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Antioxidant and Antimicrobial activity of *Scorzonera papposa* collected from Iraq and Turkey

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ABSTRACT

Plants are important natural materials used in complementary medicine. In this study, antioxidant and antimicrobial activities of *Scorzonera papposa* DC. collected from Duhok (Iraq) and Gaziantep (Turkey) regions were determined. Extracts of aerial parts and roots of the plant with ethanol were obtained. Antioxidant and oxidant potentials were determined *by* using Rel Assay Diagnostics kits. Antimicrobial activities were tested against bacteria and fungus strains using the agar dilution method. In our study, it was determined that *S. papposa* has important antioxidant activity. Also, It was found that extracts of plant parts were effective at 50-800 µg/mL concentrations. As a result, it was determined that *S. papposa* could be a natural antioxidant and antimicrobial agent that can be used in complementary medicine.

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Irak ve Türkiye'den toplanan *Scorzonera papposa*'nın Antioksidan ve Antimikrobiyal aktiviteleri

ÖZET

Bitkiler tamamlayıcı tıpta kullanılan önemli doğal materyallerdir. Bu çalışmada Duhok (Iraq) ve Gaziantep (Turkey) bölgelerinden toplana *Scorzonera papposa* DC.'nın antioksidan ve antimikrobiyal aktiviteleri belirlenmiştir. Bitkinin aerial parts and roots'ının ethanol ile özütleri çıkarılmıştır. Antioxidant ve oxidant potansiyelleri Rel Assay Diagnostics kitleri kullanılarak belirlenmiştir. Antimikrobiyal aktiviteleri agar dilüsyon metodu kullanılarak bakteri ve fungus suşlarına karşı test edilmiştir. Yaptığımız çalışmada *S. papposa*'nın önemli antioksidan aktiviteye sahip olduğu belirlenmiştir. Ayrıca bitki kısımlarının özütlerinin 50-800 µg/mL konsantrasyonlarda etkili olduğu görülmüştür. Sonuç olarak *S. papposa*'nın tamamlayıcı tıpta kullanılabilecek doğal bir antioksidan ve antimikrobiyal ajan olabileceği belirlenmiştir.

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INTRODUCTION

Nature has always been a resource for human being. People went to treat diseases by using many natural products such as plants, animals and mushrooms. Because of the side effects of synthetic drugs and their insufficiency in the treatment of diseases, people turned to natural products (Ng et al., 2000; Sevindik et al., 2018). This orientation was more in medicinal plants. Medicinal plants have formed the basis of the treatment of many diseases in parallel with human history. In addition, plants have served many purposes such as fuel, shelter, clothing, food and spices. Today, approximately 50.000 plant species are used in pharmaceutical cosmetics (Goyal et al., 2020). Medicinal plants' seeds, roots, leaves, fruits, flowers or plants are all used. Plant parts have therapeutic properties in different proportions. Plants have many pharmacological properties thanks to the bioactive substances they contain (Altemimi et al., 2017; Barbieri et al., 2017). The imbalance between endogenous antioxidants and endogenous oxidants in living organisms is called oxidative stress (Finaud et al., 2006; Gladness, 2018). Depending on the level of oxidative stress, diseases such as cardiological disorders, cancer, alzeimer and Parkinson may occur in human bodies. Supplementary antioxidants are used to reduce the effects of oxidative stress (Korkmaz et al., 2018; Glad, 2019). In this context, determining the antioxidant potential of plants is very important in determining natural antioxidant sources. The discovery of new antimicrobial agents from plants has been increasing in recent years. Especially the insufficiency of synthetic drugs directed the researchers to natural materials (Sevindik et al., 2020). The discovery of new antimicrobial sources has become imperative due to increased microbial resistance and increasing diseases of microorganism origin. Plants interact with many living forms, especially in the ecosystem (Pandya et al., 2017). This interaction increases the production of secondary metabolites. Thanks to these secondary metabolites, they have many pharmacological effects (Cowan, 1999; Pandya et al., 2017). In this context, determining the antimicrobial potential of plants is very important for the discovery of new natural agents.

In this study, antioxidant and antimicrobial activities of *Scorzonera papposa* DC. collected from Duhok (Iraq) and Gaziantep (Turkey) regions were determined.

MATERIAL and METHOD

Scorzonera papposa samples were collected from Duhok (Iraq) and Gaziantep (Turkey) regions. The plant was identified using Flora of Turkey Volume 5 (Davis, 1975). After the field studies, the aerials and the roots parts of the plant were separated, dried and powdered individually. Then, 30 g of each plant sample was taken to the extraction process at 50 ^{0}C with ethanol (EtOH) in the soxhlet extractor for approximately 6 hours. The extracts obtained were concentrated with a rotary evaporator (Heidolph Laborota 4000 Rotary Evaporator).

Determination of Antioxidant and Oxidant Potentials

The antioxidant and oxidant potentials of the EtOH extracts of the aerial parts and the roots of *S. papposa* were determined using Rel Assay kits (Erel, 2004; Erel, 2005). Trolox was used as a calibrator for antioxidant kits. Hydrogen peroxide was used as the calibrator for oxidant kits. OSI (Arbitrary Unit = AU) value was determined according to the following formula (Erel, 2005).

$$OSI\ (AU): \frac{TOS\ (\mu\text{mol H2O2 equiv./L})}{TAS\ (\text{mmol Trolox equiv./L })\text{X } 10}$$

Determination of Antimicrobial Activities

Antimicrobial activities of EtOH extracts of the aerial parts and the roots of plant samples were determined by the agar dilution method (CLSI 2012; EUCAST 2014; EUCAST 2015). Test bacteria: *Staphylococcus aureus* ATCC 29213, *S. aureus* MRSA ATCC 43300, *Enterococcus faecalis* ATCC 29212, *Escherichia coli* ATCC 25922, *Pseudomonas aeruginosa* ATCC 27853 and *Acinetobacter baumannii* ATCC 19606. Test fungi: *Candida albicans* ATCC 10231, *C. krusei* ATCC 34135 ATCC 13803 and *C. glabrata* ATCC 90030. All extracts were diluted at 800-12.5 µg/mL concentrations. Dilutions were made with distilled water (Bauer et al., 1966; Hindler et al., 1992; Matuschek et al., 2014).

RESULTS AND DISCUSSION

Antioxidant Potential

As a result of physiological and biochemical processes in the human body, a large number of free radicals and other types of reactive oxygen were produced. As the level of these oxidant compounds produced increases, the antioxidant defense system may be insufficient (Bal et al., 2019). In addition to the antioxidant defense system, supplemented antioxidants could prevent oxidative stress (Yılmaz et al., 2017). In this study, the aerial parts and the root parts of *S. papposa* were used to determine the potential for supplement antioxidants. The results obtained are shown in Table 1.

Table 1. TAS, TOS and OSI values of *S. papposa*
Çizelge 1. S. papposa'nın TAS, TOS ve OSI değerleri

	TAS	TOS	OSI
Roots (Iraq) *(Kök (Irak))*	4.817±0.073	16.549±0.173	0.344±0.007
Aerial parts (Iraq) *(Toprak üstü kısımları (Irak))*	6.328±0.141	11.525±0.095	0.182±0.004
Roots (Turkey) *(Kök (Türkiye))*	4.504±0.042	21.317±0.157	0.473±0.001
Aerial parts (Turkey) *(Toprak üstü kısımları (Türkiye))*	5.314±0.100	24.199±0.146	0.456±0.006

*Values are presented as mean±SD; Experiments were made in 5 parallels

In this study, *S. papposa* samples collected from Iraq were found to have higher TAS values than those from Turkey. Yet, it was determined that samples from Turkey sustained higher TOS values than those of collected from Iraq. The OSI value was found to be higher in samples collected from Turkey. There is no any known study in the literature about, TAS, TOS and OSI values of *S. papposa*. However, many studies about varies plants species including *Allium calocephalum* Wendelbo (TAS value 5.853 mmol/L, TOS value 16.288 µmol/L, OSI value 0.278), *Rhus coriaria* L. var. *zebaria* Shahbaz (7.342 mmol/L, TOS value 5.170 µmol/L, OSI value 0.071), *Mentha longifolia* (L.) Hudson subsp. *longifolia* (TAS value 3.628 mmol/L, TOS value 4.046 µmol/L, OSI value 0.112) and *Calendula officinalis* L. (TAS value 5.55

mmol/L, TOS value 27.42 µmol/L, OSI value 0.496) have been reported (Verma et al., 2016; Sevindik et al., 2017; Mohammed et al., 2018; Mohammed et al., 2019). Compared to these studies, the aerial parts of *S. papposa* (Iraq: 6.328 mmol/L) were found to have higher TAS values compared to *A. calocephalum*, *M. longifolia* ssp. *longifolia* and *C. officinalis*, and lower values than *R. coriaria* var. *zebaria*. Plants produce many antioxidant secondary metabolites. It is thought that these different TAS values occurring among plants vary depending on their potential to produce antioxidant compounds (Selamoglu et al., 2016). TOS values show all of the oxidant compounds produced by environmental factors and living organisms as a result of metabolic activities (Selamoglu et al., 2016). OSI values show how much the oxidant compounds produced in the plant are suppressed with endogenous antioxidant compounds (Selamoglu et al., 2016). When the TOS and OSI values were examined, it was determined that *S. papposa* (Turkey: Aerial parts TOS: 24.199 µmol/L, Roots OSI: 0.473) had higher value compared to *A. calocephalum, R. coriaria* var. *zebaria* and *M. longifolia* ssp. *longifolia*, and lower value compared to *C. officinalis*. It was reported in previous studies that *S. papposa* has antioxidant potential (Milella et al., 2014). In our study, it was also determined that *S. papposa* has important antioxidant activity.

Antimicrobial Activity

Antimicrobial agents are widely used in the treatment and prevention of infectious diseases of microbial origin. In recent years, the discovery of new antimicrobial agents has become imperative as microorganisms gain resistance against the drugs used. Plants are very important antimicrobial sources (Seow et al., 2014). In our study, antibacterial and antifungal activities of roots and aerial parts of *S. papposa* were determined (Table 2).

Table 2. Antimicrobial Activity of *S. papposa*
Çizelge 2. S. papposa'nın Antimikrobiyal Aktivitesi

	A	B	C	D	E	F	G	H	J
Roots (Iraq) *(Kök (Irak))*	400	800	200	200	400	50	100	100	100
Aerial parts (Iraq) *(Toprak üstü kısımları (Irak))*	400	400	100	200	400	50	100	100	100
Roots (Turkey) *(Kök (Türkiye))*	400	400	100	100	400	100	100	100	50
Aerial parts (Turkey) *(Toprak üstü kısımları (Türkiye))*	400	400	100	100	400	100	50	50	50
Ampicillin	1.56	3.12	1.56	3.12	3.12	-	-	-	-
Amikacin	-	-	-	1.56	3.12	3.12	-	-	-
Ciprofloksasin	1.56	3.12	1.56	1.56	3.12	3.12	-	-	-
Flukanazol	-	-	-	-	-	-	3.12	3.12	-
Amfoterisin B	-	-	-	-	-	-	3.12	3.12	3.12

*(A) *S. aureus*, (B) *S. aureus* MRSA, (C) *E. faecalis*, (D) *E. coli*, (E) *P. aeruginosa*, (F) *A. baumannii*, (G) *C. glabrata*, (H) *C. albicans*, (J) *C. krusei*
*800, 400, 200, 100 and 50 µg/mL extract concentrations

As a result of our study, it was found that the extracts of the plant parts were effective at 50-800 µg/mL concentrations. Aerial parts of plant samples collected from Turkey was found to have high antifungal activity. In addition, it was determined that the samples collected from Iraq had high activities against *A. baumannii*. Since ancient times, plants have been very important natural materials in the treatment of many diseases (Kılıç et al., 2017). It exhibits important biological activities thanks to the environmental metabolites and the secondary metabolites they produce with their metabolic activities (Omojate Godstime et al., 2014). In current study, antibacterial and antifungal activities of EtOH extracts of *S. papposa* were determined. It was observed that the effects of the plant samples were changed depending on the change of the regions. The result of this is thought to be due to the fact that they produce different levels of antimicrobial effective bioactive compounds in their bodies depending on the variability of environmental factors (soil structure, structure, climate etc.). As a result, EtOH extracts of roots and aerial parts of *S. papposa* were found to be effective against test microorganisms at different levels. In this context, it was determined that plant parts can be used as natural antimicrobial agents.

CONCLUSION

In this study, antioxidant and antimicrobial activity EtOH extract of the roots and aerials parts of *S. papposa* collected from Iraq and Turkey were determined. It has been seen that antioxidant and antimicrobial activities of plant parts change. In addition, it was determined that the effects differ depending on the regions where the plants are grown. As a result, it was determined that *S. papposa* has antioxidant and antimicrobial potentials in our study.

Statement of Conflict of Interest

Authors have declared no conflict of interest.

Author's Contributions

The contribution of the authors is equal.

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