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Total Antioxidant and Oxidant Status of *Urtica dioica* (Nettle)

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ABSTRACT

Plants are responsible for many biological activities. In this context, they are important natural materials in complementary medicine. In this study, total antioxidant status (TAS) and total oxidant status (TOS) and oxidative stress index (OSI) of *Urtica dioica* L. plant were determined. The aerial parts of the plant were extracted with ethanol from a soxhlet device. TAS, TOS and OSI values were determined using Rel Assay kits. As a result of the study, the TAS value of the plant extract was determined 7.817±0.314, the TOS value was 10.866±0.404, and the OSI value was 0.139±0.007. In this context, it was determined that the plant extract has a high antioxidant potential. In addition, oxidant levels were found to be at normal levels. As a result, it is thought that the *U. dioica* plant can be used as a natural antioxidant and oxidant source.

Urtica dioica'nın (Isırgan) Toplam Antioksidan ve Oksidan Durumu

Araştırma Makalesi

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ÖZET

Bitkiler birçok biyolojik aktiviteden sorumludur. Bu kapsamda tamamlayıcı tıpta önemli doğal materyallerdir. Bu çalışmada *Urtica dioica* L. bitkisinin total antioxidant status (TAS) and total oxidant status (TOS) and oxidative stres indexi (OSI) belirlenmiştir. Bitkinin toprak üstü kısımlarının etanol ile soxhlet cihazından özütleme işlemi yapılmıştır. TAS, TOS ve OSI değerleri Rel Assay kitleri kullanılarak belirlendi. Çalışma sonucunda bitki özütünün TAS değeri 7.817±0.314, TOS değeri 10.866±0.404 ve OSI değeri 0.139±0.007 olarak ölçüldü. Bu kapsamda bitki özütünün yüksek antioksidan potansiyelinin olduğu belirlendi. Ayrıca oksidan seviyelerinin normal düzeylerde olduğu görüldü. Sonuç olarak *U. dioica* bitkisinin doğal antioksidan ve oksidan kaynağı olarak kullanılabileceği düşünülmektedir.

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Introduction

Plants have been used by humans to meet basic needs in different communities. Many studies show that complementary medicine methods are widely used in the treatment of diseases in developing countries (Kemppainen et al., 2018; Keene et al., 2019). In studies on different plants, it has been reported that plants have biological activities such as antioxidant, antimicrobial, antiproliferative, antiaging, anticancer, DNA protector, hepatoprotective (Iqbal et al., 2017;

Campos et al., 2018; Junejo et al., 2018; Liu et al., 2018; Miastkowska and Sikora, 2018; Pehlivan et al., 2018; Sevindik, 2018; Qu et al., 2020; Wong et al., 2020; El Maaiden et al., 2021). In this context, it is important to determine the antioxidant potential of plants. *Urtica dioica* L. was used as material in this study.

U. dioica, stinging nettle is known as nettle leaf. It is a herbaceous perennial flowering plant of the Urticaceae family. It spreads in many regions from Europe, temperate Asia, North Africa, New Zealand, and North America (Lukešová et al., 2017). Stinging nettle has a long history of use in ancient societies as a source of traditional medicine, food, tea and textile raw materials (Brodal, 2004). In this study, the antioxidant potential of *U. dioica* was determined.

Material and Method

Plant samples were collected from Duhok (Iraq). The leaves of the plant were used to extract the extract. The leaves were dried and weighed 30 g. Then, it was extracted with ethanol at 50 °C for about 6 hours in a Soxhlet apparatus. The obtained extracts were turned into crude extract in a rotary evaporator.

TAS, TOS and OSI Tests

TAS (antioxidant) and TOS (oxidant) status of the ethanol extract of the plant were determined using Rel Assay kits. During the tests, the manufacturer's procedure was followed. Trolox was used as calibrator in antioxidant tests. Results are shown as mmol Trolox equiv./L. Hydrogen peroxide was used as calibrator in oxidant tests. The results are shown as μmol H_2O_2 equiv./L. OSI value (Oxidative stress index) was determined by proportioning TOS value to TAS value (Sevindik, 2019).

Results and Discussion

Reactive oxygen species (ROS) is a class of oxygen produced at high levels as a result of metabolic processes (Bal et al., 2019). In this context, when ROS reach high levels, it can cause neurodegenerative disorders such as infections, cardiovascular disorders, Parkinson's, Alzheimer's, and cancer. The antioxidant defense system plays a role in reducing the harmful effects of ROS in living organisms (Krupodorova and Sevindik, 2020). In cases where the antioxidant defense system is insufficient, supplemental antioxidants may come into play (Sevindik et al., 2018). In this context, it is important to investigate plants as supplemental antioxidants. In our study, TAS,

TOS and OSI values of the ethanol extract obtained from the leaves of the *U. dioica* plant were determined. The obtained results are shown in Table 1.

Table 1. TAS, TOS and OSI values of ethanol extract of *U. dioica*

Sample	TAS	TOS	OSI
U. dioica	7,817±0,314	10,866±0.404	0,139±0,007

Values are presented as mean±SD

There are many studies in the literature that determined the antioxidant activity of *U. dioica*. In previous studies, it has been reported that ethyl acetate, water, ethanol extracts of *U. dioica* have antioxidant potential by using reducing power, superoxide anion scavenging, DPPH activity, metal chelating activity, scavenging of hydrogen peroxide methods (Gulcin et al., 2004; Khare et al., 2012; Ghaima et al., 2013; Bourgeois et al., 2016). In our study, the antioxidant potentials of ethanol extracts of *U. dioica* were determined using Rel Assay kits. The TAS value shows the whole of the compounds with antioxidant properties in the plant (Mohammed et al., 2020a). The TAS value of *U. dioica* has not been reported before. In TAS studies on different plant species, TAS values of *Marrubium globosum* Montbret & Aucher ex Benth (TAS: 7.677), *Galium aparine* L. (TAS: 5.147), *Glycyrrhiza glabra* L. (TAS: 8.770), *Salvia absconditiflora* Greuter and Burdet (TAS: 7.350), *Ferulago platycarpa* Boiss. and Balansa (TAS: 5.688), *Adiantum capillus-veneris* L. (TAS values of TAS: 3.086), *Mentha longifolia* (L.) HUDSON ssp. *longifolia* (L.) HUDSON (TAS: 3.628), *Rhus coriaria* L. *var. zebaria* Shahbaz (TAS: 7.342), *Gundelia tournefortii* L. (TAS: 6.810), and *Rumex crispus* L. (TAS: 6.758) have been reported (Sevindik et al., 2017; Mohammed et al., 2018; Dastan et al., 2019; Mohammed et al., 2019; Sarac et al., 2019; Akgul et al., 2020; Mohammed et al., 2020b; Korkmaz et al., 2021; Mohammed et al. al., 2021; Pehlivan et al., 2021). Compared to these studies, the TAS value of *U. dioica* was higher than *M. globosum, S. absconditiflora, F. platycarpa, A. capillus-veneris, Mentha longifolia* ssp. *longifolia, R. coriaria* var. *zebaria, G. tournefortii* and *R. crispus*, and lower than *G. glabra*. In this context, it was determined that *U. dioica* used in our study has an important antioxidant potential.

The TOS value shows the whole of the compounds with oxidant properties produced within the plant (Mohammed et al., 2020a). In TOS studies on different plant species, TOS values of *M. globosum* (TOS: 12,387), *G. aparine* (TOS: 18,679), *G. glabra* (TOS: 14,590), *S. absconditiflora* (TOS: 8,501), *F. platycarpa* (TOS: 15,552), *A. capillus-veneris* (TOS: 21,532), *M. longifolia* ssp. *longifolia* (TOS: 4,046), *R. coriaria* var. *zebaria* (TOS: 5,170), *G. tournefortii* (TOS: 3,712), and *R. crispus* (TOS: 5,802) have been reported (Sevindik et al., 2017; Mohammed et al., 2018; Dastan et al., 2019; Mohammed et al., 2019; Sarac et al., 2019; Akgul et al., 2020; Mohammed et al., 2020b; Korkmaz et al., 2021; Mohammed et al. al., 2021; Pehlivan et al., 2021). Compared to

these studies, the TOS value of *U. dioica* was higher than *S. absconditiflora*, *M. longifolia* ssp. *longifolia*, *R. coriaria* var. *zebaria*, *G. tournefortii* and *R. crispus* and lower than *M. globosum*, *G. aparine*, *G. glabra*, *F. platycarpa* and *A. capillus-veneris*. According to these results, it is seen that the oxidant compound levels of *U. dioica* are at normal levels. The OSI value shows how much the oxidant compounds in the plant are suppressed by the antioxidant defense system. The increase in OSI value indicates that the antioxidant defense system of the plant is insufficient (Mohammed et al., 2020a). In OSI studies on different plant species, OSI values of *M. globosum* (OSI: 0,162), *G. aparine* (OSI: 0,346), *G. glabra* (OSI: 0.167), *S. absconditiflora* (OSI: 0.116), *F. platycarpa* (OSI: 0,273), *A. capillus-veneris* (OSI: 0,698), *M. longifolia* ssp. *longifolia* (OSI: 0.112), *R. coriaria* var. *zebaria* (OSI: 0,072), *G. tournefortii* (OSI: 0,054), and *R. crispus* (OSI: 0,086) have been reported (Sevindik et al., 2017; Mohammed et al., 2018; Dastan et al., 2019; Mohammed et al., 2019; Sarac et al., 2019; Akgul et al., 2020; Mohammed et al., 2020b; Korkmaz et al., 2021; Mohammed et al. al., 2021; Pehlivan et al., 2021). Compared to these studies, the OSI value of *U. dioica* was lower than M. *globosum*, *G. aparine*, *G. glabra*, *F. Platycarpa* and *A. capillus-veneris*, and higher than *S. absconditiflora*, *M. longifolia* ssp. *longifolia*, *R. coriaria* var. *zebaria*, *G. tournefortii* and *R. crispus*. In this context, it is seen that it suppresses the oxidant compounds produced in *U. dioica* well with the antioxidant defense system.

Conclusion

In our study, the antioxidant and oxidant potential of *U. dioica* was determined. As a result of the studies, it was determined that the ethanol extracts of the plant have antioxidant potential. It was observed that the oxidant potential was at normal levels. In addition, it was determined that *U. dioica* was successful in suppressing oxidant compounds. As a result, it is thought that *U. dioica* may be an important natural antioxidant source.

Contribution Rate Statement Summary of Researchers

The authors declare that they have contributed equally to the article.

Conflict of Interest

The authors declare no conflict of interest.

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