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Research Article

Some pharmacological properties of *Alyssum stylare* (Boiss. & Balansa) Boiss.

Imran UYSAL

Osmaniye Korkut Ata University, Bahçe Vocational School of Higher Education, Department of Food Processing, Bahçe-Osmaniye, Türkiye

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*Corresponding author e-mail: imranuysal@osmaniye.edu.tr

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ABSTRACT

From ancient times to the present, plants have been used in many different areas. One of the most striking of these areas is alternative medicine. Türkiye is a country rich for plants diversity both in terms of location and other favorable conditions. This diversity reveals the importance of alternative medicine. In this respect, it is extremely necessary to determine the pharmacological properties of plants. In our study, Alyssum stylare (Boiss. & Balansa) Boiss. total oxidant status (TOS), total antioxidant status (TAS), oxidative stress index (OSI) as well as its status against antimicrobial agents were examined. After the above-ground part of the plant sample was dried and powdered by taking the necessary precautions, extraction was carried out Rel Assay kits were preferred for ethanol extract and TOS, TAS, OSI data. Its antimicrobial status was determined using the agar diffusion method. Consequently, of the study, the TAS capacity of the plant extract was 7.911±0.217 mmol/L, the TOS capacity was 11.587±0.202 µmol/L, and the OSI capacity was 0.146±0.001. It was used that it was effective against standard bacteria strains at 25-100 µg/mL and 200 µg/mL concentrations against fungi strains. Consequently, it is thought that A. stylare can be used in studies conducted for antioxidant and antimicrobial.

Keywords: Antioxidant, oxidant, antimicrobial agent, medicinal plants.

Alyssum stylare (Boiss. & Balansa) Boiss'in bazı farmakolojik özellikleri

ÖZ

Antik çağlardan günümüze kadar bitkiler birçok farklı alanda kullanılmıştır. Bu kullanım alanlarının en dikkat çekenlerinden biri de alternatif tıptır. Türkiye hem konumu hem de diğer uygun koşullar bakımından bitkiler için zengin bir ülkedir. Bu zenginlik alternatif tıbbın önemini ortaya koymaktadır. Bu açıdan bitkilerin farmakolojik özelliklerinin belirlenmesi son derece gereklidir. Çalışmamızda Alyssum stylare (Boiss. & Balansa) Boiss'in toplam oksidan durumu (TOS), toplam antioksidan durumu (TAS), oksidatif stres indeksi (OSI) ve antimikrobiyal ajanlara karşı durumu incelenmiştir. Bitki örneğinin toprak üstü kısmı gerekli önlemler alınarak kurutulup toz haline getirildikten sonra ekstraksiyon yapılmıştır Etanol ekstraktı ve TOS, TAS, OSI verileri için Rel Assay kitleri tercih edilmiştir. Antimikrobiyal durumu, agar difüzyon yöntemi kullanılarak belirlendi. Çalışmamız sonucunda bitki ekstraktının TAS değeri 7.911±0.217 mmol/L, TOS değeri 11.587±0.202 µmol/L ve OSI değeri 0.146±0.001 olarak bulunmuştur. Standart bakteri suşlarına karşı 25-100 µg/mL ve mantar suşlarına karşı 200 µg/mL konsantrasyonda etkili olduğu belirlendi. Sonuç olarak A. stylare'in antioksidan ve antimikrobiyal açıdan çalışmalarda kullanılabileceği düşünülmektedir.

Anahtar Kelimeler: Antioksidan, oksidan, antimikrobiyal ajan, tıbbi bitkiler.

1. INTRODUCTION

Conditions like environmental pollution, alcohol consumption, UV rays, and smoking cause free radical formation in humans.[1] If there is a deficiency in the reduction of oxygen, reactive oxygen species are formed. Consequently, these formations and deficiencies cause oxidative stress.[2] Consequently of oxidative stress, it can cause many diseases in humans like Parkinson's, alzheimer's, cardiological disorders and cancer. Antioxidants come first in combating these conditions. In this context, supplemental antioxidants are used.[3] Many studies have shown that plants can be natural antioxidant agents. From past times to the present, plants have always been in the field of interest of people. When we look at the archaeological studies, human being recognize the plants and they have been; used in many areas like food, relieving health problems, shelter, comforting, spice and sweetener by people.[4-5] Recently, it has been seen that the most preferred among these usage areas is herbal

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medicine.[6] The World Health Organization (WHO) has introduced the definition of "herbal medicine" to the use of drugs or herbal mixtures for treatment and solving diseases.[7-8] In this direction, it is very valuable to determine the pharmacological properties of plants. Many assessments of plants; It has shown that it has many biological activities such as antimicrobial, antiproliferative, antienflammatory, DNA damage protective, antiaging, antioxidant, anticancer.[9-17]. *Alyssum* L. is a genus of the Brassicaceae family. It consists of approximately 195 species. There are annual and perennial ones. *Alyssum* L. is generally distributed in rocky, stony and sandy areas in Europe, Asia and North Africa.[18-19] With this research, it was aimed to determine the attitude of *A. stylare* species against antioxidant, oxidant and antimicrobial agents.

2. MATERIALS AND METHODS

A. stylare sample used in the study was collected from Sivas (Turkey). *A. stylare* plant sample was identified by using the volume 1 page 374 section of the flora of Turkey book. The soil-containing parts of the *A. stylare* sample collected from the field were removed. The above-ground parts to be used were dried in a ventilated and shaded environment. After the drying process was completed, 30 g of the samples were weighed and then powdered with the help of some shredding apparatus. The powdered samples were extracted with 200 mL EtOH at 50 ^{0}C for approximately 6 hours. The solvent in the extract was removed with the help of Heidolph Laborota 4000 Rotary Evaporator.

2.1. Antimicrobial Activity

The effect of ethanol extract of *A. stylare* against bacteria and fungi strains was investigated by agar diffusion technique, which is one of the methods used in antimicrobial studies.

Bacterial strains: *Staphylococcus aureus* MRSA ATCC 43300, *Escherichia coli* ATCC 25922, *Pseudomonas aeruginosa* ATCC 27853, *Enterococcus faecalis* ATCC 29212, *S. aureus* ATCC 29213 and *Acinetobacter baumannii* ATCC 19606 were used. Fungal strains:, *Candida krusei* ATCC 34135, *C. albicans* ATCC 10231 and *C. glabrata* ATCC 90030 were used. With this method, the lowest concentration (MIC) that inhibits the growth of the strains was determined.[20-22]

2.2. Antioxidant Activity

Total antioxidant (TAS) and total oxidant (TOS) capacity of Ethanol extract of *A. stylare* were intended. Rel Assay kits were preferred for TAS and TOS capacity. Hydrogen peroxide was used in the calibration of the TOS kit. Trolox was used in the calibration of the TAS kit. Analyzes were performed according to the protocol determined by the manufacturer.[23-24] Oxidative stress index (OSI) was determined by the ratio of TOS capacity to TAS capacity according to the formula below.[25]

$$\text{OSI (AU)} = \frac{\text{TOS, } \mu\text{mol } H_2O_2 \text{ equiv./L}}{\text{TAS, mmol Trolox equiv./L X 10}}$$

3. RESULTS AND DISCUSSION

3.1. Antimicrobial Activity

Microorganisms are among the main causes of many diseases lately. The strong of many microorganisms to drugs, especially consequently of unconscious antibiotic use, has made it difficult to combat microbial diseases.[26] Many different researchers have focused on the discovery of new antimicrobial drugs. Plants have been one of the focal points of these researchers.[27] With this research you have done, the capacity of EtOH extract of *A. stylare* plant on Antimicrobial agents were examined. The obtained results are shown in Table 1.

Table 1. Antimicrobial Activity of *A. stylare* Extract

Sample	A	B	C	D	E	F	G	H	J
A. stylare	25	25	100	50	50	100	200	200	200

***(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*
*25, 50, 100, 200 µg/mL extract concentrations

According to the study data, it was observed that *A. stylare* exhibited the highest efficacy against *S. aureus* and *S. aureus* MRSA at 25 µg/mL extract concentration. It was also effective against *E. coli* and *P. aeruginosa* at an extract concentration of 50 µg/mL, and against *E. faecalis* and *A. baumannii* at 100 µg/mL extract concentration. The plant extract was found to be effective against fungal strains (*C. glabrata, C. albicans* and *C. krusei*) at 200 µg/mL extract concentration. In this context, it was observed that the plant extract was more effective against bacterial strains than fungal strains. In previous antimicrobial activity studies on *Alyssum* species, antimicrobial activity of ethanol extracts of *A. caricum*, *A. discolor* and *A. sibiricum* was investigated using disk diffusion method. Consequently of the study, it was reported that the plant extracts were effective against S. *enteritidis*, *S. aureus*, *S. epidermidis*, *Listeria monocytogenes*, *L. innocua*, *B. subtilis*, *Enterobacter*

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aerogenes, *E. coli*, *Klebsiella pneumoniae*, *E. faecium*, *E. faecalis*, *E. Durans*, *P. aeruginosa*, *P. fluorescens*, *Salmonella typhimurium*, *S. kentucky* and *S. infantis* at different concentrations.[28] In another study, it was reported that methanol extract of *A. fulvescens* var. *fulvescens* has antimicrobial activity against *E. coli*, *P. aeruginosa*, *S. aureus*, *B. subtilis* and *Micrococcus luteus*.[29] In this context, in our research, it was researched that the extract of *A. stylare* has significant antimicrobial activity against the standard antimicrobial agents used. Consequently, it has been determined that the plant can be used as a natural antimicrobial agent.

3.2. Antioxidant Activity

Reactive oxygen species (ROS) occurring at high levels turn into a harmful situation for living things.[30] Antioxidants of endogenous and exogenous origin fight ROS. In some cases, antioxidants are insufficient. In these insufficient cases, oxidative stress occurs. Complementary antioxidants are used as a solution.[31-32] In this study, TAS, TOS and OSI capacity of *A. stylare* ethanol extract were determined.

According to the findings, the TAS capacity of *A. stylare* was determined as 7.911±0.217 mmol, the TOS capacity was 11.587±0.202 µmol and the OSI capacity was 0.146±0.001. In our study, TAS, TOS and OSI capacity of *A. stylare* were determined for the first time. In studies on different plant species, TAS capacity of *Lepidium spinosum* ARD. was determined 4.550 mmol, the TOS capacity 12.610 µmol and the OSI capacity 0.277.[33] TAS capacity of *Mentha longifolia* (L.) HUDSON subsp. *longifolia* (L.) HUDSON was determined 3.628 mmol, the TOS capacity 4.046 µmol and the OSI capacity 0.112.[34] The TAS capacity of *Euphorbia eriophora* BOISS. was determined 5.390 mmol, the TOS capacity 20.971 µmol and the OSI capacity 0.390.[35] The TAS capacity of *Echium italicum* was determined 6.056 mmol, the TOS capacity 19.107 µmol and the OSI capacity 0.316.[36] The TAS capacity of *Satureja hortensis* was determined 5.403 mmol, the TOS capacity 3.537 µmol and the OSI capacity 0.065.[37] The TAS capacity of *Ferulago platycarpa* BOISS. ET BAL. was determined 5.688 mmol, the TOS capacity 15.552 µmol and the OSI capacity 0.273.[38]

The TAS capacity of *Marrubium globosum* MONTBRET ET AUCHER EX BENTHAM. was determined 7.677 mmol, the TOS capacity 12,387 µmol and the OSI capacity 0.162.[39] Compared to these studies, the TAS capacity of *A. stylare* was higher than *L. spinosum*, *M. longifolia* subsp. *longifolia*, *E. eriophora*, *E. italicum*, *S. hortensis* and *F. platycarpa*. The TAS capacity shows all of the antioxidant compounds found in living organisms.[40,41] In our study, it was determined that the antioxidant potential of the plant is high. The TOS capacity is an indicator of the totality of oxidant-containing compounds in living organisms.[15] The OSI capacity shows how much the oxidant compounds detected in living organisms suppress by antioxidant compounds.[42,43] It is recommended to avoid or limit the consumption of foods with high OSI capacity. The TOS and OSI capacity of *A. stylare* were higher than *M. longifolia* subsp. *longifolia* and *S. hortensis*, and lower than *L. spinosum*, *E. eriophora*, *E. italicum*, *F. platycarpa* and *M. globosum*. In this context, it was determined that the TOS capacity of *A. stylare* was at normal levels. Consequently, it is predicted that the plant can be evaluated in terms of antioxidants.

4. CONCLUSIONS

Consequently, antimicrobial antioxidant oxidant data of *A. stylare* species were determined. It was determined that *A. stylare* has a high capacity in terms of both antioxidant and oxidant when compared with the species in other studies in terms of antioxidant and oxidant. It was found that *A. stylare* EtOH extract reacted at a concentration of 25-100 µg/mL in bacterial strains and 200 µg/mL in fungal strains used in the antimicrobial study. it is predicted that *A. stylare* has an important antioxidant and antimicrobial capacity and can be used in this field.

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