Original Article

Investigation of Some Antibacterial and Antioxidant Properties of Wild *Cirsium vulgare* from Turkey

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ABSTRACT

Background: *Cirsium vulgare* (Savi) Ten; belongs the *Asteraceae* family and has common uses in some countries folk medicine. **Objective:** In this study, the determination of some antioxidant and antimicrobial properties of *C. vulgare* which is wild-grown from Turkey is aimed. **Methods:** Crude extracts of plants were obtained by using n-hexane, diethyl ether, ethyl acetate and methanol as solvent. Total phenolic content (TPC) and DPPH (2,2-diphenyl 2,2-diphenyl-1 picrylhydrazyl picrylhydrazyl) scavenging activity were determined in extracts. The antibacterial activity was tested against *Staphylococcus aureus* (ATCC 43300), *Escherichia coli* (ATCC 35218), *Bacillus subtilis* (NRRL NRS-744) and *Pseudomonas aeruginosa* (ATCC 27853). **Results:** The TPC and DPPH activities of extracts revealed significant differences by following sequence MeOH > diethyl ether > EtOAc > n-hexane. The highest inhibition effect of *C. vulgare* was found on *P. aeruginosa*. **Conclusion:** Results presented that *C. vulgare* can be researched for future investigations for isolations of biologically active compounds, where some of their characteristics are expected to be contribute to the natural compounds in pharmaceutical industry.

Key words: *Cirsium vulgare*, Phenolic content, DPPH activity, Antibacterial activity, *P. aeruginosa*.

INTRODUCTION

Polyphenols are large group of natural compounds which possess wide spectrum of biological activity and many of them have been found in plant-based. The *Asteraceae* comprise one of the largest families of flowering plants with over 13.000 species in 1310 genera in worldwide.[1] Some species that belonging to that family are studied for determination of their antioxidant activity.[2,3] *Cirsium vulgare* (Savi) Ten; belongs the *Asteraceae* which is represent one of the largest plant families. *Cirsium* species are very common and widespread plants in the traditional medicine of some countries, and these plants are used in the treatment of numerous diseases due to their diuretic, astringent, antiphlogistic or anxiolitic activities.[4] *C. vulgare*, characterized also as injurious weed, with edible tap roots and stems – according to earlier literature data – contains flavonoids, sterols, aliphatic aldehydes and phenolic acids.[5] The extracts from *Cirsium* species were also shown to possess antioxidant and antibacterial activity.[6]

Antioxidants, exogenous and especially endogenous, are vital substances which possess the ability to protect the body from potent injuries caused by the free radicals.[7] It was shown that the antioxidant activities found in plant natural products could provide protective effects via inhibiting DNA oxidative damage.[8]

Antibiotics are one of our most important weapons in fighting bacterial infections and have greatly benefited the health-related quality of human life since their introduction.

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However, in recent years, many types of microorganisms with active infectious diseases have become resistant to antibiotics. Therefore, drugs derived from natural sources play a significant role in the prevention and treatments of human diseases. Actually, in many developing countries, traditional medicine is one of the primary healthcare systems.[9] Among these compounds, polyphenols are large group of natural compounds and many of them have been found in plant-based.

C. vulgare is a species as wild-grown in Trakya region of Turkey. Along with the increasing interest in natural antimicrobials and antioxidants derived from plants, due to their use and benefit in food preservation and natural food additives, in this study, we aimed to determination of total phenolic content, antioxidant and antimicrobial activities of *C. vulgare*.

MATERIAL & METHODS

Plant Material

C. vulgare which is wild plant species in Trakya region, was collected in June 2016. The specimens (NGBB 7229) were identified by Dr. Cabi at Namık Kemal University, Faculty of Science, Department of Biology.

Extractions

Crude extracts from plants obtained by using *n*-hexane, diethyl ether, ethylacetate (EtOAc), and methanol (MeOH) extraction methods. Air dried samples were used for *n*-hexane, diethyl ether, EtOAc, MeOH solvent extractions. The extractions were repeated two times, supernatants were combined, and solvents were evaporated under vacuum using a rotary evaporator.

Total Phenolic Content (TPC) assay

The total phenolic content (TPC) in plant extracts was determined by a colorimetric method with Folin and Ciocalteu's phenol reagent.[10] Total phenolic content was expressed as mg catechol equivalents (CAE).

DPPH· scavenning activity

The scavenging effect of free radicals was assayed by using DPPH (2,2-diphenyl 2,2-diphenyl-1 picrylhydrazyl picrylhydrazyl) method against DPPH radical and, monitored at 517 nm as described by Amarowicz *et al* 2002.[11] The results were expressed as IC_{50} value (IC_{50} is concentration needed for scavenging 50% of DPPH radical).

Antibacterial activity

The antibacterial activity was tested against four bacteria strains, which were *Staphylococcus aureus* (ATCC 43300), *Escherichia coli* (ATCC 35218), *Bacillus subtilis* (NRRL NRS-744) and *Pseudomonas aeruginosa* (ATCC 27853). Bacterial suspensions in the logarithmic growth phase were diluted according to the McFarland 0.5 turbidity standard in Mueller-Hinton Broth and then 100 µl from this suspension spread to agar plate surface plate. Plant extracts were solved in 1 ml water and 100 µl added to each well which were opened on the surface of the agar. Gram positive bacteria Penicillin (10IU/ml) and for the other bacteria Gentamicin (10µg/ ml) are tested as control. Zone diameters are measured after 37^{0}C incubation.

RESULTS & DISCUSSION

Antioxidant Properties of *Cirsium vulgare*

Total phenolics extracted from samples were significantly affected by the extraction solvents, and methanol extracts had significantly higher phenolics than from the other extracts while n-hexane extracts was lowest as shown in Table 1. The DPPH scavenging activity of different solvents was concentration dependent similar to Jain[12] and varied from 4.08-91.68 % in extracts at different concentrations (Figure 1). EC_{50} values of DPPH activity in different solvents revealed significant differences similar to TPC content. This could be due to the differences in extractability of different solvents

Table 1: Total Phenolic Content and EC_{50} values of DPPH activity of *C. vulgare* extracts

Extract	Total Phenolic content (µg catechol Eq / mg extract)	EC_{50} values of DPPH activity
MeOH	61.21 ± 0.37	0.22 mg/assay
EtOAc	12.13 ± 0.06	3.69 mg/assay
Diethyl Ether	13.75 ± 0.08	1.01 mg/assay
n-hexane	0.008 ± 0.01	3.86 mg/assay

* The antiradical activity was defined as the amount of antioxidant necessary to decrease the initial DPPH• concentration by 50% (Efficient Concentration = EC50) •, was estimated based on the plot.

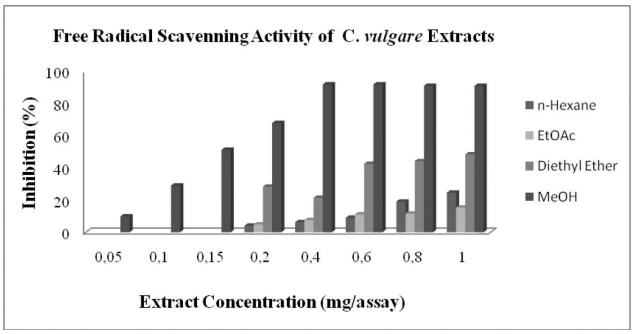

Figure 1: DPPH radical scavenging activity of *C. vulgare* extract.

Table 2: Antibacterial activity of *C. vulgare*

Bacteria	Extract zone	Penicilin	Gentamicin
Staphylococcus aureus	19 mm	33mm	-
Bacillus subtilis	21 mm	30mm	-
Escherichia coli	16 mm	-	17mm
Pseudomonas aeruginosa	22 mm	-	15mm

and it may be due to poor solubility of phenolics of this plant in hexane. This results in confirmed with the earlier determinations of Hossain.[13] This may explain the solvent polarity and the use of different solvents of varying polarity may also lead to higher and lower mass transfer of different plant phenolics.

Antibacterial Properties of *Cirsium vulgare*

Methanol extracts used for determination antimicrobial activity and the zone diameters for the bacteria are shown on Table 2. The highest antimicrobial activity of *C. vulgare* was found on *P. aeruginosa* among the bacteria strains which is 22 mm in diameter and higher than Gentamicin (15 mm zone diameter) as control. Some researchers[14,15] determined that more effective antibacterial activity against *S. aureus* than *E.coli*, similarly.

CONCLUSION

Results presented that *C. vulgare* can be researched for future investigations for isolations of biologically active compounds, where some of their characteristics are expected to be contribute to the natural compounds in pharmaceutical industry. Additionally, because of their antimicrobial activity they can be used as topical preparation or by food preservation.

ACKNOWLEDGEMENT

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CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

ABBREVIATION USED

EC_{50}: The amount of antioxidant necessary to inactivate 50% of initial DPPH; DPPH: 2,2-diphenyl-1picrylhydrazyl; TPC: Total phenolic content; EtOAc: Ethyl acetate; MeOH: Methanol; CAE: Catechol Equivalents.

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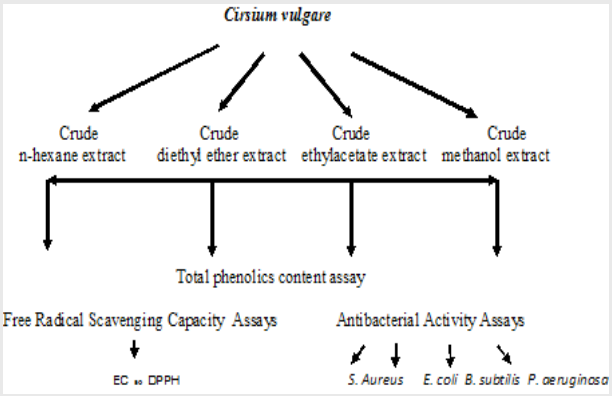
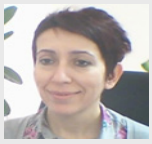
PICTORIAL ABSTRACT



SUMMARY

- *Cirsium vulgare* (Savi) Ten. belongs the Asteraceae family.
- Crude extracts of *Cirsium vulgare* obtained by using n-hexane, ether, EtOAc, MeOH extraction methods.
- Total phenolic content (TPC) and DPPH (2,2-diphenyl-1-picrylhydrazyl) scavenging activity were determined in extracts.
- The antibacterial activity was determined against four bacteria strains, which were *Staphylococcus aureus , Escherichia coli, Bacillus subtilis* and *Pseudomonasa eruginosa*
- The highest inhibition effect of *C. vulgare* was found on *P. aeruginosa* with high DPPH activity in extract. *C. vulgare* can be researched for future investigations for isolations of biologically active compounds, where some of their characteristics are expected to be contributing to the natural compounds in pharmaceutical industry.

ABOUT AUTHORS



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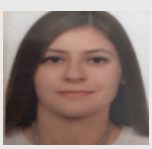

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