Many researches have demonstrated that medicinal and aromatic herbs are resources of different nutrient and non nutrient substances, many of which demonstrate antimicrobial and antioxidant characters that can preserve the man system against both pathogens and cellular oxidation reactions. So it is

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considerable to characterize various kinds medicinal herbs by their antimicrobial and antioxidant potency. The goal of the this research is to determined the antimicrobial and antioxidant capasities of 15 distinct edible samples, such as fruits and leafs of some species of Pistachio (*Pistacia vera L*.), Celtis (*Celtis aetnensis*), Terebinth (*Pistacia terebinthus L.*), Hawthorn (*Crataegus monogyna*), Sumac (*Rhus Coriaria L.)*, Almond (*Prunus dulcis*), Bitter Almond (*Amygdalus Amara*), and Fennel (*Foeniculum Vulgare*) plant extracts used for medical purposes in the Southeastern Anatolia Region (Şırnak).

2. Material and Methods

2.1. Chemicals

Trolox (6-hydroxy-2,5,7,8-tetramethylchroman-2-carboxylic acid), Folin-Ciocalteu's phenol reagent, 2,4,6-tripyridyl-s-triazine(TPTZ), 2,2-diphenyl-1-picrylhydrazyl (DPPH) and methanol were obtained by Sigma Chemical Co. (USA). Neocuproine (2,9–dimethyl-1,10-phenanthroline), acetic acid, sodium carbonate, aluminium nitrate nonahydrate and ammonium acetate were obtained from Merck Chemical Co. (Darmstadt, Germany). The all chemicals were at an analytical degree.

2.2. Plant Material

The herbs used in this study were obtained from the Akkoyunlu village of İdil district of Şırnak province by field work. The plants were collected by the researcher Resul YARAR in July and August 2016. Collected plants were dried in the oven (before processes at 40°C). About 10 g of dried plant of leaves and fruits were used to prepare methanolic samples. Extracts were shaken at room heat for 24 h. After that, exracts were filtered by filter paper and stored at +4 ºC until used in experiment. Spectrophotometric tecniques were used on antioxidant tests, total flavonoids and total polyphenols analyzes. Spectrophotometric tecniques are often utilized for the standardization of native raw substances.

2.3. Total Phenolic Assay

Total phenolic amount of samples was detected by using the Folin-Ciocalteu test (Slinkard and Singleton, 1977). Gallic acid (1; 0.5; 0.25; 0.125; 0.0625 and 0.03125 mg/mL) was used as a standard. Shortly, 400 µL of 0.5 N Folin-Ciocalteu, 20 µL sample (1 mg/mL), 680 µL of water were mixed and the mixture was vortexed. 400 µL of Na_2CO_3 (10%) solution was annexed after 3-minute incubation and again vortexed. Then the solution was waited for 2 hours. Following the wait time at the room heat, absorbances were determined at 760 nm. The concentrations of total phenolic compounds were measured as mg of gallic acid equivalents per g of the dry weight of sample.

2.4. Total Flavonoid Assay

Total flavonoid amount was determined by utilizing the aluminum chloride test (Chang et al. 2002). Quercetin (1; 0.5; 0.25; 0.125; 0.0625 and 0.03125 mg/mL) was used as a standard. 4.3 mL methanol, 0.1 mL 1 M NH_4CH_3COO, 0.5 mL of sample and 0.1 mL 10% $Al(NO_3)_3$ were put in the tubes and then tube was vortexed. Solutions were waited for 40 minutes. Following waiting, absorbance was determined at 415 nm. The total flavonoid amounts of plants were defined as mg

quercetin equivalents per g of dry weight sample.

2.5. The Determination of Antioxidant Activity

Antioxidant capacity of the herbs was calculated using CUPRAC and FRAP assays. Tecnique is the reduction of yellow Fe^{3+}-TPTZ compound to the blue Fe^{2+} -TPTZ compound by electron giving material under stuation (Benzie and Szeto, 1999). FRAP test of 3 mL (including TPTZ, $FeCl_3$, and acetate buffer) and 100 µL of the test sample or the blank (solvents used for extraction) were annexed to the tube and vortexed. Maximum absorbance rates at 593 nm were determined for 4 min at 25°C. Last absorbance was checked by the standard graph (100-1000 µmol/L). The result was explained as µmol $FeSO_4.7H_2O$ equivalents per gram of dry sample.

CUPRAC tecnique is contained of stirring the antioxidant mixture (directly or after acid hydrolysis, 0.2 mL) with 0.9 mL distelled water, 1 mL 7.5mM neocuproine alcoholic solution 1 mL 1M ammonium acetate aqueous buffer at pH 7, and 1 mL10 mM copper (II) chloride solution. Absorbance was measured at 450 nm later 60 minutes (Apak at al., 2004). The test conclusions were appraised by Trolox ® equivalent antioxidant activity (TEAC).

2.6. Biological Materials

All the of 12 microorganisms were used in this work. As bacteries; *Bacillus subtilis* NRRL B-4378, *Pseudomonas citronellosis* NRRL B-2504, *Proteus vulgaris* NRRL B-123, *Staphylococcus epidermidis* ATCC 12228, *Staphylococcus aureus* ATCC 6538, *Salmonella typhimurium* ATCC 13311, *Streptomyces griseolus* NRRL B-1062, *Escherichia coli* ATCC 8739, *Bacillus velezensis* NRRL B-14580, *Gordonia rubripertincta* NRRL B-3906, as yeast ; *Candida glabrata* ATCC 2001, *Candida krusei* ATCC 6258, *Candida albicans* ATCC 90028 strains were utilizationed. All test microorganisms were obtained from the United States Agricultural Research Service Culture Collection (NRRL), the American Type Culture Collection (ATCC), the Faculty of Pharmacy of Anadolu University and the commercial culture collections.

All microorganisms were waited at - 85 °C (Ultrafreezer, New Brunswick) in 15% glycerol and protected on nutrient agar (Merck, 1.05450) and malt extract agar (Merck, 1.05398) slants at 4 °C, respectively. They were subcultured in Petri dishes prior to use for purity check.

Microorganisms were choosed for their antibacterial capasity works, which are significant herb and human pathogens, which are manufactured biofilms and which have been the topic of study by numerous investigators in the latest works.

2.7. In vitro Antimicrobial Activity

The broth microdilution tecnique suggested by CLSI (Clinical Laboratory Standards Institute) was utilized for detecting in vitro antifungal and antimicrobial capasities of substances (Amsterdam, 1996). Chloramphenicol was utilized as standard antimicrobial materials while ketoconazole and amphotericin B were used as standard antifungal materials. They were bought from Sigma. All tests were analysed in duplicate in two independent experiments.

2.7.1. Broth microdilution test for bacteria

Broth microdilution testing was made in conformity of principles of the CLSI M100-S16 (CLSI, 2006). Metabolites of abietic acid and its the minimum inhibitory concentration (MIC) were studied by broth micro dilution tecnique using 96-well microtiter plates (Sigma, Germany). Overnight swelled bacterial suspensions in double strength Mueller-Hinton broth (MHB) (Merck, Germany) were standardized by turbido metrically to nearly 108 CFU 1/mL (using Mac Farland No: 0.5). Test substancess were dissolved in DMSO (50%) and diluted in MHB to get a concentration range of 15.62–4000 g/mL. DMSO was utilized as negative check. The solution was then diluted in MHB (100 L), inoculated with microbial strains and then incubated at 37 ◦C for 24 h. Resazurin (Sigma, Germany) solution was annexed to approve the MICs. The MIC endpoint was described as the minumum concentration with finish (100%) expansion inhibition. The conlusions of antibacterial testing are compared with those of standards chloramphenicol (Sigma, Germany) and ampicillin (Sigma, Germany) as antimicrobial agents (the final concentrations were between 0.04 and 40 g/mL). DMSO was analysed as the negative control.

2.7.2. Broth microdilution test for yeasts

CLSI Broth microdilution testing was also made exactly as summarized in document M27-A2 by utilizing 96-well microtiter plates, RPMI-1640 (Sigma, Germany) medium and inocula of 0.5–2.5 × 103 cells /mL (Mac Farland 0.5). Metabolites of abietic acid and its latest concentrations were between 15.62 and 4000 g/mL. MIC values were calculated for 24 h at 37 ◦C incubation. Resazurin solution was annexed to approve the MICs. The MIC endpoint was determined as the minumum concentration with complete (100%) expansion inhibition (CLSI, 2002).

2.8. Statistical analysis

Total data were reported as mean ± SD. Important distinction among the mean rates were investigated with ANOVA. Duncan test was used among the groups. The distinction displaying a grade of $P < 0.05$ was considered to be statistically important.

3. Research Findings

Total flavonoid content, total phenolic content, CUPRAC and FRAP values were indicated in Table 1.

Table 1. Results of phenolic contents, flavonoid contents, FRAP and CUPRAC for Pistachio, Celtis, Terebinth, Hawthorn, Sumac, Almond, Bitter Almond and Fennel species* FRAP (µmol Fe/g)

Samples*	Total phenolics (mg GAE/g)	Total flavonoid (mg QE/g)	CUPRAC (mmol TEAC/g)	FRAP (µmol Fe/g)
Celtis aet. f	1.55±0.43^{a}	0.16±0.27^{a}	0.43±0.01^{b,c}	0.02±0.00^{a}
Celtis aet. l	2.44±0.13^{a}	1.49±1.88^{a,b}	1.47±0.17^{d}	0.07±0.00^{a}
Rhus cor. f	51.57±3.10^{g}	19.31±3.77^{d}	3.33±0.17^{e}	0.79±0.28^{d}

Rhus cor. l	44.43±3.98^{f}	21.33±2.59^{d}	1.75±0.10^{d}	0.31±0.02^{b}
Crataegus m. f	1.84±0.27^{a}	0.01±0.00^{a}	0.82±0.03^{c}	0.04±0.00^{a}
Crataegus m. l	9.07±0.06^{d}	0.09±0.00^{a}	4.30±0.98^{f}	0.26±0.00^{b}
Amygdalus a. f	1.09±0.11^{a}	0.57±0.01^{a,b}	0.68±0.09^{b,c}	0.02±0.00^{a}
Amygdalus a. l	9.09±0.57^{d}	0.06±0.00^{a}	0.07±0.00^{a}	0.32±0.02^{b}
Pistacia ter. f	7.31±0.38^{c,d}	2.67±0.10^{b}	3.90±0.45^{f}	0.26±0.01^{b}
Pistacia ter. l	22.55±1.71^{e}	5.33±0.05^{c}	1.33±0.08^{d}	0.55±0.03^{c}
Prunus dul. f	0.73±0.13^{a}	0.01±0.00^{a}	0.28±0.02^{b,c}	0.01±0.00^{a}
Prunus dul. l	5.18±0.68^{b,c}	0.76±0.01^{a,b}	0.27±0.00^{b,c}	0.11±0.02^{a}
Pistacia ver. f	3.38±2.09^{a,b}	1.59±0.16^{b}	0.51±0.01^{b,c}	0.01±0.00^{a}
Pistacia ver. l	20.61±0.76^{e}	6.50±0.66^{c}	0.16±0.01^{a,b}	0.50±0.01^{c}
Foeniculum vul.	6.45±0.20^{c,d}	0.52±0.02^{b}	0.32±0.02^{b,c}	0.36±0.02^{b}

* Celtis aet. f: Fruits of Celtis (*Celtis aetnensis*), Celtis aet. l: Leaves of Celtis (*Celtis aetnensis*), Rhus cor. f: Fruits of Sumac (*Rhus Coriaria L.*), Rhus cor. l: Leaves of Sumac (*Rhus Coriaria L.*), Crataegus m. f: Fruits of Hawthorn (*Crataegus monogyna*), Crataegus m. l: Leaves of Hawthorn (*Crataegus monogyna*), Amygdalus a. f: Fruits of Bitter Almond (*Amygdalus Amara*), Amygdalus a. l: Leaves of Bitter Almond (*Amygdalus Amara*), Pistacia ter. f: Fruits of Terebinth (*Pistacia terebinthus L.*), Pistacia ter. l: Leaves of Terebinth (*Pistacia terebinthus L.),* Prunus dul. f: Fruits of Almond (*Prunus dulcis*), Prunus dul. l: Leaves of Almond (*Prunus dulcis*), Pistacia ver. f: Fruits of Pistachio *(Pistacia vera L.*), Pistacia ver. l: Leaves of Pistachio *(Pistacia vera L.*), Foeniculum vul**.:** Fennel (*Foeniculum Vulgare*).

In fruits, Rhus cor. f sample was the highest total phenolic content (51.57±3.10 mg gallic acid equivalents / g sample) and total flavonoid amount (19.31±3.77 mg quercetin equivalents /g sample). Prunus dul. f sample was the lowest total phenolic content (0.73±0 .13 mg gallic acid equivalents/g sample) and total flavonoid amount (0.01±0.00 mg quercetin equivalents/g sample). Similar results are valid for FRAP and CUPRAC analyzes.

In leaves, Rhus cor. l sample was the highest total phenolic content (44.43±3.98 mg gallic acid equivalents/g sample) and total flavonoid amount (21.33±2.59 mg quercetin equivalents/g sample). Celtis aet. l sample was the lowest total phenolic content (2.44±0.13 mg gallic acid equivalents/g sample) and Amygdalus a. l sample was total flavonoid content (0.06±0.00 mg quercetin equivalents/g sample). In CUPRAC analysis, Crataegus m. l has the highest activity with a value of 4.30±0.98 µmol Trolox equivalents/g sample. In FRAP analysis, Pistacia vera l stands out with a value of 0.55±0.03 µmol Fe equivalents/g sample.

Results indicated that Sumac (*Rhus Coriaria L.*) has the highest antioxidant activity. It is observed that aerial part of Foeniculum vul sample has low activity.

Antibacterial proporties of samples investigated against the microorganisms in this paper were qualitatively and quantitatively detected by appraising the presence of inhibition zones, zone diameter, and MIC rates. Conclusions of

antimicrobial capacity of methanolic samples are demonstrated in Table 2.

Table 2. MIC values of extracts against the bacterial strains tested

Samples	Minimal Inhibition Concentration Values (µg/mL)												
	Sa	Pv	St	Se	Bs	Sg	Pc	Bv	Gr	Ec	Ca	Cg	Ck
Celtis aet. f	1000	1000	1000	1000	1000	500	500	500	1000	1000	125	125	125
Celtis aet. l	1000	1000	1000	1000	1000	500	500	500	1000	500	62.5	15.6	15.6
Rhus cor. f	500	500	500	500	500	250	500	500	1000	500	<	<	<
Rhus cor. l	1000	500	500	500	1000	500	500	500	1000	1000	<	<	<
Crataegus m. f	1000	1000	500	500	1000	500	500	500	1000	500	125	15.6	62.5
Crataegus m. l	1000	500	500	1000	500	500	500	500	500	500	125	15.6	7.81
Amygdalus a. f	1000	1000	1000	1000	500	1000	500	500	1000	1000	125	125	15.6
Amygdalus a. l	1000	1000	500	1000	500	500	500	500	1000	1000	15.6	3.91	1.95
Pistacia ter. f	1000	500	500	500	500	125	500	500	500	500	125	31.2	15.6
Pistacia ter. l	1000	500	500	1000	500	500	500	500	500	1000	1.95	<	<
Prunus dul. f	1000	1000	1000	1000	1000	500	500	500	1000	1000	125	125	31.25
Prunus dul. l	1000	500	500	1000	500	1000	500	500	500	500	125	125	125
Pistacia ver. f	1000	1000	1000	1000	500	1000	500	500	1000	1000	125	250	125
Pistacia ver. l	500	500	500	1000	500	250	250	500	1000	1000	1.95	<	<
Foenicul. vul.	1000	250	1000	1000	500	500	500	500	1000	1000	62.5	15.6	15.6
Chlor.	0.625	0.625	0.156	1.25	0.156	0.156	1.25	<	0.156	0.313			
AmfB.											0.31	0.16	0.31
Ket.											0.04	0.04	0.16

Sa: *Staphylococcus aureus* ATCC 6538, Pv: *Proteus vulgaris* NRRL B-123, St: *Salmonella typhimurium* ATCC 13311, Se: *Staphylococcus epidermidis* ATCC 12228, Bs: *Bacillus subtilis* NRRL B-4378, Sg: *Streptomyces griseolus* NRRL B-1062, Pc: *Pseudomonas citronellosis* NRRL B-2504, Bv: *Bacillus velezensis* NRRL B-14580, Gr: *Gordonia rubripertincta* NRRL B-3906, Ec: *Escherichia coli* ATCC 8739, as yeast ; Ca: *Candida albicans* ATCC 90028, Cg: *Candida glabrata* ATCC 2001, Ck: *Candida krusei* ATCC 6258, Chlor: Chloramphenicol, AmfB: Amphotericin B, Ket: Ketoconazole.

According to antimicrobial analyzes performed, it was detected which the herb samples were mostly more effective on yeast strains than the test bacteria strains.

Among all the plants examined, the only plant is the fruits of Terebinth (Pistacia ter. f), (*Pistacia terebinthus L.*) that exhibits good activity against test bacteria. But other herbs have activity against yeast strains. That is, they have not demonstrated good activity against microbial strains.

Pistacia ter. f showed good-moderate activity only against *Streptomyces griseolus* NRRL B-1062 (Sg) from the test bacteria with 125 µg/mL mic value. Pistacia ter. l and Pistacia ver. l (*Pistacia vera L.*) were found to have the highest antifungal property against *Candida albicans* ATCC 90028 (Ca) from yeast strains by values of 1.95 µg / mL. Additionally, it was observed that they exhibited similar activity to amphotericin B that is utilized in stock antifungal medicine.

The leaves of the bitter almond extract (Amygdalus a. l) (*Amygdalus Amara*) were observed to exhibit better activity than the fruit of the bitter almond (Amygdalus a. f). Amygdalus a. l, has the best activity against *Candida glabrata* ATCC 2001 (Cg) with 3.90 µg/mL mic value and *Candida krusei* ATCC 6258 (Ck) with 1.95 µg/mL mic value. At the same time, the fact that near activity ketoconazole which is used standard antifungal drug has been found.

Although almost all antioxidant determination methods have the best activity Sumac (*Rhus Coriaria L.*) neither the fruit of sumac (Rhus cor. f) (*Rhus Coriaria L.*) nor the leave of Sumac (Rhus cor. l) plant is effective against any test microorganism. Those concentrations working in the activity study on yeast strains also showed no activity.

4. Discussion

Nowadays, researchers indicate that the antioxidant properties of the plant phenolics give beneficial effect to human health. Therefore, the number of studies on herbal antioxidants is increasing day by day. Flavonoid and phenolic amounts are in charge of for the bioactivity of plants. Total phenolic content is directly related to antioxidant activity (Bravo, 1998). There are numerous distinct antioxidants in herbs and it is very hard to determine each antioxidant content severally. That's why, it is more illuminating to use distinct trials to detect the antioxidant amount of each separately (Huang et al., 2005; Zalibera et al., 2008).

In a research utilizing methanol extract of fruit of *Pistacia vera* L. grown in Italy, the total phenolic content of extract was 11.7 ± 0.48 mg GAE/g and the total flavonoid amount was 0.69 ± 0.02 mg QE/g (Barreca et al., 2016). In this paper, fruit and leaf of *Pistacia vera* L. are investigated severally. Fruit of Pistachio (Pistacia ver. f) which has 3.38±2.09 mg GAE /g total phenolic content is lower than that grown in Italy. But leaf of Pistachio (*Pistacia ver*. l) which has 20.61±0.76 mg GAE /g total phenolic is higher than that grown in Italy. According to the total flavonoid content, both fruit of Pistachio and leaf of Pistachio have higher activity than those grown in Italy. At the same time antimicrobial activity of Pistachio was investigated in this study and both fruit and leaf were found to have antifungal activity as reported in the literature (Duru et al., 2003).

A study has been carried out on the fruit of terebinth (*Pistacia terebinthus L.*) and coffee of terebinth grown in Tokat by Yıldız and only the total flavonoid and total polyphenol amounts have been determined as in the literature (Yıldız, 2013). In this study, besides these, both CUPRAC and FRAP reduction methods were used to investigate both the fruit of terebinth and leaf of terebinth for activity. Leaves of terebinth (Pistacia ter. l) have been found to have better activity than fruits of terebinth (Pistacia ter. f) by all antioxidant activity determination methods except for CUPRAC analysis method. In fact, leaves of terebinth was discovered to have very good antifungal capacity against the *Candida albicans* ATCC 90028 from yeast strains by a value of 1.95 µg / mL.

In an article, howthorn (*Crataegus monogyna*) plant was examined separately using total polyphenol, FRAP and DPPH$^{\bullet}$ methods in Ireland (Shortle et al., 2014). According to total polyphenol analysis method, our activities of fruit howthorn

(Crataegus m. f) and leaf of howthorn (Crataegus m. l) that is grown in Şırnak, have been measured better than those in Ireland. But according to the FRAP analysis method, higher activity was observed in Ireland. Unlike in the literature, the biological activity of hawthorn plant was investigated in this study and it was determined that both fruit and leave howthorn were effective on yeast strains.

In a study, conducted by Kossah et al., on fruit of Sumac (*Rhus typhina* L.) that is grown in China determined antioxidant amounts and also antimicrobial activities were examined in 2011 (Kossah et al., 2017). Sumac plant was found to have good antioxidant activity and at the same time good effective against gram positive and gram negative microbia. In this paper, both fruit and leave parts of *Rhus Coriaria* L., another kind of sumac plant were examined. According to our results, both fruits of sumac (Rhus cor. f) and leaves of sumac (Rhus cor. l) have been found to have good activity in all of the antioxidant assays but they did not show a good effect on the tested microorganisms.

In an article recently conducted in India, fruit of almond (*Prunus dulcis*) has been found to have antifungal activity (Dhingra vd., 2017). At the same time, antioxidant activities were determined in different resolvents such as butanol, ethyl acetate and hexane, and solvent effects were compared. Antioxidant amounts changed according to the solvent type. In our study fruit of almond and leave of almond were examined and only methanol was used as the solvent. It has been found that both fruits and leaves of the almond have antifungal activity as in the literature.

It was reported that fennel plant (*Foeniculum Vulgare*) grown in Indonesia has high antioxidant activity, and it has been reported that some allergies are good and pain reliever (Choi ve Hwang, 2004).

In the literature, there is not much research on antioxidant capacity for the fruit and the leaf, species of celtis (*Celtis aetnensis*) and bitter almond (*Amygdalus Amara*). Antioxidant assays of these species were measured by using total polyphenol, total flavonoid, FRAP and CUPRAC methods and the literature was reviewed. Also antibacterial capacities of 13 test microorganisms were examined and fpund to have antifungal property.

The results of this paper demonstrate that the herb samples of pistachio, celtis, terebinth, hawthorn, sumac, almond bitter, almond and fennel contain compounds with antimicrobial and antioxidant content. The changing of synthetical with native antioxidants may be beneficial. The acquired conclusions might be considered adequate for future researches for the insulation and identification of the active guidelines. Because of their antimicrobial and antioxidant capacities, these herbs may be utilized as native resources in the cosmetic and pharmaceutical industries.

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Conflict of interest

The authors explain no conflicts of interest.

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