Evaluation of the total antioxidant capacity of *Oliveria decumbens* and *Capparis spinosa*

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Abstract

The anti-oxidative potential of extracts from two Iranian medicinal plants, *Oliveria decumbens* and *Capparis spinosa*, is assessed in this study. The *Oliveria* genus is part of the Apiaceae family and contains only one species, *O. decumbens* Vent. Capers are either wild or cultivated plants that are found in many tropical and subtropical countries. *Oliveria decumbens* and *Capparis spinosa* aerial parts were dried and ground. The herbal solution was then created by combining herbal powder and methanol. Finally, the total antioxidant capacity of the plants was determined using the Ferric Iron Reducing Antioxidant Power (FRAP) assay and the ELISA reader at 570 nm. The total antioxidant capacities of *O. decumbens*, *C. spinosa* fruit, and *C. spinosa* leaves, respectively, were 3.82 mmol Fe^{2+}/L, 1.96 mmol Fe^{2+}/L, and 1.65 mmol Fe^{2+}/L. These plants' essential oils are secondary metabolites that are widely used in the food, pharmaceutical, and health industries as antioxidant and antimicrobial compounds. In general, the traditional Iranian edible plants studied are good sources of natural antioxidant compounds.

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Introduction

Oliveria decumbens Vent. is a fragrant annual herbaceous plant of the genus *Oliveria* in the Apiaceae family.[1] It can be found in Turkey, Iraq, and Syria, as well as in Iran's western and southwestern regions (Kermanshah, Chaharmahal Bakhtiari, Fars, Bushehr, and Khuzestan).[2] Botanical studies and medicinal uses of this plant in traditional Iranian medicine show that the medicinal plant *O. decumbens* has been used to treat indigestion, diarrhea, abdominal pain, and fever since ancient times in the western half of Iran.[3]

Capparis is a flowering and woody plant genus with a long root that penetrates deeply into the soil. Cabar, Kavar, Kavarzeh, and Kavarz[4] are the Iranian names for *Capparis spinosa*. *C. spinosa*, also known as Flinders rose, is a perennial plant with rounded, fleshy leaves and large white to pinkish-white flowers.[5] The majority of the Capparaceae family is comprised of wild plants.[6,7] Its fruits have traditionally been used to treat diabetes, headaches, fever, and rheumatism. *C. spinosa* roots, fruit, and bark have also been reported to be used as diuretics, tonics, and antimalarial

agents in Iranian traditional medicine.[8] The content of 19-22% protein, 26% fiber, 1.7% ash, 31.6-36% oil source was reported.[4] This plant's fruits and buds contain rutin and quercetin (phenolic and flavonoid compounds); rutin is a powerful antioxidant bioflavonoid.[9]

Tocopherol and sterol measurements in *C. spinosa* seed oil in Turkey revealed that it can be compared to other edible oils in terms of oxidative stability and antioxidant source.[10] Many bioactive factors have been identified in this plant through phytochemical studies, including saccharides, glycosides, flavonoids, alkaloids, indoles, phenolic acids, terpenoids, essential oils, fatty acids, vitamins, and steroids.[11,12] This plant's roots and flower buds contain pectin, saponin, aminoglycosides, and a substance known as caparirutin.[5] Furthermore, in biological and chemical tests, aqueous-ethanolic extracts of the leaves demonstrated antioxidant activity.[13]

Traditional medicine relies heavily on medicinal plant extracts and active compounds for the majority of treatment.[14] Anti-allergic, anti-inflammatory, antimicrobial, and antioxidant properties are among the many physiological benefits and properties of phenolic active compounds. These compounds are used in medicine, food, cosmetics, and agriculture;[15,16] they also inhibit microbial activity and can kill germs without affecting consumer health.[5] The use of plants in the treatment of diseases, particularly infectious diseases, has grown in recent years,[1] owing primarily to the negative side effects of synthetic medicinal compounds.[17] Herbal derivatives, which are inspired by herbs, account for approximately 30 to 50 percent of all drugs available in pharmacies.[18] The incorrect use of chemical drugs to treat infectious diseases has resulted in the emergence of resistant microbial isolates, the number of which is growing by the day.[1] Chemical-resistant strains necessitate efforts to discover new antimicrobial agents. Plants and their constituents, such as essential oils and plant extracts, have the potential to replace chemical drugs;[19] however, the side effects of these compounds are less severe than those of chemical drugs.[19] Previous research has shown that the essential oils of *O. decumbens* Vent. flowers and flowering branches, as well as the leaves and fruits of *C. spinosa* L., have potent antimicrobial properties.[4] Because of the growing trend among humans to use natural compounds derived from medicinal plant sources in the treatment and control of diseases, the antioxidant effect of medicinal plants *O. decumbens* Vent. and leaves and fruits of *C. spinosa* L. was investigated in this study.

Materials and Methods

Sampling and plant preparation

The aerial parts of *O. decumbens* and *C. spinosa* were collected from Dehloran city (Ilam Province, Southwest of Iran) in April 2022.

The plant was identified and approved in the Biotechnology and Medicinal Plants Research Center of Ilam University of Medical Sciences using the morphological keys from the book of plant flora of Ilam province.[20] Collected plants were cleaned and then dried in the open air in the darkness. The antioxidant testing solution was prepared using the method described by Dokhani *et al.*[21]

The characteristics of the medicinal plants used in this study are specified in Table 1.

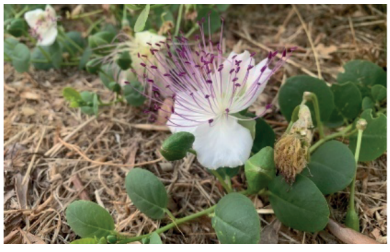
Determination of the antioxidant activity of methanolic extract

The total antioxidant capacity of the plants was assessed by Ferric Iron Reducing Antioxidant Power (FRAP) assay of Naxifer kit.[21]

The amount of 2.2 mL of Reagent 2b (R2b) solution (Naxifer, Iran) was added to the parent R2a solution and vortexed until complete dissolution, obtaining the Reagent 2 (R2) solution. It was then mixed in a ratio of 1:1, again vortexed 5 times, and added to Reagent 1 (R1) solution. The resulting was the working solution of the antioxidant kit.[21]

Standard solutions from kit of 0, 0.2, 0.4, 0.6, 0.8 and 1 µL were also prepared and added to microplate wells 1, 2, 3, 4, 5, and 6, respectively (well number 1 had no standard or zero concentration).[21] The microplate was then incubated for 30 minutes at 35° C, and finally read at 570 nm with the Elisa reader.[21]

Table 1. Details of the utilized plants.

Scientific name	Plant family	Collection area	Geographical coordinates	Photo of the plant
Oliveria decumbens Vent.	Apiaceae	Dehloran	32° 41' 28" North, 47° 15' 58" East	
Capparis spinosa L.	Capparidaceae	Dehloran	32° 41' 28" North, 47° 15' 58" East	

Results

The results showed that the total antioxidant capacity was found as 3.82, 1.96 and 1.65 Fe^{2+}/mmol for *Oliveria decumbens*, fruit of *Capparis spinosa* L. and leaves of *Capparis spinosa* L., respectively (Table 2).

Discussion

Chronic diseases are one of the most serious challenges confronting the world's health-care systems in the twenty-first century.[22,23] They are diseases with a slow onset that are both progressive and long-term.[24,25] Chronic diseases are caused by a variety of factors, including heredity, nutrition, environment, stress, and a variety of infectious and non-infectious factors.[4,26] Non communicable diseases account for two-thirds of all deaths worldwide.[27]

According to a World Health Organization report, approximately 80% of the world's population uses traditional medicine and methods to treat their diseases.[28] Medicinal plants are also used as guide compounds in drug synthesis.[28] In Asia, herbal medicines in the form of extracts are used by 40 to 62% of cancer patients. According to research on these patients, the benefits of using these herbal remedies outweigh the drawbacks.[29] Antioxidant activity is responsible for antioxidant activity in medicinal plants; antioxidants function by inactivating free radicals.[30]

Our findings revealed that the total antioxidant capacity of *O. decumbens* was 3.82 mmol Fe^{2+}/L. *O. decumbens* is a medicinal plant with potent antioxidant properties and a high free radical scavenging potential. According to Vazirzadeh *et al.*, administration of different *Oliveria decumbens* derivatives demonstrated remarkable antibacterial activity against streptococcosis, as well as improved antioxidant status and post-challenge immunity in Nile tilapia.[31]

The main compounds found in *O. decumbens* plants are thymol, carvacrol, paracetamol, and gamma-terpinene.[32] Similar studies on the total antioxidant capacity of medicinal plants were conducted in various countries, for example, in Singapore in 2002, the antioxidant capacity of 28 types of fruit in *Bacopa caroliniana* in 2003, forty-five medicinal plants in Italy in 2003, 34 vegetables and 28 fruits.[33]

C. spinosa L. flower is used in traditional medicine to treat liver and spleen diseases, as well as anemia and weakness.[34] Several studies[35] have confirmed its anti-diabetic, anti-cancer, and antioxidant properties. *C. spinosa* ameliorates cardiovascular disorders, liver damage, and nephropathy in diabetic animal models, according to Mazarei *et al.*[36] These results are attributed to its antioxidant phytochemicals such as phenolic compounds, flavonoids, carotenoids, tocopherol, and terpenes.

Table 2. Total antioxidant capacity of *O. decumbens* and *C. spinosa* L.

Common name	Scientific name	Total antioxidant capacity (mmol Fe^{2+}/L)
Laeleh kohestan	*Oliveria decumbens*	3.82
Kabar fruit	*Capparis spinosa* L.	1.96
Kabar leaves	*Capparis spinosa* L.	1.65

Others, however, show that kabar leaves methanolic extract has antioxidant properties and a higher total phenol content than fruits and stems.[9,37] The differences can be attributed to the plant's origin, method, operating conditions, and extraction solvent type. For normal metabolism, signal transmission, and cellular activity regulation, the human body requires oxidants, free radicals, and antioxidants.[37-41] Many diseases can be prevented by using medicinal plants and herbal antioxidants.[42-47] According to Iranmanesh *et al.*, *C. spinosa* fruit extract is a potential source of natural antioxidants in the treatment of diseases.[34] The main compounds in Kabar root and fruit essential oils were methyl, isopropyl, and sec-butyl isothiocyanates, while the main compounds in leaf essential oil were thymol (24.6%) and isopropyl isothiocyanate (11%).[39] Because of its antioxidant properties, kabar fruit extract may protect against acetaminophen-induced hepatotoxicity.[48]

Conclusions

The tested species appear to be valuable natural antioxidant sources with applications in both health care and the food industry. However, *in-vivo* safety and active compound identification must be thoroughly investigated before they can be used.

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