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Research Article

Antioxidant and antimicrobial potentials of functional food *Arum Dioscoridis*

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ABSTRACT

In this study, antioxidant (TAS), oxidant (TOS) and antimicrobial activities of samples collected from Osmaniye province, which is located in the Eastern Mediterranean Region of Turkey and where *Arum dioscoridis* Sm. consumption is common, were determined. Water extracts of leaf parts of plant samples were obtained in a soxhlet device. TAS and TOS status were determined using Rel Assay kits. Antimicrobial activities of plant samples were determined against standard bacterial and fungal strains using agar dilution method. At the end of the studies, the highest TAS value among the plant samples was determined as 6.486±0.182. The highest TOS value was determined as 15.576±0.235. The highest OSI (oxidative stress index) value was determined as 0.285±0.007. In addition, *A. dioscoridis* extracts were determined to be effective against test microorganisms at 50-800 µg/mL concentrations. As a result, it was determined that the samples collected from different regions of the *A. dioscoridis* samples used in our study showed variability. In addition, it has been determined that *A. dioscoridis* may be an important antioxidant and antimicrobial source.

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INTRODUCTION

Plants have been used for many different purposes since human existence. Today, plants are used both as energy and nutrients and as a source of healing [1-3]. It is important to cultivate medicinal plants in order to use them as a raw material source in the production of herbal medicines and to use them as a herbal medicine [4-6]. The Araceae family, which includes the genus Arum, includes 105 genera and 3300 species [7]. *Arum dioscoridis* is a common species belonging to the Araceae family [4]. *Arum dioscoridis* Sm. is native to forests east of the Mediterranean Sea in southern Turkey, Cyprus, Greece and the Middle East [8]. Green and arrow-shaped leaves appear in winter. A short-stalked inflorescence consisting of a black, rod-shaped spade surrounded by a brown or even purple bract (spathe) with yellow-green and purple spots appears in spring. Spathe's color pattern is variable. More than one cultivar has been defined based on different patterns [9]. In different regions of Turkey, it

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is called with names such as snakeskin, nivik herb, livik herb, abalone, bristle, tirşik, Andırın doctor, beetroot, snake tongue, snake knife [7,8]. The leaves of the plant are sold as vegetables in local markets. *A. dioscoridis* stem and leaves are cooked and consumed as soup [8, 10]. In this context, in this study, it was aimed to determine the antioxidant and antimicrobial potential of the *A. dioscoridis* plant, which is widely consumed among the public.

MATERIALS AND METHODS

Laboratory Studies

A. dioscoridis specimens were collected from Osmaniye (Turkey). Samples were taken from a total of 5 regions in Osmaniye province. The samples named as K1, K2 and K3 were collected from Kadirli district of Osmaniye province. The samples named as O1 and O2 were collected from the city center of Osmaniye. The leaves of these samples were dried and then pulverized with a mechanical grinder. Then, 30 g of the plant samples were weighed and water extracts were obtained in the soxhlet device for about 6 hours by placing them in cartridges.

Total Antioxidant and Oxidant Status

TAS and TOS values of *A. dioscoridis* samples were determined using Rel Assay kits (Rel Assay Kit Diagnostics, Gaziantep/Turkey). The protocols for using the kits were applied in TAS and TOS tests. Trolox (TAS) and Hydrogen peroxide (TOS) were used as calibrators [11,12]. The OSI (Oxidative stress index) values of the plant samples were determined by dividing the TOS value with the TAS value and as a percentage [13].

Antimicrobial Activity Studies

The effects of water extracts of *A. dioscoridis* samples against bacterial and fungal strains were determined using the agar dilution method. The bacterial and fungal strains, reference drugs used are shown in Table 1.The most effective values against bacteria and fungi were determined [14-16].

RESULTS AND DISCUSSION

Antioxidant and Oxidant Status

Oxidative stress is defined as the deterioration of oxidative balance as a result of the deficiency of antioxidants, which detoxify them with the increase of 'reactive oxygen species (ROS)' such as hydroxyl radical, superoxide radical and hydrogen peroxide formed during cellular metabolism [17-19]. Free oxygen radicals are responsible for the pathogenesis of many diseases such as cancer, cardiovascular diseases, neural disorders, Alzheimer's disease, mild cognitive impairment, Parkinson's disease, aging and atherosclerosis [20-22]. There are defense mechanisms called antioxidant systems, or briefly antioxidants, to prevent the damage of ROS to cellular structures in living things [19,23,24]. However, in some cases, the endogenous antioxidant defense system is insufficient to reduce the effects of oxidant compounds. In such cases, the use of supplemental antioxidants is very important. In this study, it was aimed to determine the use of *A. dioscoridis* plant as a supplemental antioxidant. The findings obtained in this context are shown in Table 2.

No study was found in the literature on the determination of TAS, TOS and OSI values of *A. dioscoridis*. In previous studies with different methods, it was determined that methanol and acetone extracts of *A. dioscoridis* had antioxidant potentials using Ferric-reducing, Cupric reducing and Metal chelating methods [25]. In a different study, it was reported that ethanol, methanol, acetone and water extracts

Table 2. TAS, TOS ve OSI values of *A. dioscoridis* samples

	TAS	TOS	OSI
K1	5.495±0.206	10.698±0.274	0.196±0.012
K2	6.486±0.182	13.578±0.244	0.209±0.004
K3	5.464±0.066	15.576±0.235	0.285±0.007
O1	4.387±0.189	9.280±0.141	0.212±0.006
O2	4.826±0.114	7.375±0.081	0.153±0.003

*Values are presented as mean±SD

Table 1. Microorganisms, standards and media

Bacteria	Fungi	Standarts	Media
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 1960		Amikacin, Ampicillin and Ciprofloxacin	Muller Hinton Broth
	Candida albicans ATCC 10231, *C. krusei* ATCC 34135, *C. glabrata* ATCC 90030	Fluconazole and Amphotericin B	RPMI 1640 Broth

of *A. dioscoridis* have antioxidant potential using Reduction power and DPPH methods [26]. In this context, in our study, the total antioxidant level of *A. dioscoridis* was determined for the first time using Rel Assay kits. According to the results obtained, it was observed that the antioxidant potentials of the plant samples collected from different localities were high. In addition, the highest TAS value was seen in the samples collected from K2 (6.486±0.182) and the lowest in the samples collected from O1 (4.387±0.189). In previous TAS studies on wild plants, the TAS value of *Mentha longifolia* ssp. *longifolia* was reported to be 3.628 [27]. The TAS value of *Scorzonera papposa* was reported to be 5.314 [28]. The TAS value of *Asparagus officinalis* was reported to be 7.449 [29]. Compared to these studies, the highest TAS value of *A. dioscoridis* determined in our study was found to be higher than *M. longifolia* ssp. *longifolia* and *S. papposa*, and lower than *A. officinalis*. The TAS value shows the whole of the antioxidant compounds in the plant [30]. In our study, it was determined that *A. dioscoridis* had a high TAS value and could be an important natural antioxidant in this context. In previous TOS studies on wild plants, the TOS value of *M. longifolia* ssp. *longifolia* was reported to be 4.046 [27]. The TOS value of *S. papposa* was reported to be 24.199 [28]. The TOS value of *A. officinalis* was reported to be 18.607 [29]. Compared to these studies, it was determined that the highest TOS value of *A. dioscoridis* used in our study was lower than *S. papposa* and *A. officinalis*, and higher than *M. longifolia* ssp. *longifolia*. TOS value shows the whole of the oxidant compounds in the plant. When oxidant compounds accumulate in living organisms, they cause many disorders caused by oxidative stress [30]. As the TOS value of the plant increases, adverse health conditions may occur when living organisms consume them. In our study, it was observed that the TOS values of the samples collected from different regions of *A. dioscoridis* were at normal levels. In this context, it is not thought that there will be a health problem caused by oxidant in their consumption. In addition, excessive consumption should be avoided. In previous OSI studies on wild plants, the OSI value of *M. longifolia* ssp. *longifolia* was reported to be 0.112 [27]. The OSI value of *S. papposa* was reported to be 0.456 [28]. The OSI value of *A. officinalis* was reported to be 0.250 [29]. Compared to these studies, the highest OSI value of *A. dioscoridis* collected from different regions was determined to be higher than *M. longifolia* ssp. *longifolia* and *A. officinalis*, and lower than *S. papposa*. OSI value shows how much the endogenous oxidants produced in the plant are suppressed by the antioxidant defense system. The increase in OSI value is an indicator of insufficient antioxidant defense system of the plant. In this context, it was determined that the oxidant compounds produced in the body of *A. dioscoridis* used in our study were at normal levels in suppressing. It is also seen that *A. dioscoridis* suppresses oxidant compounds better than *S. papposa*.

Antimicrobial Activity

In recent years, the resistance of microorganisms to antimicrobial drugs has accelerated the discovery of new and effective antimicrobial drugs. In this search process, herbal-based drugs that have never been researched or focused on are focused on [31-33]. In this context, the antimicrobial potential of *A. dioscoridis* against bacterial and fungal strains was determined in our study. The obtained results are shown in Table 3.

In our study, water extracts of *A. dioscoridis* collected from different regions were used and their effects against standard bacterial and fungal strains were investigated. According to the findings, the highest activity was observed in the samples collected from K3. The lowest activity was observed in the samples collected from O2. In general, all samples were more effective against fungi. The microorganism that showed the lowest effect of all extracts was *E. coli*. In previous studies, it has been reported that ethanol extracts of *A. dioscoridis* have antimicrobial activity against *P. aeruginosa* and *K. pneumonia* [34]. In a different study, it was reported that the water extract of *A. dioscoridis* was effective against *E. coli, Salmonella typhimurium, P. aeruginosa, Streptococcus pneumoniae, S. aureus* and *C. albicans* [35]. In addition to these studies, water extracts of *A. dioscoridis* were used in our study and *S. aureus, S. aureus* MRSA, *E. faecalis, E. coli, P. aeruginosa, A. baumannii, C. glabrata, C. albicans* and *C. krusei* was determined to be effective at different concentrations. In this context, it was determined that *A. dioscoridis* used in our study has antimicrobial potential.

Table 3. Antimicrobial Activity of *A. dioscoridis* samples

	A	B	C	D	E	F	G	H	J
K1	200	400	100	800	200	100	50	100	100
K2	200	200	100	800	200	100	50	100	100
K3	200	200	100	400	200	100	50	50	100
O1	200	200	100	800	400	100	50	50	100
O2	400	400	100	800	400	100	100	50	100

*800, 400, 200, 100, 50 and 25 µg/mL extract concentrations

*(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*

CONCLUSION

In this study, the antioxidant and antimicrobial potentials of *A. dioscoridis* collected from different regions of Osmaniye (Turkey) were determined and compared. As a result of the study, it was observed that the antioxidant and antimicrobial potentials of the plant samples changed regionally. In addition, the antioxidant potential of all samples was determined to be high. In addition, their antimicrobial activities were found at normal levels. As a result, it was determined that *A. dioscoridis*, which is widely consumed among the public, may be a natural antioxidant and antimicrobial source. In addition, it was observed that all areas where the samples were collected were at normal levels in terms of oxidative stress.

AUTHORSHIP CONTRIBUTIONS

Authors equally contributed to this work.

DATA AVAILABILITY STATEMENT

The authors confirm that the data that supports the findings of this study are available within the article. Raw data that support the finding of this study are available from the corresponding author, upon reasonable request.

CONFLICT OF INTEREST

The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

ETHICS

There are no ethical issues with the publication of this manuscript.

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